

# Patent Transactions and Markets for Patents

Dealing with Uncertainty

Proefschrift

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# Patent Transactions and Markets for Patents

## Dealing with Uncertainty

Patent transacties en markten voor patenten  
Omgaan met onzekerheid

(met een samenvatting in het Nederlands)

### **Proefschrift**

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## Abbreviations

AUTM	Association of University Technology Managers (USA, Canada)
BD	Business development
CRADA	Cooperative Research and Development Agreement
DDM	Decision to develop in man
DMPK	Drug metabolism and pharmacokinetics
EMA	European Medicines Agency
EPC	European Patent Convention
EPO	European Patent Office
ESP	Early selection point
FCC	Federal Communications Commission
FDA	US Food and Drug Administration
FDP	Full decision point
HR	Human resources
IND	Investigational new drug application
IP(R)	Intellectual Property (Rights)
JPO	Japan Patent Office
LES ( LESI)	Licensing Executives Society (International)
Mfi	Market for intermediary businesses
NDA	Non-disclosure agreement
NGO	Non-governmental organization
NPV	Net price value
OECD	Organisation for Economic Co-operation and Development
PCT	Patent Cooperation Treaty
PLEC	Patent licensing enforcement company
PMI	Patent market intermediary
SDP	Submission decision point
SIC	Standard industry classification
SME	Small-midsize company
TRIPS	Agreement on Trade-Related Aspects of Intellectual Property Rights
TTO	Technology transfer office
USPTO	United States Patent and Trademark Office
WIPO	World Intellectual Property Organization



# 1 Introduction

The last decade was characterized by a growing awareness for intellectual property rights, notably patents. Recent popular management literature and manager magazines, as IAM, IP Magazine, IP Today or IPManager, increasingly point at the importance of unexploited intellectual property (IP) to companies and thereby using impressive phrases and terms as “Rembrandts in the attic” (Rivette/Kline 2000) and “corporate crown jewels” (Kline 2003). The number of scientific publications in economic and management journals dealing with patent valuation, patent trading and management has been growing since the 1990ies which indicates that patents likewise attract interest in the academic sphere (Troy/Werle Forthcoming). IP management consultants constantly underline the success of strategic IP management activities of large companies, as IBM, Intel and Texas Instruments, and hint at potential profits arising from the external exploitation or commercialization of patents (Lichtenthaler 2005), notably patent licensing and selling activities. They encourage innovative companies to recognize the value of their IP and to strategically manage IP portfolios. Consequently, patents are no longer restricted to a monopoly right but more and more acknowledged as intangible asset and object of trade. Recent popular patent management literature even suggests an evolutionary phase model of patent exploitation, beginning with a stage of defensive application of patents to protect inventions, to a stage of offensive use of patents as legal “weapons”, further to a stage where patents are actively managed as business assets, and a final stage of deployment of patents as financial asset in the near future (Otsuyama 2003; Kline 2003; McClure/Malackowski 2011). This hype is paralleled by increasing patenting and licensing activities of universities which tend to see patents as fruits of research activities (Mowery/Ziedonis 2001; Owen-Smith/Powell 2003).

In fact, the substantial increase in patent applications filed worldwide indicates a large number of patents potentially available to be sold and licensed. Since 1995 patent filings have grown from 1,090,926 to 1,854,415 in 2007 amounting to an average annual rate of increase in total patent filings of 4.7% (WIPO 2008). At the same time, receipts for intellectual property (not only patents but also copyrights and trademarks) from international licensing have decupled worldwide from 10 billion USD in 1985 to nearly 110 billion USD in 2004 (World Bank 2008). Between 1990 and 2003, Germany doubled its respective revenue from 1.3 to 2.7 billion EUR (Kamiyama/Sheehan/Martinez 2006: 18).<sup>1</sup> Most recent figures reported by the German Bundesbank show that in 2005 receipts from international patent licenses and sales amounted to nearly 4.1 billion EUR (Deutsche Bundesbank 2006: 15). In

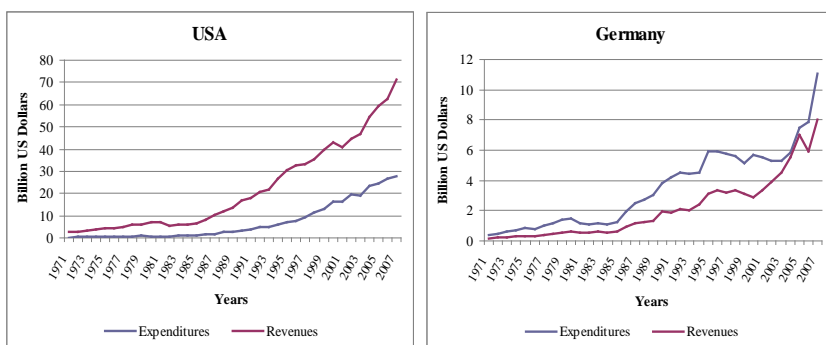
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<sup>1</sup> OECD data do not take into account inflation during this ten year time span.

France, receipts from international patent licenses and sales rose from 330 million EUR to 2.4 billion EUR in the same time period. According to the Japanese Survey of Intellectual Property-Related Activities 2004, international patent licensing income in Japan amounted to 343.2 billion YEN in 2003 (Japan Patent Office 2004). Results of the Basic Survey of Business Structure and Activities show that Japan's receipts from licensing activities have climbed from approximately 80 billion YEN to 280 billion YEN between 1994 and 2002 with a significant increase since 1997 (Motohashi 2005).

However, international IP licensing payments differ across countries as national statistics show. For instance, the US reports an active balance of respective payments since the 1970ies. In the 1980ies, long before TRIPs, the US enhanced its active balance up to 43 billion USD in 2007 indicating a large gap between receipts and expenditures. Germany shows by tradition a passive balance which was strongly fluctuating between 2002 and 2007. In Japan, receipts from international IP licensing activities exceeded the expenditures (World Bank 2008). The balance of international IP licensing payments is basically an indicator for how a country benefits from strong patent protection and international trade-related treaties, as TRIPs. In general, only a few countries strong in technology export, as for instance the US, do profit from the current trend of increasing IP licensing activities (McCalman 2001: 178).

**Figure 1: Revenues and expenditures from licenses for patents, copyright, trademarks and similar IPRs in the US and Germany between 1971 and 2007 (balance of payments in billion USD)**



World Bank, World Development Indicators 2008,  
<http://search.worldbank.org/all?qterm=World%20development>.

Patent licensing and sales transactions are not new phenomena, and markets for patents existed about two centuries ago (Lamoreaux/Sokoloff 2007; Khan/Sokoloff 2001). Yet, this subject has gained relevance in the course of the last decade for the following reasons:

First of all, modern knowledge societies are characterized by the growing importance of Intellectual Property (IP) and knowledge-based technologies which contribute to economic growth and corporate competitiveness. In a "knowledge economy", knowledge has become a significant productive factor, an asset and commodity in its own right through the creation of knowledge-based technologies, as well as the emergence of new markets for technologies, and organizational exchanges (Drucker 1993; Stehr 2001). Knowledge is economically relevant if it is utilizable and if it contributes to the value-added of companies and enhances their competitive advantages to ensure the efficient allocation of resources (Hayek 1980: 78). This holds particularly true for technological inventions characterized by novelty and "useful" knowledge (Mokyr 2002: 1-27). This type of innovative knowledge, which includes instructions and techniques usually stored in technical artifacts, is institutionally protected by patents.

Second, the economic background of universities and knowledge-based firms has changed in this time span. Universities increasingly see patent licensing as a source of revenue, funding and reputation (Mowery, et al. 2004; Colyvas 2007; Thursby/Thursby 2007). Intellectual property (IP) has become a critical economic resource and asset beside tangible economic resources for companies. For knowledge-based firms, patents are intangible assets that account for an increasing part of the company's value. Investors are gradually more aware that patents, or "intellectual capital" (Parr/Sullivan 1996; Sullivan 2000) in general, provide loan security and patent transactions increase financial liquidity. Institutional creditors follow this trend hesitantly but with interest (Lipfert/Bend 2009). For the financial sector, patents and other intangible assets are still elusive.

Third, patent licensing and markets for patents gained attention in the field of innovation management studies through the adoption of the open innovation model (Chesbrough 2006b). This model basically describes how firms that used to internally develop technologies are now opening up their internal innovation process to allow for external knowledge flow between other companies along the supply chain. The paradigmatic shift from closed to open innovation models is still a largely debatable topic. Even if the open innovation model is not well recognized in many industries, the awareness of the importance of collaborative efforts in R&D activities exists and contributors to open innovations are more likely to come from different types of organizations (Murray/O'Mahony 2007; Owen-Smith/Powell 2003). This shift also indicates supply and demand for patents. Patents are not only exchanged

and transferred to circumvent the conflict of overlapping patent rights but also to counter costly redundant research activities (Chesbrough 2006b).

Generating and augmenting, but also distributing and allocating useful knowledge appear to be essential requirements of the welfare of modern knowledge societies. In order to cope with these requirements, the societies increasingly rely – also in ideology and policy terms - on the market as the seemingly most efficient mode of distributing and allocating goods and services (cf. Djelic 2006). Markets are the central institutions of capitalist economies and the development of modern capitalism is characterized by a process of expansion of markets as mechanism for the production and allocation of goods (Beckert 2009). A functioning market is expected to reward the most promising technical innovations and to direct investments into areas where the creation of new knowledge is most useful.

Markets for patents imply typical market transactions in the form of spot-market or arm's length transactions. Following Oliver Williamson (1979; 1981), spot-market transactions occur instantly and are highly standardized and thereby involve classical contracts<sup>2</sup> (MacNeil 1980). In an arm's length transaction, the identity of market actors to the transaction is treated as irrelevant and does not affect the terms of trade. However, modes of transfer and transactions of patents can take various forms, ranging from R&D collaborations, merger and acquisitions of knowledge-based firms, cross-licensing, patent pools and patent licensing. In some transactions, patents are exchanged against payments, while in others they are exchanged against other patents, IPRs and know-how as bargaining chips. As we will see, patents are an integral component of the transfer of technological knowledge from universities and research labs to firms as well as of cross-licensing agreements and patent pools, and of mergers and acquisitions of companies. Consequently, not all patent transactions have the form of typical market transactions. Most akin to typical market transactions are patent licensing and, even much more, sales transactions for monetary rewards because they are less integrated and allow for standardized arm's length market transactions (Fosfuri 2006).

For the purpose of this thesis, I refer to transactions of patents (“patent transactions”) that comprise non-collaborative exclusive licensing of patents (“patent licensing transactions”), in which lengthy negotiations are usual, on the one hand, and arm's length sales transactions of stand-alone technologies on the other hand. Patents are the primary objects of transfer. Transactions take place among non-affiliated organizations, such as universities, small and large companies. They in-

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<sup>2</sup> A classical contract is “sharp in by clear agreement; sharp out by clear performance” (MacNeil 1980: 738) and thus associated with discrete transactions (Williamson 2000).

clude carrot-licensing, i.e. a patent holder does not threaten to sue a third party for patent infringement but deliberately offers a patent to gain revenues.

Patent transactions and markets for patents are objects of investigation in industrial economics, innovation management and IP management. Interestingly, the respective literature uses a variety of terms for this market; e.g. “markets for patents and know-how” (Teece 1981; Gambardella/Giuri/Luzzi 2006), “markets for technology” (Arora/Fosfuri/Gambardella 2001), “markets for IP” (Serrano 2006) and “markets for ideas” (Gans/Stern 2008; Arora/Gambardella 2010) but also the “secondary market for IP” (Chesbrough 2006a). It predominately refers to market(s) for technology or transfer of technology<sup>3</sup> instead of market(s) for patents – both, as singular and plural. Technological knowledge, however, is a broader term because it comprises know-how and intellectual property. It is embodied in prototypes, devices or technical services which are often inextricably intertwined and thus are transferred in bundles or portfolios (definitions of technology see Dahlman/Westphal 1981; Bozeman 2000). A patent is an integral component of the transfer of technological knowledge, and thus a narrower term. Patent transactions and markets for patents are not specially addressed by the literature.

Given the relevance of patents and their transactions for innovation, we know very little about how these transactions work and how markets for patents are functioning. How do sellers or licensors commercialize their patented technologies in order to make profit? How do buyers and licensees approach patent holders in the search of the right technology? How do both sides, supply and demand, agree on a price for a patent whose value is uncertain? And how does an arm’s length sales transaction of patents, notably a patent auction, differ from a patent licensing transaction? What is the role of intermediary organizations, which assist and consult patent holders and licensees, in the market for patents? And how does the market for intermediary businesses look like?

This thesis aims at contributing to the understanding of how patent transactions are working in practice and which elements are vital for the constitution of functioning markets for patents. One central aspect in this thesis alludes to *uncertainties in patent transactions*. The dissertation attempts to unfold different sources and facets of uncertainty that play a role in markets of patents, and at the same time it aims to explore the preconditions of these markets.

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<sup>3</sup> Technology transfer has become a separate field of inquiry in the 1970ies.

### **The pilot study preceding the thesis**

The pilot study, which was carried out by Raymund Werle and myself in 2007 and in the beginning of 2008 (further information in: Troy/Werle 2008)<sup>4</sup>, identified several sources of uncertainties that appear to be essential in patent transactions. They relate to the process of research and development (R&D), the uniqueness of a patented invention, the projection of demand, and the valuation of a patent. In the study, it was assumed that these uncertainties hamper patent transactions and consequently they have detrimental effects on the market for patents. At the same time it was hypothesized that these uncertainties allow for profit on a (secondary) market for intermediary businesses in which third parties or so-called patent market intermediaries offer their services to licensors and licensees.

Based on the pilot study, this thesis elaborates on uncertainties that result from the R&D process, the cooperation between licensors or sellers and licensees or buyers of patents and the formation of prices when the value of the patent is uncertain.

### **Research questions**

Accordingly, the overarching research question of the thesis is: Which uncertainties exist in patent transactions and how do managers cope with uncertainties in bilateral patent licensing and patent auctions? Throughout the thesis, the following sub-questions are posed:

1. *Which sources of uncertainties exist in (bilateral) patent licensing transactions between public US universities and German pharmaceutical companies?*
2. *How do managers cope with key sources of uncertainty, notably cooperation and valuation-pricing problems?*
3. *How are uncertainties tackled in patent auctions?*
4. *What is the role of patent market intermediaries (PMIs) as assistance on the market for patents and suppliers on the market for intermediary businesses (MFI)?*

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<sup>4</sup> The pilot study comprised 12 interviews that have been conducted by myself and previously by three other members of the research project team at the Max Planck Institute for the Study of Societies. Two patent managers of a large company and a small subsidiary of a large firm; three patent attorneys; one CEO of a small biotech start-up; one CEO of a small venture capital firm; four patent specialists affiliated with different types of intermediaries such as technology transfer units, brokers, and/or consolidators (who purchase patents and assemble them in portfolios which they sell); and, finally, an expert team analyzing the use of patents (Troy/Werle 2008). For the analysis, I used an in-vivo coding procedure about issues of concern to identify key sources of uncertainty discussed in Troy and Werle (2008).



The disciplinary provenience of the thesis is sociological with an open angle to the philosophy of economics and science and transaction cost theory. It means that the thesis couples to the transaction cost approach in economics (Williamson 1989; Williamson 2000; North 1986), which dominates research in patent markets, and at the same time attempts to extend this approach by incorporating sensitizing concepts from the philosophy of economics and economic sociology.

The following literature review sheds a light on regional markets for patents by pointing at the lack of data on patent transactions (1.1). This and the existence of different viewpoints on markets, as I will further argue, hint at the relevance of uncertainty not only to companies and universities involved in the market but also to researchers. Research in patent transactions and markets for patents is confronted with a lack of robust data, confidentiality and a lack of transparency in this field. Previous studies primarily focus on the determinants of the trade in patents (1.2, on page 10). However, the literature does not explicitly address patent transactions and preconditions of a functioning market for patents, as I will show.

## **1.1 Evidence for regional markets for patents and the lack data on patent transactions**

It is interesting to note that the literature in industrial economics and management science is ambivalent about whether a market (or markets) for patents exists at all. Different strands in the literature provide two opposing conclusions about the functioning and emergence of such a market:

By following popular managerial literature, some industrial economists note that “the market for trade in patents is large” (Serrano 2006: 3) and write enthusiastically about growing licensing activities (e.g. Merges 1999). Arora et al. (2002: 2) point to significant institutional changes in the past years which contributed to flourishing market activities because they facilitate market exchanges of patents: The rising number of online platforms for technologies, the increasing number of intermediaries and the transparency of information in patent databases (see also Gambardella/Giuri/Luzzi 2007; Tietze/Herstatt 2010; Serrano 2006). Gambardella et al. (2007) argue that today’s market for patents is not characterized by significant asymmetric distribution of information which may impede functioning markets. Public patent databases, as PATLIB or EPOLINE, are easily accessible and usually costless. Furthermore, buyers in this market are technologically knowledgeable and thus uncertainty about patent quality is unlikely. The authors hint at the growing share of international transactions between unaffiliated companies to prove “real markets” (see also Motohashi 2005), and at growing numbers of intermediaries that strive to facilitate patent transactions directly or indirectly (Tietze/Herstatt 2010).

The other strand of research is cautious regarding the existence and prospects of an organized market for patents. In fact, recent socio-economic research points to obstacles in patent transactions that account for market imperfections (Teece 1981; Gambardella/Giuri/Luzzi 2007; Motohashi 2005). Lemley and Myhrvold (2008) observe patents to be exchanged in a “blind market” where willing licensors and licensees cannot find each other. Furthermore, a low number of potential buyers and sellers are available to be matched up, and the good is not substitutable. As we will see in the following sub-chapters, these circumstances cause a low degree of “market thickness” (Roth 2007) or, what Max Weber (1980 [1920]: 43-44) calls “marketability” (Lemley/Myhrvold 2008; discussed in Gans/Stern 2008). The market for intellectual property is far from functioning smoothly (Granstrand 2000: 2-12).

National and international surveys report a high share of transactions between affiliated companies, usually between parent companies and subsidiaries (Kamiyama/Sheehan/Martinez 2006; Deutsche Bundesbank 2006). However, such transfers cannot be regarded as external market transactions. The same holds true for transactions between universities and companies. Ever since technology transfer has emerged as a separate field of inquiry, the literature acknowledges relationships between two enterprises to be long-standing, namely as “partnering”. Universities and research labs commercialize inventions by engaging in long-term licensing agreements and other CRADAs with industry. Bidault and Fischer (1994) even claim that stable relationships in networks of technology partners prevail, and a company tends “to limit technology transfers to the firm’s partners, i.e. organizations with which the firm has already interacted in the past.” (1994: 373).<sup>5</sup> The authors consider the “market for technology” as a myth that is maintained by technology managers in companies. Public patent auctions, online platforms for technologies and other spot-market forms of exchange do not represent the vast bulk of transactions and they are still in their infancy (Lichtenthaler/Ernst 2008). Thus, not every patent transaction is a typical market exchange (Troy/Werle 2008).

The co-existence of increasing licensing activities on the one hand and obstacles in transactions on the other poses the question of how this discrepancy is possible. One rationale of this phenomenon is the lack of robust market data and of transparency about supply and demand.

Comprehensive data and studies on national and regional markets for patents and licensing activities of companies are widely missing. Many OECD countries require that cross-border licensing contracts be reported, thus time serial data at an aggre-

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<sup>5</sup> Bidault and Fischer (1994) arrive at this conclusion in a small survey of 31, mostly French, pharmaceutical firms (licensor and/ or licensees) in the early 1990s.

gate level are available for international transactions (Kamiyama/Sheehan/Martinez 2006: 16). Based on the share of expenditures for licensing-in, Arora et al. (2001: 31) roughly estimate the volume of North Americas “market for technology”, which comprises know-how and other technical collaborations, to be 25 billion USD in the mid 1990ies. For Europe they estimate 6.6 billion USD and for Japan 8.3 billion USD, and the world wide volume to be up to 40 billion USD. Guellec et al. (2007) compare different figures of the size of the market for patent licenses only and conclude conservatively that in 2005, the US market was 40 to 50 billion USD worth, whereas the European and Japanese market sizes were estimated to be between 15 and 20 billion USD. Using information from the USPTO patent database for the period between 1980 and 2001, Serrano (2006) identifies the fraction of US patents being transacted. He finds that nearly 20% of all US patents are transferred at least once over their life cycle and he shows that through the sale a patent gains 5.1% to its intrinsic value. For the period between 1979 and 2004, Chesbrough (2009) finds that a US patent is reassigned 1.6 times on average, amounting to a reassignment or patent ratio of 0.17.<sup>6</sup> However, reviewing these investigations more accurately one will find that the volume of markets for patents is not specified, and robust statistics on national and regional level are missing.

This lack of data has various reasons. A substantial number of companies engaged in patent licensing do not publish royalty revenues in financial reports (Gu/Lev 2004). The information policy of IBM, largest patent holder and world leader in IP licensing for the last decade, is a prominent case but it does not reflect common practice in this industry. These companies are not only a frequently quoted model of aggressive IP licensing for profit but extraordinary examples of a company’s public relation strategy and shareholder information policy in licensing (Sullivan 1996).<sup>7</sup>

These shortcomings pose serious problems for researchers who attempted to find solutions to this data problem. Some researcher focused on reassignments of patents (Serrano (2006) and also Burhop (2009)). Yet, a change in ownership may also occur when companies would be acquired, undertake spin-off operations, bankruptcies, security agreements and joint ventures (Chesbrough 2009). Consequently, researchers are not able to learn about details and backgrounds of reassignments or other registered patent transfers. Most patent transactions take place as patent licensing and not as sale transactions. Hence, most patent transactions are not registered.

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<sup>6</sup> Standard deviation is 0.55, patents that have not been reassigned are excluded (Chesbrough 2009).

<sup>7</sup> In 2002, IBM reported IP income of 1.1 billion USD which accounted for approximately 15 percent of its pretax net income.

Interestingly, comprehensive databases do exist for historic markets for patents. Consequently, historic studies are more likely to prove growing markets for patents than contemporary studies. Lamoreaux and Sokoloff (1999; 2001; 2007), for instance, examine the market trade in patents in the United States in 19<sup>th</sup> century and advance the argument that intense market exchanges existed prior to the establishment of in-house R&D laboratories in large firms. Intermediary organizations, as law firms and patent agents, provided sufficient transparency in supply and demand, and they allowed individual inventors to specialize in the commercialization of patented inventions (see chapter 7, page 221-252).

While patents are publicly disclosed and open to research, patent trading remains private and secret. The reasons are far reaching and in need to be explained in the course of the thesis. As I will further argue, this lack does not only aggravate research in patent transactions but is one cause why markets for patents are “blind” and cooperation and valuation-pricing problems occur.

### 1.2 Determinants of the trade in patents

Empirical studies identify a number of determinants of the trade in patents that are relevant to this thesis and thus briefly discussed here: Motives to file a patent and to license patents for industrial firms and universities, the appropriation of rents from patents, the size of the companies, the value of patents, the enforceability of patents and transactions costs. The role of institutional support for the trade in patents is less clear for patent trading.

#### **Motives to file a patent**

Inventors have various options to protect their idea. They can benefit from lead time advantage, use exclusive relationship to costumers, trade secrets and other forms of IP. Patenting is only one option, and not always the most effective one (Levin, et al. 1987; Arundel 2001) and it is the least important to inventors in most industries (Taylor/Silberston 1973; Blind, et al. 2006). Blind et al. (2006) come to the conclusion that for companies active in patenting, patenting has an outstanding position among all protection strategies aimed to improve the protection of own asset items and to appropriate the economic benefits from the invention. Also, inventors have different motives for patenting inventions. Empirical studies<sup>8</sup> consistently show that the most traditional motive to file a patent, namely protection from imitation, is the highest ranked motive for patent holders. This motive is followed by

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<sup>8</sup> It is very interesting to observe that surveys referring to patent motives and strategic use of patents do have a very large number of cases whereas studies about licensing activities do not.

a defensive blockade (patent fences) and offensive blockade (Cohen, et al. 2002; Pitkethly 2001; Arundel/Patel 2003).

Gaining licensing revenues from patents is among the very low ranked in all studies. The PatVal-EU project, an extensive study of the value of more than 9,000 European patents in six EU countries (DE, ES, FR, IT, NL, UK) in 2003/04, surveyed the use of patents by firms. It provides evidence that over 50% of the patents are used only for internal R&D and about 18% are used to strategically block competitors. About 9% are licensed only and 17% left unexploited (“sleeping patents”).<sup>9</sup> The share of patents licensed in Europe is relatively small compared to other forms of exploiting a patent. Previous findings in other countries and anecdotic evidences indicate a relatively weak internal and external exploitation of patents. Despite the increasing awareness of patent exploitation, “they are kept on the shelf by the corporation throughout the patent’s legal life” (Chesbrough 2006a: 3).

Recent literature casts light on reasons for unused patents (“sleeping patents”). The number of patents is also used to signal innovativeness because it improves the technological image of companies (Gambardella/Harhoff/Verspagen 2006). As intangible assets, patents can enhance the value of inventing companies and serves to establish reputation (“reputation motive” in Blind, et al. 2006; Lerner 1994). Reputation may even prompt companies to enter in a race for patent portfolios and to file more patents (Hall/Ziedonis 2001). However, these findings are subject to numerous caveats and qualification because patents are rather used to improve the negotiating basis than as signal or for other image reasons, as e.g. for attracting additional external sources of finance (Cohen/Nelson/Walsh 2000; Blind, et al. 2006). For universities, however, the effect of institutional reputation and institutional prestige on licensing activities is well documented (Thursby/Jensen/Thursby 2001; Sine/Shane/Di Gregio 2003).

### **Motives to license or sell patents for firms**

Contrary to motives to patenting, the highest ranked motive to license patents is attaining profit from licensing, followed by strategic motives, as blocking rivals and building patent fences (Gambardella/Giuri/Luzzi 2007; Teece 1998). Management studies show that against the background of a seemingly growing differentiation and diversification of patent utilization, motivations towards the external use of patents are not confined to the commercialization of patents allowing for high profits and low production costs. Apart from seeking licensing revenues, patent holders license out, first, in order to open up a new product market by promoting their technologies, second, to improve firm’s supplies costwise or qualitywise for incorporating in

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<sup>9</sup> The rest was internally used and licensed.

products and components (West 2006; Bidault 1989). Licensees license-in patents to ensure access to new product markets, to obtain complementary resources, to prevent or retrieve the infringement of third party's patents through cross-licensing agreements in favor of gaining "freedom to operate" (Bidault 1989; Hall/Ziedonis 2001; Reitzig 2004). In other words, licensing may not be an end in itself but part of companies' long-term strategy to hold and enlarge shares on the product market. Additionally, licensing is influenced by the degree to which the innovative activities carried out by the patent holders are mutually dependent upon the innovative activities of the other relevant market actors (Bidault 1989; Davis 2006).

Cross-industry studies reveal significant differences across industries for licensing activities. The majority of licensing contracts is signed in the chemicals, electronics and computers (Anand/Khanna 2000 for USA and Canada; Motohashi 2006 for Japan). The ratio of unused patents is relatively large in the pharmaceutical industry but companies consider them for licensing instead of building patent fences (defensive strategy). In the chemical industry, holding unused patents for defensive purpose is widespread (Reitzig 2004). The propensity to licensing is lower here, even though most contracts are signed in this industry. In electronics, semiconductor and machinery, a typical product is based on integrated circuits involving numerous patents owned by different firms and on cumulative technologies, thus trading patents in those industries is largely compelled by an overlap or "thicket" of patents (Grindley/Teece 1997; Hall/Ziedonis 2001). Also, if standard setting is relevant in industries, firms tend to license forcefully to assure the diffusion of technologies (Shapiro/Varian 1999). These findings indicate that patent licensing activities considerably vary across technologies and industries. It provides a rationale why many authors prefer to use the term "markets" for patents as plural or alternatively refer to the trade in patents or patent transactions.

### **Motives to license (or sell) patents for universities**

University licensing decisions differ considerably from those made by private firms. The motives of universities to license patents are much more complex also because universities do not have stakes in the product market. Traditionally, universities have the incentive and mission to invent and disclose scientific outcomes (Eisenberg 1989), be it through scientific publications or through patent applications and licensing to industry. The latter goes along with commercialization efforts on the part of the university technology transfer office (TTO) that seeks either to license a technology to a firm or to form a start-up company. Income from royalty payments, however, is not the only goal of licensing. Much more, universities see the commercialization of inventions (Thursby/Thursby 2007) and the dissemination of knowledge per se as a goal. Furthermore, the goals of licensing for universities

highly vary within the organization. The commercial success of universities is hardly measurable in terms of licensing revenues. Besides, TTOs use the number of created start-ups, industrial relationships and the landing of grants as indicator for their performance (Lockett/Siegel/Ensley 2005)

University licensing strategies and success substantially vary across universities, scientific fields, and technologies (Thursby/Thursby 2007). Licensing activities are also a function of the involvement and willingness of faculty and administration to license technologies (Jensen/Thursby 2001). Moreover, an increased business reliance on outsourced R&D rather attribute to a growth in university licensing than a shift in faculty research towards applied science (Thursby/Thursby 2002). Numerous studies provide evidence that higher royalty shares for faculty members are associated with greater licensing income for the university (Friedman/Silberman 2003; Lach/Schankerman 2004).

### **The size of the company**

The size of companies is an explanatory factor for the propensity to license. Large companies have a lower propensity to license than smaller firms. Their R&D is integrated, and usually they own the complementary assets for innovation. Moreover, they can obtain capital more cheaply either because they have internal funds or because market power or other factors facilitate access to financial resources. Also, large companies are more likely to license-in whereas for small companies it is rather the other way (Gambardella/Giuri/Luzzi 2007; Motohashi 2006). This finding is not surprising because small firms often lack adequate production and marketing capabilities and therefore are pursuing out-licensing activities more intensively (see Chapter 5). Large companies, however, are more likely to license-out their non-core technologies downstream.

### **The value of patents**

One of the most intriguing findings in empirical studies is that patents with a high economic value are more likely to be licensed than non-valuable patents, and in return, licensed patents have a higher economic value than non-licensed patents.<sup>10</sup> In the Pat-Val survey, Gambardella et al. (2005; 2006) find that a licensed patent is in any case picked from a subset of better patents, and valuable patents induce a higher demand. The literature on patent reassignments and patent transfer provides account that transferred patents are more valuable than the average patent (Serrano 2006;

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<sup>10</sup> In Reitzig's study (2003) study companies responded to the question "Please imagine that the patent would be in the hands of your strongest competitor for the rest of its life; what would be your interest in buying the patent today knowing what you know now." This question is different from the Pat-Val Eu survey (Gambardella/Giuri/Mariani 2005; Gambardella/Harhoff/Verspagen 2006).

Burhop 2009). At first glance, these findings are surprising because one may assume that firms tend to exploit valuable patents internally instead of licensing or selling them. However, following Hanel (2006), Choi (2003) and Meurer (1989) this question is not crucial when patents are cross-licensed and pooled to avoid litigations or used as a bargaining chip (“settlement licensing” in Meurer 1989). The same refers to licensing and sales in which the patent holders lack downstream capacities and complementary assets, for example with universities, research labs or other specialized engineering companies.

A closer inspection shows that the distribution of the value of patents is typically highly left-skewed across technologies, so relatively few patents are of a high value. In the Pat-Val study, for example, patent holders were asked to estimate the value of their patents.<sup>11</sup> Only about 16.8% of the surveyed European patents were worth more than 3 million Euros. Another 15.46% were estimated between 3 million and 1 million Euros while 42.45% ranked between 1 million and 100,000 Euros and 24.4% less than 100,000 Euro. The uneven distribution of patents’ value is documented in several national and international studies, though more or less pronounced (OECD 2006; Reitzig 2003; Pakes 1986).

In fact, the value of patents is a complex factor and the low value of a patent does not sufficiently explain why many patents are not licensed. The results of the Pat-Val-EU study show that patents with a low value are not licensed because they are not valuable enough and hence have limited demand.<sup>12</sup> The results imply that many patent holders are not forcefully blocking competitors but also considering patents as bargaining chips and as tradable good to gain revenues. Hanel (2006) summarizes basic results of studies in a literature survey. He finds that the value of a patent depends on the ratio between the total sales of competitors that infringe a patent, and sales revenue of the patentees from using the technologies of competitors as well as his propensity to litigate. The patent value increases when a patent is more likely to be infringed by competitors. Also, patents owned by weak competitors are more valuable. Summarizing basic results of studies in a literature survey, Hanel (2006) concludes that the most valuable patents are not those likely to be used by the patent holder but those likely to be infringed upon by rivals “because the main role of the patent is as a bargaining chip to buy freedom of action” (Hanel 2006: 902).

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<sup>11</sup> The patent holders were asked to quote the minimum price at which they would have sold the patents on the day of patent grant.

<sup>12</sup> In the study, proxies of the value of patents or their generality did not affect the conditional probability of licensing.



### **Enforceability of intellectual property rights**

Furthermore, non-market factors have an impact on licensing activities. Arora and Ceccagnoli (2006) find that the effectiveness of patent protection, as perceived by the surveyed R&D managers, positively affects the propensity to license when complementary assets are absent or unimportant. Merges (1999) and Teece (1998) show that weak enforceability of IPRs aggravate appropriation of patents. To a high degree, the enforceability of ownership of knowledge is a function of the efficiency of national IP regimes. Efficiency results from the extent of legal barriers to replication and imitation of protected inventions (Teece 1998). As a consequence, licensing contracts usually have a complex structure and require long negotiations to arrive at provisions that deal with the weak enforceability of IP rights (see also Brosseau/Chasserant/Bessy 2005).

### **Transaction costs**

Another more theoretical strand in the literature analyzes the functioning of markets and investigates imperfection in the market arising from imperfect projection in R&D processes, weak IP protection, and other obstacles inherent in the characteristics of the good. Analyzing the gap between private and social benefits from basic research, Richard Nelson (1959) and Kenneth J. Arrow (1962; 1969) demonstrate that due to a lack of predictability in R&D processes purchasers are inclined to value a basic research invention below its expected profitability and social value. Even if the net value of an invention is predictable, the costs of transfer may exceed expected revenues when additional scientific knowledge cannot be obtained. Arrow (1962) points to the information disclosure problem which engenders significant information costs in international technology transfer (see page 49). Teece (1977; 1986) identifies significant “costs of transmitting and absorbing all of the relevant unembodied knowledge” (Teece 1977: 245), which complements patents in respective transactions (“technology transfer costs”) and involves “sticky information” (Von Hippel 1994), as we will see. Moreover, seller and purchaser are concerned either with hold-up and hold-out problems which generate additional obstacles for market entrance (Shapiro 2001). It is widely acknowledged that markets are characterized by high transaction costs which render classical contracts unlikely (Williamson 1991).

### **The role of political institutions**

By tradition, patent policy has much stronger sought to protect intellectual property rights and investment in innovation than to strengthen the tradability of inventions on a market. Governments and regulators, including the courts, have mainly been involved in generally expanding and strengthening the propertization of novel and useful knowledge. National and international law (e.g. TRIPS) lacks provisions

dealing specifically with the peculiarities of the commercial trade of patents. Political initiatives aiming to endorse the development of regional markets for patents in Germany and Japan for instance, have been initiated not until recently (Troy/Werle Forthcoming). The most recent initiatives support small and mid-size companies that miss patenting and licensing experiences (SIGNO in Germany and INPIT in Japan). In the US, similar government grant programs have been launched in the 1980ies (the „Small Business Innovative Research Program“ and „Small Business Technology Transfer Program“). These initiatives and programs sponsor numerous consulting services for innovating company’s founders, amongst other the commercialization of inventions (U.S. Small Business Administration 2009). Other programs aim to encourage knowledge transfer from universities to (regional) industrial companies. These initiatives, however, are not designed to support typical market transactions.

Political initiatives hardly address the market for patents while private initiatives seem to dominate. Private bottom-up initiatives include regime-building efforts at the international level, where professional non-governmental associations, e.g. the Licensing Executives Society International (LESI) and the Association of University Technology Managers (AUTM), have started to review and assess licensing practices in different countries (Brousseau/ Chasserant/ Bessy 2005; also Razgaitis 2007) and to work on accepted methods for patent valuation. These efforts have a shaping effect on patent transactions because they strengthen expertise among business managers, lawyers, and other professionals beyond corporate practice. Non-governmental associations seem to be more appropriate at strengthening the development of markets for patents and at addressing obstacles in these markets (Troy/Werle 2008).

### **Conclusion and research gaps**

To sum up, many empirical studies dealing with the trade in patents investigate patent transactions either from the perspective of the patent holder (Teece 1998), the awareness of open innovation and patent exploitation in firms (Chesbrough 2006b; West 2006) or the value of patents (Gambardella/Giuri/Mariani 2005). Theoretical studies in economics deliver insights into effective designs of licensing contracts (Macho-Stadler/Pérez-Castrillo 1991) and into obstacles in patent transactions that result from the characteristics of the good, e.g. the high specificity of this asset (Williamson 1979), knowledge as semi-public good (Nelson 1989), indivisibility of inventions and the information disclosure problem (Arrow 1962). Some studies use a transaction cost approach (Williamson 1989; Williamson 2000; North 1986) which takes into account a low frequency of transactions (Tietze/Herstatt 2010) and uncer-

tainty. Other studies consider the timing of patent licensing along different development stages of a technology (Allain/Henry/Kyle 2010; Nishimura/Okada 2010).

The majority of the studies, however, falls short from the multifariousness of uncertainty and patent transactions. They widely acknowledge the relevance of uncertainty for markets for patents but it still remains an one-dimensional or even vague concept and its effect on patent transactions is not fully understood (except for: Gans/Hsu/Stern 2008). As I will show in the next sub-chapter, industrial economists recognize uncertainty as a barrier to transactions mainly because it leads to high transaction costs (Williamson 1979). To the best of my knowledge, the respective literature does not inspect differences between typical market transactions of patents, i.e. arm's length sales transactions, and more integrated transactions, i.e. bilateral patent licensing transactions between organizations. Furthermore, the viewpoint of the purchaser or licensee (Arora/Gambardella 2010), and patent licensing between university and industry are commonly ignored.

This thesis tackles three research gaps in the literature: First and foremost, different sources and facets of uncertainties in patent transactions are analyzed. The role of the managers involved in patent trading and the interaction between supply and demand are considered in particular. Second, the thesis compares two forms of patent transactions - patent licensing transactions with lengthy negotiations and arm's length sales activities in IP auctions. It explores similarities and dissimilarities between these two transaction types by inspecting uncertainties prevalent in each type and the way managers cope with them. Third, the role and function of intermediary organizations in the market for patents and the (secondary) market for intermediary businesses are analyzed and reconstructed.

The next sub-chapter introduces the concepts of uncertainty, transactions and markets.

### **1.3 Conceptualization: Uncertainty and markets**

It is a well documented fact that uncertainty is a key factor in inventing activities and market transactions. Uncertainty about the transaction process reduces the efficiency of the market for technology and patents (Arora/Gambardella 2010).

In new institutional economics, uncertainty is foremost regarded as impeding conditional factor when paired with opportunism of market actors. Markets tend to collapse due to the concurrence of uncertainty and opportunistic behavior of actors (Akerlof 1970). Following Williamson, the lack of full and relevant information for rational decisions is a "critical attribute" (Williamson 1979: 239) which has at least two implications for markets. First, uncertainty is a *condition* that hinders the execution of complete long-term contracts and it foremost affects specific investment

(Williamson 1979). In the latter case numerous sequential adaptations of the contract become necessary to rectify the alterations of the contractual conditions. Under uncertain conditions, a contract becomes a “mere promise, unsupported by credible commitments, will not be self-enforcing” (Williamson 2000: 601). Second and as a consequence, uncertainty triggers *opportunistic behavior* among actors. This situation may initiate moral hazard and also adverse selection in the long run (Williamson 2000).

However, the role of uncertainty, as we will see, is twofold: It can be treated as obstacle for primary markets for patents and as a structural precondition for the market for intermediary businesses. Hence, uncertainty unifies impeding and enabling viewpoints. To arrive at a consistent definition of uncertainty, I relate to the concepts of the philosophy in economics.<sup>13</sup>

### **A definition of uncertainty**

Philosophers in economics introduced different definitions of uncertainty. John M. Keynes (1973 [1921]) describes uncertainty as a *lack of confidence in a belief with different degrees (high-low)*. Frank Knight (2002 [1921]) defines uncertainty distinctive from risk. For Shackle (1990 [1954]; 1969), uncertainty is induced by a *lack of foreknowledge* which is relevant to make decisions. To avoid confusion, I define uncertainty as a *lack of information which is relevant to make decisions*. There are reasons to assume that the availability of information is easier to detect and describe and less dependent on the cognitive capacities of actors than (tacit) knowledge (cf. Kitch 1980). However, notably in describing R&D processes and the technological part of the patent, knowledge is often the more appropriate term.

For simplicity, I assume that information is knowable, can be comprehended and is discovered by the actors involved in transactions once it is available to them. The rationale is that in the empirical field, managers devote a good deal of time to gather and interpret relevant information - often more than they would actually need (March/Feldman 1981). Information in guidelines and programs allow for different interpretations by the actors. Moreover, the occurrence of uncertain situation does not indicate an immediate reduction or absorption of uncertainty. Uncertainty may be ignored by managers, as March (1981) and March and Feldman (1981) argue. Yet, ignoring uncertainties may well be a reaction to uncertainty. And in no ways it means that uncertainty is *not* perceived by the managers.

The variation of uncertainty in different degrees is possible, as I found, when we adopt the position of an *observer*. The degrees vary with the amount of decisive

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<sup>13</sup> The literature in innovation and organizational studies and innovation policy came up with a variety of definitions and typologies of uncertainty (overview in: Jauch/Kraft 1986). Yet, they are mostly anchored in a specific paradigm or innovation-related topic.

information (weight of argument) at a point in time to make informed decisions and to form expectancies (Keynes 1973 [1921]: 77). With less decisive information, decision-making is confronted with speculation. With more decisive information that accumulates over time, decision-making is akin to a calculative attempt. *Low uncertainty could be positioned between high uncertainty and risk if we assume that information accrues over specific stages (ex-post viewpoint)*. Third, uncertainty is distinguished from risk to avoid commingling and conflation of those two concepts (cf. Knight 2002 [1921]). The term risk is used when actors assume that the occurrence of an event, for instance a loss or yield, is calculable or measurable. The relevant information for decision-making is available.

### **Different viewpoints on the market**

It is also obvious that authors draw different conclusions about a market for patents depending on the definition of a market.<sup>14</sup> *Neoclassical and social welfare economists* define the market as an abstract place in which suppliers of goods meet and thereby forming a market price for this good (Marshall [1920] 1961). Neoclassical economics argues that the decisions of market actors are determinate by the market price. The decisions of market actors are directed to the maximization of utility or cost-constrained profits.<sup>15</sup> *For (new) institutional economists* the market is referred to as a governance mode of transactions beside the hierarchy and the hybrid organization (networks) (Williamson 1989). In Williamson's terminology, the market is the most efficient governance mode for more standardized goods and services, characterized by simplicity, that are traded with low and high frequency.<sup>16</sup> When uncertainties are prevalent in transactions, either the market governance or vertical integrated organization of exchange are efficient (Williamson 1979).<sup>17</sup>

*Economic sociologists* tend to abandon the efficiency postulate and emphasize the socio-structural, institutional and cultural embeddedness of market actions

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<sup>14</sup> While economists tend to use the word "market" as singular, economic sociologists make use of the plural.

<sup>15</sup> Each individual decision contributes to the supply and demand of goods and services whereby any change in cumulative supply and demand has a marginal effect on prices.

<sup>16</sup> Specific and non-standard transactions, however, are governed by unified (frequently recurring) or bilateral structures (occasionally recurring) (Anderson/Schmittlein 1984). When the need to consult, to adjust quantities and prices and to refine agreements is high, transactions are more efficiently effected in a vertical integrated governance form (hierarchy) regardless of the frequency of transaction.

<sup>17</sup> For instance, institutional economists are inclined to argue that market is most efficient for transactions of standardized goods and at the same time, if such transactions appear to emerge, the market necessarily becomes efficient. Consequently, a market is always efficient under the given conditions - otherwise it would not exist under the efficiency postulate.

(Zukin/DiMaggio 1990; Beckert 2009). Accordingly, economic sociologists developed numerous definitions of markets. The *structural approach* in economic sociology emphasizes social networks as basic context of economic activities. The market is seen as a network of buyer and seller relations that is spanned over products or services and market niches (White 1981; White 2002; Burt 1992; Granovetter 1985; Granovetter 1973). In such a network, market-related information is exchanged over ties, trust established, and social statuses and roles are ascribed and reproduced. *Institutional approaches* pay attention to political and regulative institutions and thereby underline the importance of the state and legal rules for markets (Fligstein 1996; Carruthers 2006; Hall/Soskice 2001; Dobbin 1994). In this strand, markets are, for instance, seen as institutional fields (Aspers/Beckert 2008: 238-239; Fligstein/Dauter 2007: 112-117).<sup>18</sup> They are established or constituted by producers/sellers and consumers/buyers, intermediaries, and regulators who orient their actions toward each other and to the objects of trade (cf. DiMaggio/Powell 1991). A set of shared formal and informal rules, standards, conventions, and norms governs the way transactions are carried out. The *cultural approach* argues that social values and moral legitimacy of economic processes shape markets and are a precondition for their constitution (Zelizer 2009; Lawrence/Phillips 2004). More integrative approaches regard the *market as social structure* (Swedberg 2003: 123; Aspers 2006; Aspers 2009). As it is spelled out in the next section, markets are characterized by a structured exchange of rights and a social order (Aspers 2008).

In this thesis, the market is understood as a social structure with stable expectations and structured exchanges between market actors.

### **Functioning markets**

With regard to functioning markets, economists widely refer to a static model of a “perfect market” that generates a maximum of social welfare. This market model, however, is hardly realized. From the viewpoint of economic sociology, functioning markets entail a social order and the structural problem of uncertainty is solved.

A functioning market exchange of goods revolves around the social order of markets and the problem of dealing with uncertainty (Beckert 1996; Beckert 2009). Basically, an established social order of markets is characterized by stability of expectations with regard to the actions of others. This order features a structured exchange so that actors can expect repeated exchanges for their goods and conceive a chance of exchange in their struggle for market power (“marketability”) (Fligstein 2001; Weber 1980 [1920]). With stable expectations, market actors are confident

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<sup>18</sup> To be precise, this definition of a market stems from the neoinstitutional field approach in the sociology of markets.

enough to engage in market transactions despite the remaining risks they must take (Beckert 2007). A market is functioning when certain constitutive elements are in place that coordinate economic actions: the valuation of goods, cooperation and competition between market actors. According to Beckert (1996; 2009), these elements represent the central sources of uncertainty for market actors: valuation, cooperation and competition problems.<sup>19</sup> As we will see in chapter 3, valuation and cooperation problems are most essential to markets for patents.

The *valuation problem* is a source of uncertainty that alludes to actor's preferences for goods. On the one hand, this problem concerns the assignment of a value to goods of a certain class (e.g. automobiles, wine, works of modern art), on the other hand it refers to the assignment of different values to highly heterogeneous goods within the same market (Beckert 2009). The attribution of subjective values to goods, however, is not just a matter of individual preferences. Often valuation is oriented to non-economic factors, for instance institutional standards, objectified cognitive patterns of valuation, normative legitimation of valuable goods and social positioning of consumers (cf. Zelizer 2009; Fligstein 1996). These structural elements reproduce specific forms and principles of valuation of goods, as for example qualitative criteria, scales, formulas and other measurements. Beside market prices, the valuation of goods according to such principles is regarded as a precondition for functioning markets.

The *cooperation problem* arises due to incomplete information about the intention of other market actors and the characteristics of the good. Market exchanges engender "social risks" because market actors on the supply and demand side often close incomplete contracts and are confronted with asymmetric distribution of information among actors. These risks become severe when market actors are not able to "infer the seller's actual intentions from manifest signals" (Beckert 2009: 259; Bacharach/Gambetta 2001) and to recognize the quality of a product. A market does not emerge or even collapses when actors fear moral hazard and deception (Akerlof 1970). Signaling trustworthiness, reputation effects, informal sanctioning, enforcement of compliance and trust are frequently discussed as solutions to the cooperation problem (Axelrod 1984; Coleman 1990; Luhmann 1988).

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<sup>19</sup> The competition problem describes the constant market struggle (Weber 1980 [1920]: 43-44) for temporary advantages over competitors. Suppliers are constantly trying to increase their market shares in order to gain competitive advantages in a given market. Competition creates uncertainty because suppliers are not informed about new market entrants and the strategies of competitors. More competition in the market reduces profit opportunities for individual market actors. Thus, notably incumbents or groups of smaller firms usually attempt to shape the competitive situation in the market by changing the market structure that affect their market position and consequently their profit (Beckert 2007).

### **The transaction process**

The basic research object in this thesis is the patent transaction process. As Commons (1936) suggests, a transaction is a transfer of rights and obligations between two partners.<sup>20</sup> It comprises the actual formation of prices and quantities in a nutshell. As Harrison White (1988: 232) points out, market actions are “intensely social”. Thus, transactions are not simply transfers of rights but social relationships that establish mutual commitment between the actors as regards the transformation of patented and complementary knowledge into a final marketable product, and the exchange of patents in licensing agreements. A processual viewpoint allows to analyze transactions in a time serial with different stages. Furthermore, a transaction process is a robust object to be investigated because it follows a logic and order.

Following transaction cost theory, transactions are composed of various phases in which transaction costs may arise (Williamson 1979). In this thesis, a transaction begins when potential sellers and buyers consider a sale or purchase of a patent, and it ends after the contractual obligations are fulfilled. These phases can be thought as serially arranged, beginning from the decision of licensors and licensees to sell or acquire a patent until the contractual obligations are fulfilled or renegotiated. The patent transaction processes consists of contacting, due diligence, financial negotiation, legal or non-financial phase, the contract closure and renegotiations in the course of the contractual relationship (see chapter 3.4.2, page 93-94). In practice, however, transactions may not always follow this strict sequence.

### **Market constitution**

Approaches in economic sociology delivered essential insights into structural elements and structural preconditions of established markets. These markets imply transparency and taken-for-grantedness of market exchange in a given market structure. In new and emerging markets, however, many constitutive elements are in flux. They appear spontaneously, e.g. through endogenous coordination, or through exogenous regulation (Aspers 2009; Möllering 2009). This circumstance requires a different perspective. The following new approaches contribute to the constitution of markets: First, the cultural approach in economic sociology which incorporates cognitive elements of economic action. In this strand, the performativity theory (Callon 1999; Callon 2007) is a prominent example. Second, agency-related approaches in the new institutionalism in organizational studies (DiMaggio 1988; Zucker 1987). Here, the theory of institutional entrepreneurship is worth mentioning.

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<sup>20</sup> Commons (1936) emphasizes the equality of partners which is not the basic assumption of this study.



The *performativity theory* asserts that mainstream economic theories, notably industrial and managerial economics, have a shaping effect on economies and economic action (cf. Callon 1999). The knowledge, techniques and operational tools provided by established scientific communities is not only explanatory but prescriptive to economic processes (MacKenzie/Muniesa/Siu 2007). Economic theories are part of the cognitive framework of markets which guides the (potential) market actors' strategies. Additionally, they create awareness of trade and profit opportunities. Economists do not only supply knowledge but actively engage in deliberate and planned market creation. Thereby, they may dictate the design of new or more efficient market transactions. Through their prominent influence, they make economics true by construction (Callon 1999: 2-3).

A prominent example cited by Callon is Garcia-Parpet's (2007) study on the strawberry auction at Fontaines-en-Sologne in the beginning of the 1980ies. This case study illustrates the transformation from a traditional marketplace for strawberries to a computerized auction through the planned creation of auction by auction advisers. The introduction of the computerized auction was a consciously planned and "reasonable approximation to economists' views to a 'perfect market'" (MacKenzie/Muniesa/Siu 2007: 7), and not the spontaneous appearance of an ideal market (Garcia-Parpet 2007).

The performativity theory implies the top-down construction of markets - from theory to practice or from external (academic) institutions to the economic world.<sup>21</sup> It emphasizes the power of knowledge, techniques, instruments and tools – in other words: (Market) devices (Muniesa/Millo/Callon 2007). However, economic processes are also shaped by endogenous bottom-up initiatives of actors in the market. Such initiatives include information exchange in expert groups (Maguire/Hardy/Lawrence 2004), field-configuring events (Lampel/Meyer 2008; Möllering 2010), and discursive practices (Lawrence/Phillips 2004; Garud/Jain/Kumaraswamy 2002; Zilber 2002).

The concept of *institutional entrepreneurship*, which represents an agency approach, advances the argument that institutional change is driven by strategic action, interest and institutional rules (DiMaggio 1988; DiMaggio/Powell 1991; Maguire/Hardy/Lawrence 2004; Eisenstadt 1980). This core assumption also applies for the building of institutions or institutional fields, e.g. the constitution of new markets (Möllering 2009). More narrowly, it is explained how creative entrepreneur-

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<sup>21</sup> Santos and Rodrigues (2009) distinguish between a strong and weak notion of performativity. In the strong sense, the performativity approach implies that economists actively engage in market creation processes through their engineering efforts. In the weak sense, it makes the more tenable assertion that economics play an active role in economic processes.

ial forces bring about change and shape organizational processes and institutions (Garud/Hardy/Maguire 2007) Institution-building is regarded as a purposive act that implies constitutive actors' involvement. The building and making of institutions result from efforts of actors, who pursue a certain interest in forming and shaping institutions. For institutional entrepreneurs, established institutional rules become an "object of strategic considerations" (Beckert 1999: 781), and their taken-for-granted character and shaping effect on structural expectations are no longer in place for them.<sup>22</sup> Institutional entrepreneurs are knowledgeable agents with a capacity to reflect and act in new ways (Garud/Hardy/Maguire 2007; Lounsbury/Glynn 2001). They are particularly influential if they use cultural material and knowledge strategically as to convince rival social groups (Suddaby/Greenwood 2005).

### 1.4 Aims and case background

Economists tend to underestimate or even neglect the importance of social structures and culture to overcome uncertainty. Economic sociologists regard these aspects as crucial and emphasize the role of uncertainty as structural precondition for the constitution of a market. However, empirical studies in sociology usually deal with established markets and scrutinize their emergence *ex post* but ignore transactions.

This thesis adds insights into both disciplines by investigating the process of transactions and the constitution of a market, which is regarded as ambivalent or is still in the making. A processual viewpoint on patent transactions on the (micro) level of social interactions between market actors, as I will argue, is important to reveal key uncertainties and to understand how managers cope with uncertainties.<sup>23</sup> The ambivalence of the market and its current emergence is an interesting case in order to study the role of uncertainty as precondition for market constitution. The uncertainty surrounding the patent of an early stage technology exacerbates the lack of transparency in the market and so the thesis contributes to the understanding of how companies and universities act in order to make profit from innovation.

How are uncertainties and patent transactions exactly studied? The second part of the thesis consists of three empirical studies which are briefly introduced here.

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<sup>22</sup> In building and shaping new institutions, however, influential actors still refer to established institutional rules (Streeck/Thelen 2005; Djelic/Quack 2007). Strategic agency requires a common ground to form strategies (Beckert 1999) and to mobilize other actors.

<sup>23</sup> An exception is provided by Serrano (2006: 4) who attempts to "trace the flow of technology transfer and to analyze whether small firms specialize in the creation of innovations that eventually are sold to their larger counterparts."

### **Background of the case selection in the first study**

In this dissertation, uncertainties in patent transactions are analyzed by comparing transactions of patented technologies that are characterized either by a high or low degree of (fundamental) uncertainty about the invention and the patent. The first and principal study on patent transactions at the late research stage and clinical stage IIa investigates bilateral patent licensing of patents on drugs between US universities and German pharmaceutical companies. The focus is on impeding factors in patent transactions.

In this study, I chose bilateral licensing transactions of patents on drugs between US universities and German pharmaceutical companies as case for the following reasons: It is recognized that the pharmaceutical industry heavily relies on patent protection (Taylor/Silberston 1973; Mansfield/Schwartz/Wagner 1981; Levin, et al. 1987; Cohen/Nelson/Walsh 2000). Patent claims of conventional pharmaceuticals are relatively well-defined, imitation is easy to detect and thus, disputes are lower in this field (Bessen/Meurer 2008: 18). In the pharmaceutical industry, appropriating rents from patents is higher than in other industries (Cohen, et al. 2002). As we have seen, companies do consider pharmaceutical patents for licensing. Open innovation is widely acknowledged (Chesbrough 2006b) and a number of studies have well documented its actual implementation in the pharmaceutical industry (Bianchi, et al. 2011). The pharmaceutical research and the drug development process often require cooperation between universities and companies in the form of scientific collaborations (Gassmann/Reepmeyer 2005). Besides, non-collaborative (exclusive) out- and in-licensing activities are also widespread. Patent licensing activities allow to share the high risk of drug development and to gain complementary assets and product market access.

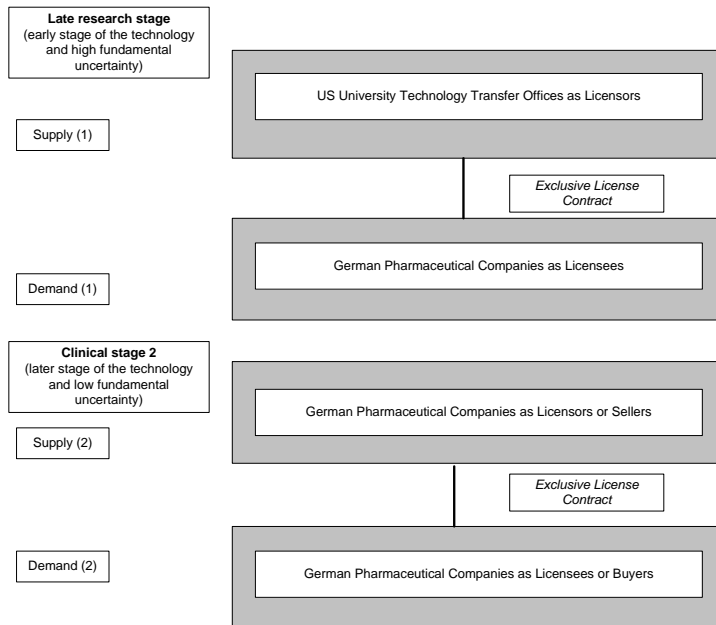
For 15 years the German pharmaceutical industry has been facing a significant decrease in R&D-productivity and a saturated product market (Bundesverband der Pharmazeutischen Industrie e.V. 2005). Furthermore, the costs and the complexity of drug development are spiralling upwards (Hughes 2009) and significant revenue losses due to patent cliff of blockbusters are expected in the forthcoming years (Gassmann/Reepmeyer 2005). German pharmaceutical companies seek to license-in early-stage technologies and thereby form the demand side of the market for early-stage pharmaceutical patents as well as supply and demand for late-stage patents.

With regard to the supply side of this market, public US universities are a prominent example. The US government facilitated technological diffusion from universities to firms through the provision of the Bayh-Dole Act in 1980. With this legislation, universities were given the right to own and exclusively license inventions from federally funded research to the industry. This has spurred the commercialization of intellectual property (IP), notably patents, by means of patent licensing and

the creation of start-up companies (Mowery, et al. 2001; Mowery/Ziedonis 2002). Among the different governance modes of technology transfer, licensing of patents has traditionally been the most popular one (Jensen/Thursby 2001). Since most IP transactions are international (Pitkethly 2001), I assume that this case selection represents patent licensing practices of drugs pretty well.

The actual case selection in this field is based on the *degree of (fundamental) uncertainty*, which is the explanatory variable of interest in the first study (cf. Ragin 1987). In the first case (case 1), I investigate transactions between US universities as licensors and German pharmaceutical companies as licensees of patents for compounds in the late research stage. The late research stage is a case in point for high fundamental uncertainty about the product and patent because clinical studies have not been carried out and only a target and a lead in the organism have been identified and optimized. It is not entirely clear whether the mechanism of a compound is for curing, for example breast cancer or another type of cancer. Consequently, the product market is not fixed and fundamental uncertainty is high in this case. As second case (case 2), I chose transactions between German pharmaceutical companies as licensors and licensees of patents in the end of clinical stage IIa. In this stage, the drug is specified, and thus this case relates to a lower degree of fundamental uncertainty about the product and patent. The second case is treated as a counter case to assess the effect of uncertainty on transactions.

The case of pharmaceutical patent licensing significantly differs from patent transactions of other technologies and thus the study is confined to a specific technology and industry. Clinical research and pharmaceutical products are regulated by governmental agencies, as for instance the FDA and EMA. As opposed to R&D processes in neighboring biotech strands, the pharmaceutical pipeline is longer and follows a sequential line. The value of patents is high in general and increasing over the clinical stages. In other words, the vertical transfer of pharmaceutical patents is riskier with regard to uncertain future outcomes and high investments than the transfer of patented technologies in other industries. The market for therapeutic drugs is subject to price regulation which has an influence on holding patents in this field (Schankerman 1998). Due to the specific character of pharmaceutical licensing, the findings of this study do not hold for patent transactions in other industries. Licensing practices widely differ across industries (Anand/Khanna 2000) and, strictly speaking, a representative case of patent transaction does not exist. Other than capturing the variety of patent transactions across industries, pharmaceutical patent licensing is chosen as a case to reveal the effect of different degrees of uncertainty on transactions.

**Figure 2: Case selection**

### Background of the case selection in second and third study

In the second study, I investigate a transaction form known to be efficient for goods which are characterized by uncertainty about the quality of the good. The IP live auction is a theoretically interesting case in this thesis for the following reasons. First, the IP auction is a prototype of an arm's length market transaction that is supposed to efficiently allocate patents among bidders in the auction (cf. Marshall [1920] 1961). Second, IP auctions are hosted by an intermediary organization that acts as "third party assistance" (Williamson 1979). The role of a third party is to facilitate arm's length transactions. Third, the patent auction is a counter-case to bilateral licensing. Live IP auctions differ from established bilateral licensing transactions because the auction floor is open to any interested and qualified market actor, as we will see. Thereby numerous sellers are able to reach numerous buyers and vice versa. In the focus of this study is the Live IP auction hosted by Ocean Tomo LLC, a US patent market intermediary. Telecommunications, electronics, consumer products, computer, software and web services account for the vast bulk of lots being offered on the auctions (Jarosz, et al. 2010).

In the third study, I analyze the structure of the market for intermediary businesses (Mfi). This market is defined as a secondary market for patents that is currently

emerging in response to the need for consultancy and assistance by companies and universities active in managing and transferring IP and technologies. Thereby, I mainly refer to US patent intermediary firms (PMIs) working for clients in the electronic and semiconductor industry. In this field a new generation of PMIs specialized in semiconductor technology and electronics is currently growing (Monk 2009). This case selection allows to explore the emergence of a secondary market for patents.

### 1.5 Outline of the argument and structure of the thesis

The empirical studies have in common that they focus on patents, the effect of uncertainty on patent transactions and make use of a pragmatist-cultural approach and a process analysis of transactions. Except for the third study, they investigate conditions of markets for patents on the micro-level. The core argument throughout all chapters is that the *effect of uncertainty on patent transactions differs in two degrees of fundamental uncertainty (high versus low)* and that *information, expertise and control on the part of market actors are decisive for successful patent transactions*. One of the central claims of this thesis is that similar cultural-material arrangements (so-called judgment devices) that help to cope with uncertainty can be found in two transaction forms - bilateral exclusive licensing and arm's length sales transactions.

While analyzing the patent as transferrable and tradable good, I come to the conclusion that patent transactions allow for standardized arm's length transactions in principle but with restrictions. A two-sided view on patents - either as singular good and as commodity - is important to gain a differentiated perspective on uncertainty. To analyze patent transactions, I suggest a combination of pragmatist and cultural concepts from economic sociology. This combination shall *connect the levels of culture and social action in economic sociology* and thereby allow for a multifaceted view on patent transactions. Moreover, I argue that a pragmatist-cultural approach offers a worthwhile alternative to institutional and structural approaches because it is stronger related to uncertainty. This framework is guiding for the empirical chapters.

In the first study, which includes two case studies, I attempt to show that the degree of fundamental uncertainty about the innovative product and the patent has an effect on the way managers trade patents. In the late research stage (case 1), both, licensor and licensee seem to be captured by a fundamental lack of information. Confidence in prospective developments on the part of the parties is essential to overcome uncertainty in this stage. In the clinical stage IIa (case 2), both parties are inclined to suspect the other side to hide information. The signaling of trustworthiness and competence becomes important. The effect of fundamental uncertainty about patent transactions is rather that of a facilitator than of a causal variable.

In the second study, I argue that IP auctions are a highly preconditional social arena of market coordination that requires information, expertise and control on the part of the hosting auctioneer. The auction mechanism and the assistance of the auctioneer Ocean Tomo LLC solve cooperation and valuation-pricing problems for clients, though the auctioneer himself is likewise confronted with those problems. The auction event appears to be a necessary step for the implementation of this transaction mode and for market constitution in general. It shares basic characteristics of collective market-making events (Möllering 2010).

In the third study, I aim to show that despite technological and industrial differences the services of patent market intermediaries (PMIs) in the electronic and semiconductor industry do address similar valuation-pricing and cooperation problems raised in the previous chapters. In the (primary) market for patents, PMIs are assisting parties and support various managing activities of firms and universities. Apart from their assisting function, PMIs also shape the primary and secondary market for patents through new services and business models. These business models are unprecedented and singular, as I argue, because they do not emulate services in other markets. Since a patent can be exploited in many ways, it allows for various business models that promise high profits.

The structure of the thesis is as follows. Chapter 2 highlights the peculiarities of patents as legal construct and technological knowledge. It discusses two preconditions of markets for patents – propertization and appropriation of technological knowledge. Chapter 3 develops a pragmatist-cultural framework to analyze patent transaction processes on the micro level. The framework makes use of concepts in pragmatist and cultural economic sociology that are strongly connected to uncertainty. The second part of the thesis consists of the three aforementioned empirical studies. Chapter 4 presents the findings of case 1 on low fundamental uncertainty that refers to patent transactions between US universities as licensors and German pharmaceutical companies as licensees of patents in the late research stage. Chapter 5 highlights the results of case 2 as a counter case to chapter 4. Moreover, this chapter discusses similarities and dissimilarities of transactions at both stages. Chapter 6 includes the third study about the functioning of arm's length sales transactions as opposed to more established forms of bi-lateral licensing is researched. This study also explores constitutive elements for a market for patents. In the third study, which is summarized in chapter 7, the role of patent market intermediaries and structural features of a secondary market for patents - the market for intermediary businesses - are analyzed. Here, the focus is on facilitating effects of uncertainty. Chapter 8 is the final part of the dissertation. It responds to the overarching research questions and

carves out three core dimensions which characterize patent transactions and the markets for patents: A lack of transparency, control and competence.

## 1.6 Concluding remarks on focus and demarcation of the thesis

The overall contribution of this thesis is theoretical or conceptual. The thesis shall provide a toolkit to analyze transaction processes of complex and singular goods enclosed by uncertainty. The lack of robust macro data on patent transactions and markets for patents aggravates research on uncertainty on the macro level. Since firms and universities are heterogeneous with regard to commercialization and licensing strategies or even follow a variety of strategies for different technology types (Ziedonis 2004), I did not choose a case study on the company level. Instead, uncertainty is investigated by referring to the *licensing practices of business development and technology transfer managers*.

The objects of research in this study are *patent transaction processes*. In the studies, I reconstruct patent transactions from the descriptions of practices given by managers on the supply and demand side. Thereby I focus on daily practices and expert knowledge of the managers involved in transactions. The expert knowledge of managers is not only a source to learn about uncertainties, it also enables a researcher to understand the structural conditions of transactions from the viewpoint of the actors who interpret them (Flick 2002). By analyzing practices in transactions from both, sellers and buyers, I am able to capture judgment devices, which reduce uncertainties.

It is likewise important to mention what the thesis does *not* aim to achieve:

First, it is not argued that markets *are* the most efficient means for the allocation of patents. The central role of the market in this thesis results from two opposite viewpoints on the market characterized in the last sections. The thesis does not argue nor make recommendation for or against the market as the most efficient governance mode of transactions. Notably basic scientific knowledge is driven by non-commercial incentives and motives, and thus its distribution is effected through non-market mechanism, as for instance publication in scientific journals (David 1998; Nelson 2004). Moreover, innovators have other means to appropriate rents from innovation than patent sales and licensing transactions (Arundel/Van de Paal/Soete 1995; Cohen 2005).

Second, this thesis does not argue that patent protection has a positive effect on innovation and the market for technologies. Under specific circumstances, patents inhibit innovation (Heller/Eisenberg 1998), and strong legal protection is increasingly disputed from the perspective of free entry to the final product market (cf. Hilty



2006). The detrimental effects of patents on innovation and the product markets are widely neglected in the thesis. Some scholars argue that the market for patents and technology spurs innovation (Arora/Fosfuri/Gambardella 2001) but it is not fully clarified how it enhances innovation. Apart from that, strong patent protection and markets for patents do not impede open source access to technologies. Both modes of knowledge transfer co-exist and increasingly gain relevance. As Chesbrough (2009) puts it: “it is ironic that stronger patent protection has coincided with a increased prevalence of open source technologies.”

Third, I do not argue that political institutions should play a more prominent role in the provision of institutional support to the trade in patents. Private initiatives have been more successful than political programs until recently but this does not mean that political institutions are not essential to patent trading. It is rather the opposite. The role of the state for markets for patents is crucial as patents are granted by governmental institutions (Fligstein 2001: 3, 4, 45-53; Carruthers/Ariovich 2004). Specific features of the good, as for instance the standardized body of patents as well as the specific legal terminology, are institutional outcomes that can be seen as preconditions for functioning markets for patents. The government may enforce compulsory licensing so that a patent holder must grant the use of an invention to the state or other entities.



## 2 The patent as tradable good

### 2.1 Introduction

The upsurge of IP licensing activities and the increasing awareness for the commercial potential of IPRs and technologies indicate that patents more and more become a source for profit for companies and universities. Patents are not only exchanged to prevent costly litigations and conflicts from overlapping patent rights. Instead, it is recognized that patent transactions allow for revenues from royalties and a decline of costs in R&D endeavors when companies acquire and exploit technologies outside the firm (cf. Chesbrough 2006). This chapter highlights the *peculiarities of patent transactions and markets for patents* by focusing on the patent as tradable and transferrable good and analyzing constitutive elements of functioning markets for patents. Licensing of *patents on drugs* to established pharmaceutical firms<sup>24</sup> is chosen as example.

The first part analyses the twofold nature of patents as transferable and tradable good in the market. It is usually acknowledged that patents are marked by two sides, the exclusive right on the one hand and the technological knowledge including complementary know-how and services that is protected by the patent on the other hand (Razgaitis 2003: 3). The role of patents varies in transactions. Depending on the background of a transaction, they may be treated primarily as legal construct or as constituent part of a broader technology transfer. The nature of patents as tradable good differs accordingly, from the object of a pure patent licensing activity to an existing company<sup>25</sup> or as a part of a broader technology transfer project. This bifurcation has implications for the patent as tradable good. As I will spell out, patents share characteristics of so-called “singular goods” (Karpik 2010) and commodities. They are anchored in three perspectives emphasizing either technological-scientific, legal or economic aspects of the good. Finally patents protect universal technical solutions but at the same time the scope of protection is an institutional outcome (cf. Fligstein 2001: 3, 4, 45-53; Jaffe 2000). Patents are embedded in a broader institutional context that comprises the granting procedures of patent offices, and the patenting and licensing practices of universities and companies.

In the second part, the chapter discusses two preconditions for a functioning market for patents: *Propertization* of technological knowledge through the patent as

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<sup>24</sup> With regard to pharmaceuticals, I refer to drugs and therapeutic methods for humans but not to cosmetics and other health products.

<sup>25</sup> Universities may also license patents including equity to start-ups when they are created.

exclusive right on the one hand, and *appropriation* and transfer of knowledge between two contractual parties on the other hand. These two preconditions are constitutive elements of any functioning market from the viewpoint of economics.

Economic theory considers property rights as a precondition for functioning markets (Demsetz 1967; Coase 1960). A functioning market can only emerge if a set of property rights is well defined and guaranteed. Contrary, externalities<sup>26</sup> and inexhaustibility of the good impede the formation of prices and the efficient allocation of goods in a market. Propertization comprises the assignment of ownership to a person, the effective exclusion of third parties from using the good and the legal enforceability of ownership. If propertization is not guaranteed, a legitimate ownership title is not established and the internalization of beneficial effects (positive externalities), as for instance the flow of knowledge, through compensation is not realized (Demsetz 1967). Appropriation specifically refers to attributes of license contracts, characteristics of the good making it transferable and the ability of the buyer to acquire the good (Arrow 1962; Rosenberg 1994). If appropriation is not assured, the good is not fully commensurable and separable from its producer (inventor), from the sphere of production and the actors trading the good (cf. Jessop 2007).

Functioning markets for patents imply typical market transactions, for instance arm's length or spot market transactions between market actors. Such transactions are highly standardized and thereby involve classical contracts (MacNeil 1980). The chapter aims to answer the question of whether and why arm's length transactions of patents are possible (or impossible) in principle. This question is important to identify those peculiarities of the good and the market for patents that permit (or do not permit) typical market transactions.

Finally, the two-fold nature of patents and the two preconditions for markets are analyzed for patents on conventional drugs. Patents and patent licensing play an important role to pharmaceutical companies (Anand/Khanna 2000). By reviewing the literature, I agree with the argument that patents on conventional pharmaceuticals are relatively robust (Levin, et al. 1987; Taylor/Silberston 1973; Cohen 2005) and propertization is widely fulfilled. With regard to appropriation of knowledge and transfer of technologies, I conclude that collaborations and cooperation between and within organizations play a pivotal role.

The chapter is structured as follows: Sub-chapter 2.2 provides an encyclopedic overview of patents to guide the reader through the subject matter and then analyzes

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<sup>26</sup> Externalities or external effects are either benefits or costs to actors who are not involved in the action causing the cost or benefit. As a result externalities can be positive (benefit) or negative (cost). The costs or benefits are not included in market prices and thus not transmitted by the market.

the twofold nature of patents as tradable good. The second and third sub-chapters deal with the two preconditions of a functioning trade and transfer of patents: Propertization (2.3) and appropriation (2.4). Then, the question of arm's length transactions of patents is discussed (2.5). The final part of the chapter uses patent licensing of pharmaceuticals as example to elucidate the twofold nature of patents and the two preconditions of functioning markets for patents (2.6).

## **2.2 Two sides of a coin: Patents as legal constructs and characteristics of technological knowledge**

### **The patent as legal construct**

Intellectual Property Rights (IPRs) are absolute exploitation rights granted by patent offices to inventors, authors and creators or their successors in title. Patents protect technical inventions whereas trademarks cover names and brands. Other creative outcomes are protected by copyrights. IP law is national law in principle, yet most essential features are similar or identical in industrialized nations (cf. Mersch 2005). The IP holder has the right to exclude others from commercially exploiting the idea. Through the grant of IPRs she obtains a monopoly right<sup>27</sup> because only she is entitled to make, use, or sell any product that falls under the terms of IPR. Furthermore, the IP holder is allowed to license or sell this right to others. By these forms of trade the right to commercial use of the creative outcome is transferred to others or shared with them.

Copyrights, trademarks, designs and patents differ significantly from each other with respect to legal stipulations and the scope of protection (Götting 2007; Bently 2008). Copyrights protect personal intellectual creations, in particular literature, music, science and art, but also computer programs (software). Trademarks typically protect distinctive names, phrases, words and images used by individuals, companies or other legal entity.<sup>28</sup> Patents are usually granted for inventions.<sup>29</sup> While copyright is effective as soon as the work is published, trademarks, designs and patents must be applied and registered with patent offices. Trademarks can be maintained indefinitely as long as the trademark holder is paying renewal fees. Patents, however, are granted for a limited period of time, generally a maximum of 20 years.

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<sup>27</sup> Legal scholars frequently use the term "monopoly" or "monopoly right" to capture the exclusive character of IP rights.

<sup>28</sup> According to the Trademark Act of 1946, a trademark includes any word, name, symbol or device used by a person or which is bona fide intended to be used for commercial purposes.

<sup>29</sup> US patent law grants patents for inventions and discoveries whereas the European Patent Convention (EPC) permits inventions only.

In contrast to copyrights and much more than trademarks, the grant of a patent is bound to a series of requirements and examinations. Inventions must fulfil three criteria in order to be patented. In US patent law, the invention must be novel, non-obvious and useful (35 U.S.C §§ 101-103 Consolidated Patent Laws). According to the European Patent Convention (EPC), an invention must be novel, involve an inventive step with respect to prior art and be “susceptible of industrial application” (Art. 54-57 EPC). The invention is novel if it has not been described in another patent (application) or in a printed publication anywhere and not previously used and invented by another party (35 U.S.C § 102), or it has not been made available to the public by means of a written or oral description (Art. 54 EPC). Non-obviousness and involvement of an inventive step means that minor or trivial improvements in knowledge cannot be patented if they are obvious to an expert who is familiar with the state of prior art (35 U.S.C § 103, Art. 56 EPC). Usefulness refers to the commercial and non-commercial use of the invention. The three requirements of patentability in US and European law correspond in content, yet their construction and application varies (cf. David 1993; Khan 2002; Harhoff 2006).

Much stronger than other forms of IPRs, patents are defined by temporary, technical and geographic scopes of protection. The patent fees usually increase during the patent’s span of life.<sup>30</sup> The patent holder (patentee), however, may choose to relinquish the patent if the costs of legal protection exceed the expected discounted cash flow arising from the deployment of the invention (Motohashi 2004). Furthermore, patent applicants must define patent claims which determine the subject matter of protection in terms of technical features.<sup>31</sup> The geographical scope is determined by the number of territories for which protection is sought. Inventors may file an application in various countries, either through the PCT application procedure or a European Patent, or through multiple national applications during the priority period. Due to the territorial principle the international application splits into a bundle of national patents at the time of the grant. Consequently, if patents are sold and licensed, the buyer or licensee may acquire either a share or the full bundle of different national rights.

When inventors file a patent application they must follow the application procedure stipulated by national and international patent offices. Patent applicants must disclose the invention “in a manner sufficiently clear and complete for it to be car-

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<sup>30</sup> The costs of renewal are rising gradually up to the maximum duration of 20 years. The German Patent Office charges a fee of 70 Euro upon the third year. The fee to be paid for each additional year increases by 1,940 Euros for the 20<sup>th</sup> year. The total sum adds up to 13,000 Euros. In the US, the renewal fees are at about 7,500 Dollars in 2006.

<sup>31</sup> Claims are not always requested when the patent is filed for the first time.

ried out by a person skilled in the art” (Art. 83 EPC). The patenting procedure involves the examination of novelty, non-obviousness and usefulness by national or international patent offices.<sup>32</sup> The grant of a patent is generally precluded once the invention is made available to the public before the filing date. United States patent law, however, permits the filing of a patent application within a “grace period” after the first publication (35 U.S.C. 102 Consolidated Patent Laws). The filing deadline is referred to as the publication bar date, which is established by means of any pre-filing communication or public use of the invention. In the European Patent Convention, a publication is not considered if it occurred no earlier than six months preceding the filing of the European patent application (Art. 55 (1) EPC). Furthermore, national and international patent offices examine the subject invention with regard to non-obviousness and decide whether to accept or reject the application. The examination takes some time and thus causes a pendency time (patent backlog) that lasted on average 45.3 months at the EPO and 32 months at the USPTO in 2007 (WIPO 2009).<sup>33</sup>

In return for the patent grant, the patent applicant is obliged to disclose the invention to the public which has implications for patent transactions. Usually, two bundles of property rights are exchanged when a transaction is concluded in the marketplace – a bundle that attaches to the (physical) commodity or service and a bundle of ownership titles (usufruct, exclusivity and alienability) (Demsetz 1967). Since technical information is disclosed to the public, it is available to the buyer for free. Consequently, the buyer or licensee only acquires the right to exclude others or to use the invention in return for money or other compensation. An essential peculiarity of market for patents is that the exclusive right *is* the good or commodity bought and sold in the market.

Regulations for patents are less permissive than other registered rights with respect to subsequent changes in the scope of protection (American Bar Association 2009; Perez Pugatch 2004: 2). In contrast to trademark holders, patentees are not allowed to expand the scope of protection. Once the patent is granted patent holders can no longer alter the patent claims according to changes in business needs, except

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<sup>32</sup> Despite numerous similarities in national patent laws, national patent policies and particularly the national patent offices’ practices of granting patents differ significantly from each other and vary over time (Jaffe 2000).

<sup>33</sup> The number of unexamined (pending) patent applications has increased since the late 1990ies in Europe and in the US due to a faster growth rate in patent filings (WIPO 2009).

they file a subsequent patent.<sup>34</sup> A patent has claims which determine the scope of protection for the invention and the limits of patent protections are complex. First, they refer to the demarcation of “invention” and “discovery” and the legal interpretation of the three criteria of patentability. In the EPC, an invention if it is new but not a discovery can be patented whereas US patent law mentions discoveries as patentable. Second, patents seem to have „fuzzy and unpredictable boundaries“ as Bessen and Meurer (2008: 10) argue. The words that lawyers use are often vague and the rules for interpreting them are unpredictable. If a patent is sold or licensed, sellers and buyers are both confronted with fuzzy limits and unpredictable boundaries of the good being traded and with different legal interpretations of patents. Hence, markets for patents are characterized by the vagueness of the good and contingency of legal interpretations.

Inventions are outcomes of creative processes that embody or yield a novel idea. They are associated with industrial applicability and development coupled with economic activities (cf. Mokyr 2002). Discoveries refer to the detection and observation of a new event or phenomenon with the provision of insight into previously unknown causal relationships. They are guided by basic research activities and ideally add to the state of the art and may be the priming for successive technical developments. According to patent law, however, the content of a patent is a methodical instruction especially for technical actions<sup>35</sup>. The instruction must disclose the solution of a technical problem in a way that it comprises a causally induced performance as a direct result of the use of controllable physical agent.<sup>36</sup> Patent law stipulates how the content of a patent should be represented. This implies that the representation of information in patents is neither arbitrary nor necessarily made to attract buyers in the markets for patents but foremost to suffice legal stipulations. Legal stipulations seem to dominate markets for patents.

### **The characteristics of technological knowledge**

Inventions and discoveries encompass novel technological knowledge. This knowledge facilitates the manipulation of natural phenomena in order to fulfil a human purpose (Mokyr 2002: 1-27). It is stored in technical artefacts, such as “any new and useful process, machine, article of manufacture, or composition of matter,

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<sup>34</sup> Unlike patentees, trademark holders can make subsequent changes in the trademark, for example they can expand the geographical scope of protection of international marks. They can renew the registration through a single procedural step, which requires less bureaucratic effort than that of patents.

<sup>35</sup> The German patent law uses the notion of "Lehre zum technischen Handeln".

<sup>36</sup> GRUR 1969, 672 – the case of red pigeons; BGH GRUR 2000, 1007 – the case of voice analysis program.



or any new and useful improvement thereof' (35 U.S.C. § 101). The knowledge involved in the technical descriptions, data, formula and illustrations of patents is codified but not all knowledge that has emerged in the context of the invention can be brought into a concise written form (Von Hippel 1994; Nonaka/Takeuchi 1995; Howells 1996; Zucker/Darby/Brewer 1998). Some elements are personal or "tacit" (Polanyi 1966: 9-11), and thus are difficult to describe in a precise language. The imprecise codification of novel knowledge may impede the issuance of a patent. Consequently, the granting of a patent through the patent office is uncertain. Furthermore, imprecise codification causes difficulties in the protection from imitators because it is difficult to tell if someone is using the invention (Macho-Stadler/Martinez-Giralt/Pérez-Castrillo 1996). Inventors refrain from filing a patent when infringement of a patent would be difficult to prove and the patent would not be enforceable in this case (Cohen/Nelson/Walsh 2000).

The exploitation of novel technological knowledge bears a *free-rider problem*. Useful novel knowledge is expensive to invent, but it can be distributed at low marginal cost or diffused by generating technical spillover effects (cf. Foray 2004). Particularly codified knowledge is easy to imitate and therefore exposed to the free-rider problem because it can be expressed in written forms, or in algorithms or designs (Teece 1981; Teece 1986). Codified generic knowledge, which comprises scientific knowledge, is highly affected by a low-cost diffusion of knowledge. Nelson (1989) argues that generic knowledge is inherently public even if the inventor tried to keep it privy. It is rapidly commonly shared by professionals and soon becomes state of the art (see also "positive externalities" in 2.4). Consequently, at least companies tend to file a patent to control and prevent diffusion and imitation among competitors. Private aspects are more pronounced with industrial knowledge than with generic (scientific) knowledge. Industrial knowledge is firm-specific and "costly if not impossible to use elsewhere" (Nelson 1989: 232). The firm-specific and idiosyncratic character of some techniques renders the good useless for many companies (Rosenberg 1982). Rivals on the product market, however, profit nonetheless from application and imitation (Mansfield/Schwartz/Wagner 1981). Industrial knowledge is generated and anchored in specific contexts, for example in the R&D department of a company, and thus often "idiosyncratic" (Nonaka/Takeuchi 1995). Because of the context dependency of industrial knowledge it does not smoothly circulate and cannot easily be reconstructed (Kitch 1980; Stehr 2002). In this case inventing companies are often able to keep the invention privy as a trade secret (Cohen/Nelson/Walsh 2000; Arundel 2001).

The information included in the patent claims is often "sticky" (Von Hippel 1994) and often cannot be differentiated from other "similar-sounding items" (Arrow 1962: 161). Sticky information involves vast amounts of technical data and compli-

cated formulas that have accrued in the inventive process and is often not mentioned in the patent. Equipped with the technical description of a patent, it is basically possible to comprehend technical details of the invention in its mode of operation. More often than not, additional know-how is required to be able to construct and to imagine a final product (cf. Stehr 2002: 55-57; Troy/Werle 2008). If the latter is not accessible or not developed as a prototype or proof-of-concept, unintended diffusion may be prevented because rivals cannot easily extract the novel knowledge for reverse engineering (Samuelson/Scotchmer 2001).<sup>37</sup> The information needed exceeds what is documented in the technical description of a patent. Dissemination of information across companies occurs rapidly but that does not mean that imitation happens equally fast and free-rider problems are evident (Griliches/Eads/Mansfield 1984; Mansfield 1985). Imitation requires re-engineering capabilities and access to secret information, and the imitation time depends to a large degree upon the ratio between imitation costs and innovation costs (Mansfield/Schwartz/Wagner 1981; Mansfield 1986; Lieberman/Montgomery 1998).

### **Three implications for patents as a tradable good**

Following the characteristics of patents as legal construct and as foil of technological knowledge, three implications for patents as tradable good should be further discussed:

First, patents appear to share attributes of *singularities and commodities*. “Singularities” are goods, services and persons characterized by uniqueness, incomparability, incommensurability and uncommonness (Karpik 2010). They are distinctive and highly specified and embedded in the cultural sphere of production and allocation, though they are tradable on typical markets in principle (ibid.). High quality wine and antiques are examples illustrating the attributes of singularities. Commodities, however, are the direct opposite. They are homogenous and thus non-distinctive with regard to quality. Commodities are divisible as lot sizes and thus allow for high economies of scale and mass distribution. They are commensurable because a common and standardized scale of equivalence exists to measure and compare goods. Commodities are relatively isolated from their original sphere of production and can

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<sup>37</sup> Based on an explorative study, Mansfield (1985) demonstrates that process technologies leak out more slowly to rival firms in practically all industries because communication and interaction with other firms are less frequent in process than in product technologies. As opposed to process innovations, rivals can extract knowledge easily from products through reverse engineering (Samuelson/Scotchmer 2001). Consequently, inventors are more likely to keep process innovations secret than product technologies. However, in a sample of 37 chemical products Lieberman (1984; 1987) shows that diffusion of process innovation enables late market entry of rivals although learning curve effects at the industry level are strong.

be easily transferred to any other location and market actor. Commodities fulfill basic criteria of goods traded in a perfect market.

Numerous arguments suggest that patented inventions involve characteristics of “singularities”. Regardless of the value and quality of a patent, a patentable and patented invention is novel and non-obvious and thus unique by legal definition. Moreover, inventors often use patents as signals (Owen-Smith/Powell 2003), or in other words, patents underpin the reputation of its originators. The invention is usually exceptional to the inventor who invested much time and effort in the investigation process (Arrow 1962). In the R&D process, “the ‘best’ way to proceed is seldom apparent” (Van de Ven, et al. 1999: 170) to the researchers and innovators. Technological knowledge has a price but, as the case of university research shows, “it is not produced for sale but is simply a gift of [human] nature or another ‘aspect of man’” (Jessop 2007: 117). Because of this and the costly and time-consuming R&D process, it is plausible to anchor patented and patentable invention in the sphere of knowledge production.

Yet, a patent is not purely singular. In some technical fields patents are a mass phenomenon. A complex technical device consisting of dozens components is protected by numerous patents (Ziedonis 2004). Patents are commensurable and comparable in principle. They are characterized by the use of a precise legal language. Particularly the claims are written in a precise diction. They comprise terms with specific legal meanings which are used in conversations between patent attorneys and in court decisions. The diction does permit a high degree of comparability with prior art and thus commensurability. Patents are classified through the international patent classification system (IPC) and can be identified with the patent office from which the right has been granted. To demonstrate novelty and non-obviousness, a patent applicant intentionally points to key improvements of the invention with regard to prior art by citing other patents. Ironically, distinction and uniqueness is established by comparing advanced with prior art.

Basic attributes of singularities and commodities coincide and are entangled with patents because this good has two sides. A patent is incommensurable insofar as it enfolds its distinctive function in conjunction with other IPRs, services, know-how and technical components in final products or in a patent portfolio to be managed. An electronic device, for instance, may be understood as unique if it is made up by a special compilation of patents and know-how inherent in the device – though this viewpoint is debatable. Much more it seems appropriate to relate incommensurability to a R&D project or a novel technology (Bidault 1989: 7).

In addition, it makes a difference how patents and technological knowledge are treated by universities and companies who use and transact them. Market actors may treat knowledge and patents respectively “*as if* it were a simple commodity” (Jessop

2007: 118, italics in original) and thereby acting on the fiction that patented technological knowledge is tradable as any other commodity despite singular features of the good (so-called “fictitious commodity”) (cf. Polanyi 1957; discussed in: Jessop 2007).<sup>38</sup> A prerequisite for the commodity fiction is that patents, for instance, are in fact largely intended to be sold or licensed on a market and hardly used for other (strategic) purposes, e.g. internal utilization and blocking competitors (Bidault 1989: 6-7). As chapter 1 pointed out, empirical evidence for functioning and organized markets for patents is weak. Instead, it is acknowledged that growing licensing activities and significant institutional changes in the past years indicate a transformation on the half way. In such a changing environment, social and political processes, e.g. a pressure for licensing and the trend towards commercializing patents, play a pivotal role (see chapter 2.6.3, page 59-63).

Second, patents are anchored between *three perspectives emphasizing either technological-scientific, legal or economic aspects of the good*. From a technological-scientific viewpoint, a patent is a methodical instruction that includes essential information about the solution of a technical problem. Through the disclosure of the patent, technological information is disseminated to other inventors who build upon this knowledge. Yet, the content of a patent does not explicate all details necessary to rebuild and copy the invention. From a legal perspective, patents are absolute exploitation rights and constitute a restricted monopoly right. This right, however, should not be conflated with a monopoly of a producer in a product market, as would economists define it.<sup>39</sup> From an economic perspective, patents allow inventors to appropriate rents from R&D activities. The grant of a patent enables inventors to earn a certain rent on a market for products and a market for patents likewise. Patents stand between two interrelated markets along the supply chain of innovative products (Arora/Fosfuri 2003; Fosfuri 2006). Consequently, different kinds of revenues and payments may arise from patents. As we will see, these three perspectives have implications for the valuation of patents (cf. Ensthaler/Strübbe 2006), and patent transactions enfold along those three viewpoints.

Third, while patents protect *universal technical problem solutions* and scientific insights, patent enforcement and the scope of protection are *historically contingent*

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<sup>38</sup> Polanyi’s (1957) argues that the commodity fiction is a vital organizing principle of society and that it can even be understood as part of a larger commodification process in a market society in which singular goods, which are not produced to be sold on a market, are increasingly treated as simple commodities.

<sup>39</sup> A monopoly indicates market power and the ability of a monopolist to introduce monopoly prices on products. A patent does not necessarily entail a real monopolistic position of the patent holder on a market (Baumol 2002).

*results.*<sup>40</sup> The knowledge protected by patent rights is measured according to universal physical laws and scientific criteria. Technical instructions following these laws are either true or false. In the patent examination process, inventions are tested on the universe of prior art including all types of scientific and non-scientific publications. The legal aspect of patents, however, is historically contingent because property rights vary over time (Horwitz 1973). Thereby the prominent role of the state cannot be overstated. Intellectual property right is enacted by governmental institutions and continuously altered and reproduced by patent offices' practices of granting and court decisions (cf. Fligstein 2001: 3, 4, 45-53; Jaffe 2000). Historic studies show that the field and scope for which patent protection can be sought extended over the past decades in OECD nations due to several amendments, as the example of genetic sequences shows (Gallini 2002; Burton, et al. 2005). Whereas the scientific validity of patented knowledge may be unaffected the legal rules are in flux and often pending for decades.<sup>41</sup> Against the background of longstanding license contracts, enforcement and validity of patents and patent license contracts shift or are even pending over a long time due to (a lack of) court decisions.

### **2.3 Propertization and exclusion as first precondition for a market**

IPRs allow creators to assert ownership rights on the outcomes of their ideas and innovative activities in a similar way to that in which they can own physical property. Well defined property rights and licensing payments compensate for positive externalities (cf. Coase 1960). In fact, there are similarities and differences between immaterial and physical property. Similar to physical property, outcomes of creative and inventive activities are identifiable and can be assigned to the creator and inventor. Ownership of creative and inventive outcomes is, however, more complex. First, more inventors and creators could be involved in the invention which prompts the problem of the identification of the true inventor(s). Second, the division of inventorship and applicantship is connected to different rights to the invention. In the US, only the inventor may apply for a patent although it may be assigned to a

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<sup>40</sup> The first formal rules of patenting have been developed and applied in 15th century in Venice. Patents should protect inventors and provide them with privileges to reward them for their efforts and achievements. At the same time, patent rights were established to import foreign technologies and their inventors who have been obliged to teach local craftsmen (David 1993). In past centuries some nations have modified and even abolished their national IPR system, e.g. Switzerland.

<sup>41</sup> For example, in the recent court case *KSR international vs. Telefax* the Supreme Court rejected the strict application of the test for determining obviousness which sets the bar for sustaining the validity of patents higher (Berneman, et al. 2009).

corporate entity afterwards and inventors may be required to assign inventions to their employers under a contract of employment. According to the German “Gesetz ueber Arbeitnehmererfindungen” (ArbnErfG) employers have a claim to utilize inventions arising from work and thus are entitled to apply for the patent exclusively (discussed in: Bartenbach/Volz 2004).<sup>42</sup>

Even though the division of ownership and application of an invention follows specific rules of national patent regimes, Intellectual Property Rights (IPRs) are increasingly treated as real and universal property rights. Last decades have witnessed a strong tendency to treat IPRs largely as physical properties and thus to strengthen the role of IPRs (Götting 2007). This means that a natural right of ownership was assigned to the inventor (French law), or that the principle of the monopolistic privilege was applied to the first and true inventor as an exception from a competitive market order to spur innovation (English law) (Khan/Sokoloff 2001). In modern industrial countries, the legal viewpoint has widely converged to a strong protection of inventions through property rights. Foremost in the USA, it is frequently argued that only effective legal protection and full ownership of IPR would make it possible to encourage inventors to invest in innovative activities and to prevent free-riders from exploiting inventions of others cost-free. This assertion has also contributed to a property-like protection of technological knowledge, though the application of the economic theory of property to the case of IPRs falls partly short. Lemley (2005), for instance, argues that especially US courts often follow the maxim that “all enrichment derived from that use of an intellectual property right is necessarily unjust” (ibid: 1044). This point is recurrently supported by multinational corporations who call for strong legal protection (Sell 1999), even if infringement does not always cause any harm to the patent holder.

*Alternatives to patent protection:* The application of patents often turns out to be costly and ineffective. Notably in the software and white biotechnology industry, trade secrets, encryption and the establishment of technical walls to protect technological knowledge are effective alternatives to patents (Levin, et al. 1987; Cohen/Nelson/Walsh 2000; Blind/Edler/Friedewald 2003). Competitors soon catch up to advance innovative technologies and find alternative technical solutions (Winter 2006; cf. Schumpeter 1911). In complex technologies, for instance, the product and technology cycles are short and technical standard setting is not always necessary (Blind, et al. 2006). In this specific case patents render ineffective because the patenting procedure and stipulations impose an unprofitable bureaucratic hurdle on

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<sup>42</sup> The German Arbeitnehmererfindungsgesetz was introduced in the second world war and postwar period. It aimed at encouraging corporate innovations and thus still follows the Chandlerian model of integrated R&D.

inventors and patent applicants. For patent applicants, the patenting procedure bears a variety of obstacles and uncertainties. In general, the grant procedure takes four years on average from the date the application was filed.<sup>43</sup> The procedure requires formalities examinations and a subsequent substantive examination when the office inspects whether the invention (or discovery) meets the requirement of patentability. For this purpose the applicant can request an investigation provided by many offices. The office either grants or refuses the application.

*Oppositions:* The grant of a patent does not guarantee full ownership of an invention. In Europe, third parties can file an “opposition” proceeding within nine months after the publication of the grant of the European patent. In the USA, the same procedure is called “re-examination” whereas in Japan it is called “trial for invalidation”. Opposition or re-examination proceedings challenge a formal decision which has been made by patent offices. Opposition is usually filed on the basis that an invention does not meet the requirement of patentability under the law. For example, the patent does not disclose the invention clearly and completely to be carried out by an expert<sup>44</sup>, or the subject-matter of the patent extends beyond the content of the application. Also, when the office obviously did not accurately observe the entire field of a specific technology prior to grant novelty can be contested.

*Disputes:* A patent is an entitlement promising security, but it may be no more than a fiction. A patent owner’s legal protection from infringement is formally guaranteed but disputes can appear for several reasons. A third party can inadvertently or deliberately infringe upon a patent. In the first case, the infringer may be not aware about patented inventions that were filed before the day of disclosure or the patent provides a very similar problem solution in a specific technological field. Basically, no state enforcement agency exists to identify the use and abuse of patented knowledge. Companies and universities must find on their own whether the invention is protected by other current, or by lapsed but potentially restorable patents. In the second case, the detection of infringement may be difficult when patents overlap, the scope of the claims is vague, and claims might be invalid (Lemley/Shapiro 2005; Bessen/Meurer 2008: 47; Ziedonis 2004). Ownership of a technical invention is not

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<sup>43</sup> The total number of pending patent applications is estimated at around 4.2 million worldwide in 2007. The USPTO had the largest so called “backlog” (28% of the world total) in 2007, followed by the Japanese Patent Office (21% of the world total) (author's calculation based on WIPO 2009). Moreover the increase in patent filings at the patent offices of USA, Japan and the European Patent Office has also contributed to the increase in pendency time and backlogs of pending applications (WIPO 2009).

<sup>44</sup> The European Patent Convention uses the term „a person skilled in the art“ according to Art. 83.

sufficient to prevent other companies from imitation or the production of similar goods ("invent around") (Mansfield/Schwartz/Wagner 1981).

Alleged patent infringement can trigger long legal procedures. Patent infringement may be legally pursued by the patentee, and damages or other sanctions can only be imposed by courts.<sup>45</sup> While a patent owner or a licensee brings a court action for infringement, an alleged infringer or a patentee's competitor may respond with a patent nullity suit (Lemley/Shapiro 2005). Patent enforcements impose significant costs on innocent violators (Bessen/Meurer 2008: 7). Harhoff and Reitzig (2004) estimate average costs of a due infringement process to amount to 300,000 Euro in Germany. For the USA, the average costs may sum up to 4 million US Dollar. Moreover, 1.1 to 3.2 percent of the disputes are resolved by the court. Nullity proceedings, however, often turn out to be unpredictably costly in Europe because actions must be taken in every single country where the patent holder has sought protection.

Since 1990, patent infringement suits have increased in countries having the largest patent offices. Interestingly, it has not been clarified whether patentees or infringers benefit from litigations. Jaffe and Lerner (2004) find that US case law has favoured patentees over infringers and the risk of invalidation has decreased at least until the 1990ies. However, numerous law cases have been decided in favour for the infringer in the 1990ies so that a pro-patentee treatment is far from clear. Moreover, whenever a patent lawsuit is filed the jury and the court are challenged to assess the damage and determine the compensation for losses arising from infringement. According to 35 U.S.C 284, US courts can even increase damages up to three times. This became known as "triple damage".<sup>46</sup> Courts eventually apply the last rule under few conditions.

Patent enforcements impose significant costs on innocent violators, yet patent holders and infringers can profit from litigations (Bessen/Meurer 2008: 7). Litigations are part of a company's strategy to appropriate rents from R&D. Patent holders and third parties basically profit from litigations if their expected return net of legal costs will be equal or larger than the expected outcome of a pre-trial settlement (Cremers 2004). Scattered evidence show that patentees of large and often cited

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<sup>45</sup> The often cited dispute between Kodak and Polaroid is a prominent example of an inadvertent infringement that has occupied patent lawyers for decades.

<sup>46</sup> "Upon finding for the claimant the court shall award the claimant damages adequate to compensate for the infringement but in no event less than a reasonable royalty for the use made of the invention by the infringer, together with interest and costs as fixed by the court. When the damages are not found by a jury, the court shall assess them. In either event the court may increase the damages up to three times the amount found or assessed." 35 U.S.C 284.



patent families are inclined to file a patent suit foremost in the USA and inventors increasingly risk to be a victim of patent lawsuits there (Lanjouw/Schankerman 2001; Bessen/Meurer 2008: 5, 144).<sup>47</sup> The (expected) value and previous oppositions against a patent and the number of forward and backward citations of patents are identified as key determinants of patent litigations (see for a detailed discussion in: Lanjouw 1992; Lanjouw/Schankerman 2001; Cremers 2004).

Litigations increase and lessen the value of patents. Competition for the use of patented knowledge including patent litigation signals that a patent is valuable and that its protection is associated with the presence of potential users of the underlying knowledge (Lanjouw 1992; Lanjouw/Schankerman 1998). Valuable patents are more exposed to litigation risks than non-valuable patents. On the other hand, litigations may also lessen the value of patents to its owner if the enforcement procedure is long and burdensome (Bessen/Meurer 2008: 7). Hence, the value of patents and the likelihood of a patent litigation influence each other.

The effects of litigations on licensing activities are not extensively tackled by empirical studies. License contracts are often closed to settle differences between patent holders and alleged infringers. In return, litigation is often assumed to be a failure of settlement in pre-trial negotiations (Cremers 2004). In Europe, only a trickle of patent infringements comes to adjudication (Harhoff/Reitzig 2004). Pre-trial negotiations and settlements avoid costly and long-lasting litigations with an open end. The patent holder receives compensation for the alleged infringement without delay while the potential infringer eliminates the risk of a prohibition of production and sale by adjudication (Bartenbach 2006: Rz. 11). Thus, the settlement of patent infringement is frequently the outset of a licensing agreement.

To sum up, propertization of useful novel knowledge and the assignment of ownership to an individual or a company in the form of IPRs is not fully assured. Patents help to assert ownership of inventions but the proprietary character of patents is narrowed by the grant of a *limited* monopoly right subject to appeal. In fact, international and national patent law provides many options to challenge the monopoly right of patent holders. Third parties are given the right to continuously put the patent under test, be it through oppositions or nullity suits. These circumstances have implications for patent transactions. Nullity suits and patent infringement affect existent license contracts. More often than not the licensor is obliged to uphold patent protection and to prosecute alleged infringement. This is understandable because similar to a patent holder the licensor is confronted with opposition and nullity

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<sup>47</sup> Lanjouw and Schankerman (2001) also find that patents are more likely to be cited by other inventors shortly litigation as compared to other patents of the same age involved in litigation before ("publicity effect").

suits in almost the same way. Yet, this obligation may be shared with the licensee (Grubb 2004: 446-447). In this case the licensor opens a procedure to defend the IP while a licensee bears the costs partly or completely. The licensee has a legal and economic interest in a smooth procedure because utilization and production are at stake. Less under strain with respect to the prosecution he provides the financial resources and cooperates with the licensor.

## **2.4 Transfer and appropriation of technological knowledge as second precondition for a market**

Appropriation refers to the transfer of information between actors and the licensee's apprehension of the transferred knowledge and competence to further develop the invention. Patents can be sold and licensed. In the course of a sale the patent is completely surrogated to the purchaser. While inventorship remains untouched, the seller (patent holder) relinquishes the exclusive right for a fixed compensation. The purchaser is then entitled to fully control the utilization of the invention which comprises the grant of further licenses. Sales contracts usually involve one exchange of rights for a lump sum, but often with a few payments in part. With licensing, however, the proprietor of the patent does not change. In licensing agreements the exchange of rights and duties usually occurs repeatedly over several milestone-stages. License contracts are continuing obligation and long-term agreements. The licensee may be permitted to grant sublicenses to other companies.

Obligations of licensors and licensees change with two basic types of contracts. In a *non-exclusive license agreement* the licensor is entitled to license the patent to numerous licensees who ultimately share the patent. Consequently, more than two companies or universities become part of the contractual relationship. This type of contract is usually chosen when the parties aim to diffuse the technology (Macho-Stadler/Martinez-Giralt/Pérez-Castrillo 1996). An *exclusive licensing agreement*, which is in the foreground of this thesis, entitles the licensee exclusively. Exclusivity is vital when the licensee does not intend to share the invention with others. This is the case when the technology is in need of high specific investments incurred by the company. Contrary to non-exclusive licenses the licensee usually takes over further obligations; for example, it is common that the licensee opens and finances the prosecution by himself. In some cases, the licensee may even forbid the use of the patent by the patent holder and thereby obtains comparable rights as those of real patent holder. The effects of both contracts types may be combined. For instance, non-exclusive license agreements are furnished with a *field-of-use restriction* allowing for territorial, temporal and factual exclusivity and extensive diffusion of the invention in a variety of technical fields at the same time. With the grant of a co-

exclusive license, a patent holder maintains the right to use the invention (cf. Groß 2007). This contractual architecture becomes even more complex when sublicenses are granted and thereby a chain of licenses is generated.

However, appropriation and transfer may be aggravated by some other hampering features of the patented knowledge and its appropriability by the licensee:

The first aspect refers to the *indivisibility of inventions* which is connected to its sticky attributes (see page 56). Indivisibility arises because the use of information about production possibilities is not determinate by the production rate due to high uncertainty in the knowledge production (Arrow 1962). A lack of indivisibility aggravates the transfer of novel knowledge between two corporate entities. Basic research inventions yield insights and problem solutions hardly ever conveyable as isolated or well identifiable commodity. The utilization and appropriation of novel knowledge often necessitate subsequent exchanges of knowledge and services including close collaboration between the R&D personnel (Herrling 2009). This circumstance may ultimately turn a straight transfer of patents into a complex R&D project in which universities and companies are both involved and which exacerbate the specification of what is actually traded between the contractual partners.

Indivisibility of inventions encounters a second aspect, the *information disclosure problem*. Knowledge is indivisible but it is fragmented in a variety of uses (Antonelli 2007). And the recognition of this variety by the potential licensee requires the disclosure of additional information by the licensor. Potential licensee and purchaser are usually able to value and evaluate the technology only if the licensor reveals complementary know-how and information of prospective utilization – “its value for the purchaser is not known until he has the information” (Arrow 1962: 171). As soon as the licensor reveals the information the transfer is (partly) accomplished. This leads to the paradox that demand in the market for patents arises with the notice of the tradable good which coincides with its transfer. Consequently, the demand for the information will be below the market optimum (ibid.). Arrow assumes that the costs of information transmission are low and thus, information leaks out fast. However, the information disclosure problem is vital if licensees are able to acquire and apply the novel knowledge instantly.

The transfer involves another knowledge appropriation problem relating to the *acquisition and apprehension of the invention* by human beings. Appropriation and application of the invention is far from obvious (cf. Rosenberg 1982). The acquisition of novel technological knowledge requires the apprehension of invention by the licensee (cf. Simon 1957). This aspect points to the subject-specific competence of managers and R&D personnel to comprehend the complex contexts of inventions; e.g. formulas and measurements. The appropriation and acquisition of the invention widely depends on the specific previous knowledge of the licensee and the

capability of human actors to transform a hardly articulated context of meaning into action (Kitch 1980). To argue from a constructivist viewpoint, a successful transfer comprises a „decisive connection“ (Luhmann 1984) by the licensees. The connective behavior determines *how* the invention is acquired and translated into a prototype. The transfer of novel technological knowledge exceeds a pure and prompt information disclosure, not just because of intangible attributes of information but due to the acquiring capabilities of the licensee. High mobility and exchange of personnel among firms, as Arrow (1962; 1985) points out, provides a means to acquiring knowledge easily. However, companies may prevent unhindered information flow through specific non-disclosure clauses in employment contracts and through non-disclosure agreements.

Another issue refers to a *functioning cooperation and collaboration* between licensor and licensee, vertically and horizontally. Cooperation is particularly vital for patent licensing anchored in larger R&D projects. Licensees and licensors participate in collective action to contribute to common goals, e.g. joint development projects and technical standard setting. As we will see, a R&D project is risky and the management of such projects necessitates not only strong financial backing provided by strategic alliances with larger companies (Nicholson/Danzon/McCullough 2005) but cooperation in patent licensing. Both, licensor and licensee are entering a process in which few actors collectively define and construct the object being exchanged (Coriat/Weinstein 2004). A functioning cooperation between licensor and licensee depends on various factors (cf. Hall/Link/Scott 2000; Cockburn/Henderson 2001). The licensee's capacities and willingness to further develop the invention, if necessary, and to incur high investments in the development stages are prerequisites that cannot be overstated. The licensor needs to assure that confidential information does not leak out in multi-party negotiations and that the patent is valid and does not infringe a third party's right (Razgaitis 2002: 12). As we will see, these aspects are sources of cooperation problems.

In the context of cooperation and collaboration, contractual agreements between licensors and licensees play a vital role. Patent licensing agreements are often complex (Brousseau/Chasserant/Bessy 2005: 15).<sup>48</sup> They are composed of several sub-contracts including the actual patent license contract and, as indicated, other agreements such as disclosure and transfer of know-how, collaborative technical development. They often go along with additional contracts for resulting gains from sub-license agreements as well as confidentiality, jurisdiction and arbitration agreements (Hoffmann/Adler 2002). Collaborative technical development agreements are nego-

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<sup>48</sup> Brousseau et al. (2005) estimate that about 50 percent of all licensing agreements are of this comparatively complex kind.

tiated, stipulating, for example, that the patent owner's complementary knowledge, including know-how and tacit knowledge, which the patent specification does not contain, is transferred to the licensee and purchaser. Arbitration agreements are noteworthy in case conflicts arise while the contract is being completed. The complex form of patent license contracts corroborates the singularity of many patent transactions, which obviously go beyond the mere exchange of knowledge laid down in the patent specification (Troy/Werle 2008). The further development of the patented knowledge and shared ownership of emerging new knowledge points to numerous contractual details. Costs and risks arising from long R&D projects must be estimated and assigned to one or both corporate entities which ultimately bears them. In return, the parties involved negotiate details specifying how resulting financial revenues and risks will be split.

Complex contracts and the commingling of competitive and cooperative elements in licensing activities have implications for the notion of a typical market transaction of patents. As indicated, market transactions are characterized by one-spot exchanges and classical contracts. Many licensing contracts obviously comprise characteristics of a non-market transaction, such as close cooperation and repeated exchanges between licensor and licensee, and neoclassical or relational contracts (cf. MacNeil 1980). Consequently, the markets for patents are characterized by non-market transactions. But does the notion of a typical market transaction hold in principle for patent licensing or is it subject to restriction and rejection? This question will be tackled in the next sub-chapter and in doing so, the arguments follow the two-fold nature of patents.

## **2.5 Are arm's length transactions of patents possible?**

According to neoclassical economics a functioning market ("perfect market") is supposed to efficiently allocate goods and services and as a result maximizes social welfare. The efficient functioning of a market needs transparency, homogeneity of goods (commodities), and complete information on the part of the actors involved in transactions. From the viewpoint of the patent as a tradable good - notably as *legal construct* - two arguments support the suggestion that arm's length transactions of patents are possible in principle:

First, patents are basically transparent and standardized which is vital to market transactions. The disclosure of the patent ensures transparency about the object of transfer (Arora/Fosfuri/Gambardella 2002). The information in the patent claim is

public and accessible to all and, unlike trade secrets<sup>49</sup>, the information is not secured in a private sphere. The standardized structure of the patents permits a systematic search of patents in public patent databases by using standardized search parameters (Allison/Lemley 2000). The structure of patents is relatively standardized. Patents consist of a title, abstract, technical description and experimental section. The description includes one or more claims, the citation of other claims and the specification of the use of the invention, and optionally illustrations. The experimental part of the patent designates the class of the invention, its purpose and the primary properties. The process of patent application follows a standardized order and aims at proving the requirements of patentability systematically. This procedure also contributes to write robust and valid patents.

Second, patents are more tangible and unambiguous than other forms of technologies and IPRs because the knowledge is codified and limited in scopes. The codified features of patented knowledge basically facilitate licensing and purchase activities. The knowledge in the patent is not vague or tacit but explicit. Since the scope cannot be altered, the patent does not change in substance, as for example trademarks. Hence, a patent is a clearly defined good with an identified length and breadth of claims. In principle, a patent allows for a systematic valuation according to these inherent parameters.

These key features of patents, however, are historically contingent and the results of multiple translations and modifications by the actors involved. The grant of a patent depends on the successful use and command of the legal terminology. Patent attorneys bring each phrase and term in the right shape and place to convince the patent examiner. The patent examiner may request the modification of words and phrases, e.g. the patent's title, which are confusing and entail redundancies. If the wording is confusing, the patent is not granted or will be opposed. Consequently, the tradable good is subject to tests about its legal validity, particularly if the patent is valuable. Interestingly, valuable patents seem to have a higher likelihood of being opposed *and* traded (Harhoff/Reitzig 2004; Gambardella/Harhoff/Verspagen 2006).

Limitation of protection and the risk of disputes about patents do not prevent functioning markets for patents but may even generate contractual relationships between universities and companies. As indicated, patent transactions are initiated by pre-trial settlements if the benefits exceed the costs of disputes. Yet, both parties must be

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<sup>49</sup> According to Art. 39(2) of the TRIPS, a trade secret is an undisclosed information which has commercial value "because it is secret [...] [and it, IT] is secret in the sense that it is not [...] generally known among or readily accessible to persons within the circles that normally deal with the kind of information in question"(2003). As opposed to patents, trade secrets are by definition non-accessible to the public. Undisclosed information is shut away from the public and secured in a highly private sphere.

willing to engage in a license contract and share profits and risks. With stick-licensing, however, a patent holder or third party gives an alleged patent infringer the choice whether to take license or to be sued for infringement. This form of licensing is a legitimate and profitable way to exploit patents financially (Lichtenhaler/Ernst 2009). From the viewpoint of the licensee, the closure of such license contracts is not the result of a voluntary decision but of a dilemma. Against the background of a free and open market for patents, it is debatable categorizing stick licensing as typical market transactions.

Does the notion of a typical market transaction hold in principle for patent licensing or is it subject to restriction and rejection? The twofold nature of patents as legal construct and part of technological knowledge implies that arm's length transactions are possible in principle but are confronted with constraints. Patents share attributes of singularities and commodities and they are embedded in historically contingent processes. In the long run, singular goods and services may transform themselves into (fictitious) commodities with changing market conditions or macro historical path breaks (cf. Polanyi 1957). With more companies and universities active in patenting and licensing and a higher frequency of transactions, typical market transactions become more common than ever before (Tietze/Herstatt 2010) and patents are increasingly treated as if they were simple commodities.<sup>50</sup> However, constraints in such a marketization and commodification process are bound to occur if the complexity of patent transactions is recognized and singular attributes of patents are taken seriously.

## **2.6 Patent licensing of drugs as example**

In this section, the two preconditions of a functioning market are illustrated by using the example of (bio)pharmaceuticals, notably drugs and therapeutic methods.

### **2.6.1 Propertization: Patents on drugs**

Modern drug discovery is a target-directed discovery that brought about a steady shift from chemistry to biology (Lednicer 1993). Simply put, a "target" is a cellular or molecular structure in the body on which a drug or therapy should act. The identification of disease-related targets is an essential point in the R&D process of pharmaceuticals. The increasing use of the genomics approach in this process and the support of bioinformatics to store and interpret data in target libraries are current trends in the discovery of new drug targets (LeVine/Rang 2009). Conventional

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<sup>50</sup> Interestingly, the reverse is not intuitive provided that novelty of the invention is taken seriously.

therapeutic drugs are based on small-molecule technology. The largest category of drugs in use nowadays and of new registration involves this type of chemical therapeutic agent (Rang/LeVine 2009). Biopharmaceuticals are a new therapeutic drug form that has gained significance in the drug discovery process (Walsh 2003). They are therapeutic protein or nucleic acid preparations, including gene therapy, monoclonal antibodies, antisense technologies, and other techniques for protein synthesis, made by techniques using recombinant DNA technology and other living microorganisms. In the last two decades, this technology was boosted through modern biotechnology. Despite the dominant role of conventional small-molecule drugs, bioengineering proteins have contributed an increasing proportion of new medicines to be registered with the FDA (Rang/LeVine 2009), though they have not been successful in terms of drug development so far (Drews 2003).

The scope of patentability for drugs and therapies varies across nations and is historically contingent. The US Supreme Court upholds patents for live, human-made micro-organisms as a “manufacture” or “composition of that matter” under US patent law (35 U.S.C § 101 Consolidated Patent Laws) (Gallini 2002). US patent law is permissive for patents for methods of surgical or medical treatment or diagnosis, and isolated DNA sequences and genes are patentable as chemical compounds (Grubb 2009). European patent law, however, is much more restrictive because it stipulates that the invention is “susceptible of industrial application” (Art. 54-57 EPC). Only compounds to be used in preventing and treating a disease are patentable but not the methods of treatment per se (Scassa 2001).

Patents are by far the most important form of protection for pharmaceuticals. The average costs for developing a new chemical entity (NCE) to a drug are estimated between approximately 800 million USD (DiMasi/Hansen/Grabowski 2003) and 1.7 billion USD (Gilbert/Henske/Singh 2003), depending on the discount rate, total capitalized costs and launch costs. In this industry, patents are seen as a means to appropriate rents from costly R&D activities, while trade secrets play a minor role (Cohen/Nelson/Walsh 2000; Levin, et al. 1987).

Patents on drugs are more valuable to patent holders than patents in other technological fields. In the PatVal survey presented in chapter 1 (Gambardella/Harhoff/Verspagen 2006), the authors identified pharmaceutical patents to be included in the highest value class of European patents (300 million Euros value). In fact, the majority of pharmaceutical patents do have a low value and thus, the distribution of their value is left-skewed as well. However, the average value is higher because a few blockbuster patents deliver the essential value to companies. Even if only a trickle of patented pharmaceuticals becomes real blockbusters, they may compensate a pharmaceutical firm and universities for billions of USD (Grubb 2009). Bessen and Meurer (2008: 107) estimate that over one-half of the value of



worldwide patents accrues to a small number of large pharmaceutical companies and over two-thirds can be attributed to firms in the chemical and pharmaceutical industries. University patents for pharmaceuticals include some of the most valuable technologies (Thursby/Thursby 2007). In general, important and valuable inventions are likely to be patented in all major markets (Bessen/Meurer 2008: 5, 14). Consequently, protection for pharmaceutical patents is usually sought worldwide and the family size of those patents is large.

Oppositions are numerous in areas with strong patenting activity and with high technical or market uncertainty (Lemley/Shapiro 2005). Opposition is an important mechanism by which the validity of a patent can be challenged, as Harhoff and Reitzig (2004) demonstrate for European pharmaceutical and biotechnology patents between 1979 and 1996. They find that opposition rates are high for biopharmaceuticals, e.g. microorganisms or enzymes (IPC field C12N) and fermentation or enzyme-using processes (C12P). Classical pharmaceuticals (A61K without cosmetics) face a lower opposition rate.<sup>51</sup> A high number of references to scientific publications in a patent and the number of forward-citations are strong indicators for the value of pharmaceutical patents and a high likelihood of opposition (Harhoff/Scherer/Vopel 2003). However, for most large patent offices, the fraction of patents opposed or subject for re-examination or invalidation is small compared to the total number of grants (WIPO 2009).

Similar to opposition proceedings, valuable pharmaceutical patents are more likely to be involved in infringement suits at US and German courts (Lanjouw/Schankerman 2001; Cremers 2004). Imitation of chemicals and conventional pharmaceuticals is relatively easy to detect. This may explain why litigation costs for pharmaceutical patents are relatively low (Bessen/Meurer 2008: 143). Pharmaceutical firms earn far more from their patents than they lose to litigation (Bessen/Meurer 2008: 16). Some studies on patent litigation find that patents for pharmaceuticals and chemicals have a low litigation rate (Cremers 2004; Bessen/Meurer 2008), though this obviously does not apply for biotechnology. Other studies report a higher likelihood of patent litigation for pharmaceuticals (Lerner 1995; Lanjouw/Schankerman 2001). However, all studies agree that disputes are found to be higher for valuable patents and for patents in cutting-edge fields because uncertainty about and inexperience with such technologies impede settlement bargaining (Lanjouw/Schankerman 2001).

To conclude, patents for conventional pharmaceuticals are comparatively robust and the condition of propertization is widely fulfilled - taken into account that the

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<sup>51</sup> According to this study, oppositions of US owners are more frequent than those of Japanese owners.

property-like characteristics of IPRs are weak on the whole. Patents for conventional pharmaceuticals, as patents of discrete technologies in general, have quite well-defined boundaries (Bessen/Meurer 2008: 18) and the technological knowledge is largely codified. However, biopharmaceuticals and cutting-edge biotechnology challenge researchers, patent lawyers and examiners likewise. Usually the patent examination process of patent offices is quite standardized because it starts from structural similarities of the compound according to classical chemistry (T852/91). Chemical compounds have structural similarities because a minor change in the chemical structures can dramatically affect a compound's properties and result in different functions. This means that a chemical entity is regarded as novel and involves an inventive step even if changes in the chemical structure are minimal. Consequently, it is quite difficult to invent around a patent for a drug (Merges/Nelson 1990). This basic rule of patent examination suffices for conventional small molecules but is not well applicable for biopharmaceuticals, e.g. protein-based drugs (cf. Skoglösa/Unge 2009).<sup>52</sup> This may explain why biotech patents are more exposed to opposition and litigation than conventional drugs.

### **2.6.2 Transfer and appropriation: Patent licensing along the clinical pipeline**

In general, pharmaceutical discoveries and inventions are more codified and relatively easy to describe in a precise language. The outcomes of an R&D project are usually delivered in the form of molecules, cells, models, experimental data, and other documentations. The structural description of molecules, for example, provides a clear and complete definition of biochemical characteristics (Gambardella 1995: 55; Grubb 2004: 401-402). In fact, much of the knowledge that has emerged in the context of drug discovery is generic (Nelson 1989) and can be brought into a concise written form. Since codified generic knowledge diffuses with low costs it is obviously easier to transfer.

*Indivisibility of the invention:* However, R&D projects have a tacit dimension too and patents do not fully capture the relevant technological know-how inherent in the discovery process. Know-how results in this field emerge along the whole process and can not be fully isolated. Investigating the validity of a compound, for example, is not a linear process. Know-how is generated in a series of costly experiments, tests and computer simulations by multidisciplinary research teams in and outside the laboratory. It is an inquiring and probing process followed by decisive check-

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<sup>52</sup> When applying this rule, the patent office tends to grant protein pharmaceutical patents with a very narrow scope (Skoglösa/Unge 2009).

points, e.g. the early selection point (ESP) and the full decision point (FDP),<sup>53</sup> which entail either success or failure of the project (Rang 2009b). In any case, inquiring and probing deliver new insights because drug discovery often leads to results with multiple applications. Even in later stages, resources used in an unsuccessful project may well be redeployed for another more useful project, though with opportunity costs (Rang 2009b). Hence, probing enhances know-how. Know-how then becomes “the fruit of experience, of the accumulation of ideas of improvement, in a nutshell, of ‘learning by doing’” (Bidault 1989: 7). This know-how is hardly transferrable.

*Acquirement and apprehension of the invention:* Yet, as opposed to R&D processes in other technologies, the stages of the drug discovery process are relatively serial and demarcated, though not clear cut (Rang 2009b). They include pre-determinate steps with specific tasks to be fulfilled. In principle, the separation of drug discovery from development process allows specialization and a vertical division of labor between different organizations (Pisano 1990; 1991). When a licensee selects a project he must be aware that success derives not only from building commercial and regulatory strategies but from exploiting unexpected scientific opportunities (Rang 2009a). To find those opportunities and to assess the value of the project, a (new) research partner operating on subsequent development stages must be able to apprehend and replicate the original team’s findings in principle before moving forward (Gambardella 1995: 47). Numerous studies give account on why and to what extent appropriation of R&D outcomes is facilitated and aggravated at the same time (Powell/Koput/Smith-Doerr 1996; Jensen/Thursby 2001). The R&D process is highly research-driven throughout all phases and the personnel involved is highly skilled, often with a similar science-related background and a profound general knowledge in natural science. The R&D personnel having a high level of education often work autonomously in teams and thus are often perceived as productive by companies (Herrmann 2008: 115). As I will further argue, this is also important to the licensing process (Rang 2009a). Short tenures of the personnel and project-based work in pharmaceutical firms strengthen the ability of the licensing company to cope with the appropriation of projects (Arrow 1962; 1985).

*Collaboration and the information disclosure problem:* Appropriation is aggravated when the pace of technological progress in a field is high, e.g. biotechnology, and new discoveries create a radical break from previously dominant methods. Biotech firms operating in such a dynamic environment are often found to be in constant and intensive touch with other firms and universities through different forms of

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<sup>53</sup> The early selection point (ESP) is reached when the drug candidate molecule is taken into preclinical development. The full decision point (FDP) is the point when evidence of clinical efficacy in man is obtained and a “proof of concept” exists (Rang 2009b).

alliances and partnerships (Powell/Koput/Smith-Doerr 1996; Poyago-Theotoky/Beath/Siegel 2002). The same holds true for the appropriation of early stage technologies. The licensee profits when the inventor is actively involved in the further development of the drug (Jensen/Thursby 2001). In the drug development process, different sorts of expertise are involved. After the early selection point (ESP), responsibility for development usually passes to a multidisciplinary team which demands collaboration between different departments within a licensee company (Herrling 2009). Collaboration and exchange with academic scientists facilitate the acquirement and apprehension of know-how by the licensee (Gambardella 1995: 47). At the same time it entails an information disclosure problem when different departments from different companies are involved. In any case, appropriation points to the competence and experience of the licensees, including its personnel, in a relevant technical field.

Drug research and development is a *transformation process* in which the object of transfer significantly changes. In the early and late research stage, a compound is embedded in a research project, notably in the scientific environment of a laboratory or university. The project is open to new insights and surprises. The target selection procedure reveals the most qualified products and the project progresses with any further selection step. In this early stage, patent protection in the US exists, if at all, in the form of a preliminary patent. In subsequent clinical stages, the drug becomes the primary object of a costly development project that is on the way to the product market. New insights and surprises, however, are much more considered as a disaster than as a promising avenue to success (Rang 2009b). The object of trade and transfer transforms into a granted patent if the application procedure was successful. Internationally granted patents disaggregate to a bundle of national patents, and national courts become the competent institutions for infringement and nullity suits. Since drug development and regulatory approvals take years, effective protection for a drug sold in a product market is much shorter than 20 years. Most national legislations do permit a patent term extension of up to five years for pharmaceuticals to compensate for regulatory delays.<sup>54</sup> However, pharmaceutical companies find themselves under time pressure when a patent on a promising drug has been granted.

Finally, drug discovery involves the filing of numerous patents which often lead to *complex licensing constellation and contractual relations between different organizations*. Since drug discovery may bring about results with multiple applications, a new application of a compound entails further patents. In order to sell the compound

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<sup>54</sup> In the US, the Hatch-Waxman Act regulates the extension of patent protection for pharmaceuticals. In Europe, extension is granted for substances subject to regulatory approvals through a Supplement Protection Certificate (SPC).

for the new use, a third party would require a license from two patent owners. If the two patent owners wish to sell or license the compound for the new use, they would need to grant a license to each other. Licensees who intend to invest in drug development understandably seek to broaden the field of use in terms of time and geography in order to assure a competitive advantage over rivals in a therapeutic field. Consequently, exclusive licenses for drugs play a pivotal role to pharmaceutical companies.

In summary, some preconditions of appropriation are largely fulfilled. Others, however, still challenge licensors and licensees. Indivisibility of know-how, which emerges in new technical fields, surely poses a problem for licensees to continue the development. Close collaboration between firms mitigate this problem, though it usually requires cooperation between multidisciplinary teams within and between organizations. Finally, collaboration may even initiate and intensify an information disclosure problem. This problem will be addressed in chapter 4 and 5.

### **2.6.3 Universities and companies heading to the ‘market’?**

It was argued that, from the viewpoint of the patent as legal construct, arm's length transactions of patents are possible in principle. Yet, the key features of patents that allow typical market transactions are historically contingent and the results of multiple translations and modifications on the part of the government and strategic actions by patent holders involved in patent licensing. Since empirical evidence for functioning and organized markets for patents and commodification of patents is weak, the crucial questions regarding the trade in patents may be found in the respective setting: Is there a trend towards the commercialization of patentable inventions? Why do some universities and companies actively seek to commercialize patents? And do they act under a pressure to earn revenues from licensing? A short review on these two aspects should contribute to the discussion of whether universities and companies are heading to functioning markets for patents.

#### **A trend towards commercialization of patentable inventions?**

The last three decades witnessed a substantial increase of patent licensing at public US universities. To facilitate technology transfer between universities and industry universities have established technology transfer offices (TTOs) (Siegel/Veugelers/Wright 2007). Before the provision of the Bayh-Dole Act in 1980, only 20 US universities had technology transfer offices (Colyvas, et al. 2002) and fewer than 250 US patents were issued to universities each year (Aldridge/Audretsch 2010). Between 1980 and 1990, the number of TTOs decupled and by 2000 nearly every major research university had one (Colyvas, et al. 2002). In 1998, US TTOs surveyed by the Association of University Technology Managers

(AUTM) report that university license revenues have grown with a factor of 3.17 from 220 million USD to 698 million USD between 1991 and 1997. The previewed AUTM figures for 2010 show another steep increase in total licensing income of 2.4 billion USD, 4,469 issued US patents and 4,284 licenses executed (AUTM 2011). The majority of licenses are non-exclusive licenses (about 60% of total licenses) to established companies for new technologies that are likely to become a standard. Exclusive licensing is the dominant form for start-up creation and for technologies that need substantial resources in the further development, as e.g. drug development (AUTM 2007). Invention disclosures, which involve the number of inventions reported by faculty researchers to TTOs, are highest in the medical, biomedical engineering, and life science fields, followed by computer science and electrical engineering. To sum up, data on increasing invention disclosures and patent filings at US universities (AUTM 2007) indicate a trend towards commercialization of patentable inventions.

Interestingly, this trend is not fully represented in the missions and goals of universities. The traditional missions of universities are the publication of scientific research results and high-level education. Yet, it is frequently argued that the norms of science are increasingly shifting to academic entrepreneurship and the commercialization of patents (Etzkowitz 1998; 2000) and that these norms shape the commercialization process in return (Louis, et al. 1989; Debackere/Veugelers 2005). This argument is not completely supported by surveys and qualitative research investigating the missions of US universities. Patenting, licensing and TTOs are important to the transfer of only a subset of university technologies (Colyvas, et al. 2002; Sampat 2006). Universities still attribute high importance to publications, open science communication (i.e. conferences) and consulting (Cohen/Nelson 1998). A change in norms and missions of universities are rather regarded as extension than as replacement of traditional norms and mission (Etzkowitz 1998).

Pharmaceutical companies more and more use patent licensing with universities and other companies in the respective fields to gain profits and reduce development costs. In general, the labor division along the R&D process are conducted by different organizations. Typically in such a stage division universities and small innovative firms tend to operate in the early stage of a drug compound, followed by the preclinical process. The initial stages of the drug development process are less costly. Large companies tend to invest in later clinical stages closer to the commercialization of the drug. The costs of clinical account for about half of the overall R&D investments, while 25% is spent for drug approval (Rang 2009c). In return, companies licensing-out at later stages of drug development can reap higher profits from patent licensing than universities at the early stage (Edwards/Murray/Yu 2003). Drug development in late stages is more costly but drug candidates heading to the

advanced clinical stages have a higher likelihood of reaching the product market. Thus, the labor division between research and preclinical development is a way to share the risks that emerge in the journey from research to the final product.

In many cases, pharmaceutical firms find long-term strategic alliances with universities and companies with intensive links between organizations more beneficial than patent licensing without such strong links. The rapid development in biotechnology are far too complex for a single firm to handle alone (Chesbrough 2006: 53 quoting the example of Merck). In this instance, appropriation of know-how is better effected through a constant knowledge exchange via conferences, advanced training for firm staff and systematic exchange of research staff between companies and research institutes. Pharmaceutical companies are willing to finance university research in order to secure good appropriability conditions. In close collaborations, companies gain knowledge that is fruitful for in-house drug discovery. They can then appropriate the outcomes of the transferred knowledge through patents. This encourages investments in academic research even though knowledge produced in such alliances may well diffuse in the outside environment (Gambardella 1995: 56). In general, pharmaceutical companies do not profit from using a patent as bargaining chip nor from licensing-out a promising drug in a later stage when substantial investments have been made. Firms that incur high costs in drug development and aim to bring a drug to the product market make highest revenues from patent-protected inventions by excluding rivals from the use of the invention (Reitzig 2004: 401-402; Grubb 2004).

### **A pressure to license?**

Technology transfer from universities to firms and inter-industry links between those organizations refer to different types of interactions between the two sectors. As indicated, they comprise a variety of forms - collaborative research, contract research, start-up creation, cooperation in graduate education, advanced training for firm staff, systematic exchange of research staff between companies and research institutes. The commercialization of patentable knowledge accounts for one part of technology transfer and occurs through two channels, notably licensing university IP to the marketplace, i.e. to existing firms, and the establishment of start-up companies (spin-offs) that are rooted in research activities at the respective universities. Universities and companies obviously use multiple channels to exchange knowledge, and patent licensing between universities and companies for monetary revenues is not the dominant mode. So, why do some universities and companies actively seek to commercialize patents? And why not?

First of all, US public research institutions faced increasing budgetary restrictions of public funding and costs of state-of-the-art interdisciplinary research in the last

years. To compensate this decline, they seek for new funds (Debackere/Veugelers 2005) and revenues from patent licensing are a popular means. A survey of major US universities by Thursby et al. (2001) showed that the most important objectives for TTOs are royalties and fees generated followed by the number of inventions commercialized. The number of licenses signed and of patents awarded is less important. The findings of a subsequent study by Siegel et al. (2003) are similar, though with a slightly different order. Therefore, the enhancement of university revenues does play an important role in US university policies, even though additional revenues were not the central objective of the Bayh-Dole Act (Colyvas, et al. 2002). Much more in line with this legislation, public US universities usually seek to diffuse technologies in order to create spill-overs and serve the public interest (Aldridge/Audretsch 2010). The high number of non-exclusive licenses to firms indicates that universities use this channel to fulfil this economic mission. While budgetary cutbacks and a lack of funding are certainly reasons why universities are under pressure to license-out technologies, non-exclusive licensing and start-up creation are obviously seen as a way to enhance public benefit. Even though a small number of universities do make significant profits, this is not the case for the majority of TTOs. Universities are today more commercially productive than they were in past decades. However, inefficiencies across TTOs are still persistent (Thursby/Kemp 2002) and most US universities are slow in harvesting profits from licensing deals (Edwards/Murray/Yu 2003).

Reasons and motives for licensing-in patents are quite obvious for pharmaceutical firms. For decades and nearly centuries, pharmaceutical companies restrict innovation to drug development and cede research activities to universities. Universities do not have the resources to carry out costly clinical trials and bring a drug to the product market. Since the 1980ies, drug development costs and regulatory stringency of drug approval have been rising, while the number of new drugs launched on product markets has declined. At the same time, drug testing has become more effective and drugs with side-effects and inefficacy are discarded early in research stages. The early selection of effective drugs leads to fewer drugs with inefficacies and side-effects that enter the product market today (Gambardella 1995: 39-41). Consequently, when patent protection of a blockbuster drug expires, pharmaceutical firms find themselves under pressure to replace a loss in profits. Increasing costs in R&D and a considerable threat of revenue losses due to patent expiry prompts business development managers to pro-actively license-in technologies.



## 2.7 Conclusion

The aim of this chapter was to outline peculiarities of patent transactions and markets for patents. It discussed the twofold nature of patents, analyzed two preconditions of functioning markets for patents from the viewpoint of economics and gave an encyclopedic overview of patent licensing to introduce the reader into the multidisciplinary topic. Thereby, I referred to the example of patent licensing of drugs to established firms.

Other than non-protected parts of technologies or know-how, patents allow creators to assert ownership rights on the outcomes of their ideas and innovative activities in a similar way to that in which they can own physical property. Apart from that, patents are granted to solve the problem of free-riding and reduce positive external effects that would otherwise prompt inventors to decline their R&D investments. Similar to any other private property rights, they confer power. “They [private property rights, IT] are rules that constrain and enable, and they locate decision-making power over assets” (Carruthers/Ariovich 2004: 24). Legal scholars frequently use the term “monopoly right” in order to describe the power of patent holders to exclude third parties from using an invention. Yet, this right is not equivalent to the market power of a monopolist (Baumol 2002) nor is it free of restrictions. Despite legal restrictions on patents, it is important to note that antitrust law is more generous to patent holders than to owners of tangible assets because patent licensing often coincides with technology transfer for which antitrust law has exceptions (Bessen/Meurer 2008: 31). The precondition of propertization is largely fulfilled for patents on drugs.

The precondition of appropriation of technological knowledge is not fulfilled when know-how, which emerges in the course of a R&D project, is needed by the licensee. Patent databases allow for transparency and an efficient search for patents. Yet, patents are public and the technological knowledge open to all free of cost. Apart from freedom-to-operate concerns and competitive advantages, a patent may be of interest for the buyer only if additional know-how is provided which is not contained in the patent. Indivisibility of the invention, the information disclosure problem, the apprehension of know-how by the licensee and complex agreements aggravate market transactions. In the case of patents on drugs, close collaborations within and between organizations is often required. However, close cooperation intensifies information disclosure problems.

In this chapter, I concluded that patents share characteristics of singular goods and commodities. For instance, the transparent and standardized structure of patents implies that patents basically admit a higher degree of standardized and systematized transactions than other non-protected parts of technologies, as know-how and

other forms of IP. At this point, the question of whether and to what extent patents are treated as simple commodities by market actors was briefly mentioned. In line with Polanyi (1957), Jessop (2007) argues that technological knowledge is not actually produced in order to be sold and bought, though it is traded on the market, which is organized as if knowledge were a commodity (so-called “fictitious commodity”). This argument, however, does not find full support in empirical studies and thus it was not explicitly addressed in this chapter. I argued that the crucial point regarding the trade in patents refers to specific social and political processes in a currently changing environment of science and technology development. These processes are the trend towards commercializing patents and a pressure for licensing.

## 3 A theoretical framework for analyzing patent transactions

### 3.1 Introduction

The majority of studies explicitly dealing with patent transactions and markets for patents have their provenience in industrial economics and managerial studies. They are based on assumptions from neoclassical economics, new institutional economics or more narrowly transaction cost economics, and contract theory. A number of theoretical contributions in mainstream economics conveyed interesting insights into patent transactions and markets for patents, for example Arora and Fosfuri's (2003) and Fosfuri's (2006) explanation of the interplay of markets for technologies and products in the chemical industry, the contribution of Gans and Stern (2008) on the structure of the market for ideas, and Macho-Stadler et al. (1991; 1996; 2005) and Jensen and Thursby (2001), who made suggestions for designing licensing contracts, to name a few.

In most of these frameworks, however, uncertainty plays a minor role. One reason is that uncertainty is of different importance to the theoretical strands that provide the basis for the models. While the neoclassical economics neglects uncertainty and risk at all, new institutional economics and contract theory integrate both factors as explanatory factors. Another reason for the negligence of uncertainty may be that theoretical models in economics focus on strategic interactions, the market structure and the role of transaction costs without investigating the conditions under which managers act when they initiate, negotiate and close contracts. The way new institutional economics and notably contract theory treat uncertainty and contingency has been criticized (Luhmann 1997; Ganssmann 2007). Amongst others, scholars in economic sociology, which is the provenience of this study, pointed to the rigid use of the efficiency postulate in economic strands and their fundamental presumption of rational behaviour and opportunism of actors. This has also led to a debate about calculability and decision-making under uncertainty (Beckert 2007; 2007; Karpik 2010). In a similar way, the theoretical contributions to markets for patents, if they treat uncertainty at all, are confronted with these critics.

This chapter takes this critic as a starting point to develop a theoretical framework - applied as analytic instrument - that helps to explain how transactions fail due to uncertainty. More concretely, the chapter poses the question of how to study patent transactions that are impeded by uncertainty. Thus, the focus will be on the impeding side of uncertainty. *The framework should provide an analytic tool that is necessary to answer the overarching question on uncertainties in patent transactions and how managers cope with uncertainties.*

The analytic framework consists of concepts from pragmatist theory (Dewey 1938; Dewey 1960 [1929]) and the cultural strand in economic sociology (Karpik 2010) which are brought under a common roof. Despite the different paradigmatic origins of the strands, both theories contribute to the understanding of uncertainty and how actors cope with it (see for a similar approach by Stark (2009)). This choice, as I found, offers a worthwhile alternative to established approaches in economic sociology, notably institutional and socio-structural explanations of established and transparent markets (cf. Fligstein 2001; White 2002).

The chapter addresses “measuring problems” known from other areas of study that investigate the concept of uncertainty (cf. Jauch/Kraft 1986). It provides suggestions on how to ground uncertainty for studies in empirical fields that are characterized by confidentiality of contractual relations and a lack of transparency. The example of pharmaceutical patent licensing is chosen because it allows to study patent transactions, notably bilateral licensing, under the conditions of different degrees of uncertainty.

The first sub-chapter highlights the theoretical contributions of philosopher in economics, John M. Keynes, Frank Knight and George L. Shackle, on uncertainty to arrive at a clear definition of the concept and to respond to the question of how actors react to uncertain situations (3.2). Their concepts differ in basic assumptions: the role of information and knowledge, the allowance of degrees of uncertainty and the distinction between risk and uncertainty (discussed in: Loasby 2007; Crocco 2002). The pilot study preceding this research identified three facets of uncertainty: *fundamental, procedural and strategic uncertainty* (see page 76-78). These facets or types of uncertainty have two sources, which are discussed in 3.3. First, they are caused by the *innovation and patenting process*, foremost when the outcome of a R&D project is uncertain and a product market is not specified and when the patentability of a compound is not clarified. This source is associated with the good that is traded in the market for patents and involves the innovative product and the patent. Second, the three types of uncertainty relate to *the market for patents*, more precisely to *valuation and pricing of patents and cooperation between licensors and licensees* (Troy/Werle 2008). Finally, the theoretical framework for analyzing patent transactions and a few suggestions about studying uncertainty in the empirical field are presented (3.4).

## 3.2 Perspectives on uncertainty

### 3.2.1 Perspectives on uncertainty in the philosophy of economics

#### John M. Keynes

In his “Treatise on Probability” Keynes (1973 [1921]) describes uncertainty as a lack of an actor’s rational belief in the “existence of a logic relation between two sets of propositions in cases where it is not possible to argue demonstratively from one to the other” (ibid: 9, italics original). In general, Keynes assumes that a probability statement can be expressed as a logical relationship between two propositions.<sup>55</sup> The core and starting point of the definition of foresight or certainty is the existence of a logic probability relationship between two propositions ( $p$ ,  $h$ ) and degrees of an actor’s belief. An actor gives a probability statement if he knows (is certain about) a proposition  $h$  and perceives a logical relationship between proposition  $p$  and  $h$  to be justified because he has a high degree of belief in proposition  $p$  that corresponds to the logical relationship.<sup>56</sup> This actor will be certain about the truth of  $p$  if the logical relationship is perceived as  $p$  being a logical consequence of  $h$ . In return, he will be certain about the falsity of  $p$  if the logical relationship is that of the falsity of  $p$  being a logical consequence of  $h$ . If the logical relationship is not perceived in terms of consequences, the actor has a degree of partial belief in  $p$  between certain belief and certain disbelief (Braithwaite 1973).<sup>57</sup>

The knowledge an actor has of the proposition  $h$  depends on his subjective estimation of the situation (subjective probability). In principle, Keynes assumes that actors are able to obtain precise degrees of beliefs in any proposition of the world, and the degrees vary. The logic probability relationship, however, is “[...] fixed objectively, and is independent of our opinion” (Keynes 1973 [1921]: 4). Certain rational belief corresponds to knowledge that the actor obtains directly or by argument through the acquaintance with a logical relation (Lawson 1985; Keynes 1973 [1921]: 10). Hence, certainty is the state of complete confidence in a belief (high degree of belief) that a probability relationship holds in accord with the correctness

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<sup>55</sup> The assumption of a logic relationship between two proposition is a weaker or more general way to express relationships than to assume a proposition ( $p$ ) to be a logic consequence of the other ( $h$ ). According to Braithwaite (1973) the originality of Keynes work is made up by this approach.

<sup>56</sup>  $h$  can be a conjuncture of propositions.

<sup>57</sup> In the editorial foreword of the Treatise on Probabilities, Braithwaite (1973) notes that most present-day logicians would describe knowledge in terms of the structure and use of language system, and they would probably start with the degree of the actor’s belief and then analyze the conditions that must be satisfied in order to fulfill this degree.

of this belief (Lawson 1985).<sup>58</sup> Another Keynesian term alluding to uncertainty is the *weight of arguments*. This term is defined by the relation of “the *absolute* amounts of relevant knowledge and of relevant ignorance respectively” (Keynes 1973 [1921]: 77, italics in original). This relation is necessary to estimate the magnitude of the probability of an argument. With an increase of relevant evidences at an actor’s disposal, this magnitude may increase or decrease because “we have a more substantial basis upon which to rest our conclusion.” (Keynes 1973 [1921]: 77). The accession of new evidences will always increase the weight of an argument while the probability of the argument may increase or decrease. As a consequence, the degree of ignorance also decreases.<sup>59</sup>

The increase of the weight of an argument and subjective probabilities are points that are essential to a basic assumption in the thesis: To argue that uncertainty allows for different degrees and that actors give probability statements about a proposition.

#### **Frank Knight**

Frank Knight defines uncertainty distinctive from risk. Risk relates to outcomes of economic action to which probabilities can be assigned. The essential characteristic of risk, as Knight (2002 [1921]) points out, is that it indicates “a quantity susceptible of measurement” (Knight 2002 [1921]: 19-20). Uncertainty alludes to situations in which information, on which probability calculations could be based, is lacking. Notably in singular and highly unique events with a high variance of conceivable outcomes (high contingency) a distribution of the outcome in a group of instances is not known through calculation a priori or from statistics of past experience. Uncertainty is unmeasurable and thus restricted “to cases of the non-quantitative type”

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<sup>58</sup> For Keynes, the opposite or negative correlative of certainty is rather impossibility than uncertainty. “If *a* is certain, then the contradictory of *a* is impossible” (Keynes 1973 [1921]: 16). Uncertainty is associated with ignorance. Interestingly and disappointingly, Keynes does not clarify what uncertainty means in contrast to certainty.

<sup>59</sup> In *The General Theory*, Keynes (1936) demonstrates this effect by explaining investment and preference for liquidity. If the future interest rate were known to actors, it would be clear that either purchasing a debt or holding cash is advantageous. All rational actors would behave similarly and consequently all become winners without a yield. With uncertain future interest rates, however, investors are forced to believe either in a decline or raise of the bonds. Every new evidence suggesting a rise of the price of the bonds provides the investors with further insights that strengthens his expectations and prompts him to align his strategies accordingly. He will sell the bond for cash, and finally join the group of cash holder. This also explains why people prefer to be liquid, either because they want to avail themselves of cash for current transactions and future speculations or they precautiously secure a portion of the current resources for future cash (cf. Keynes 1936).

(ibid: 233).<sup>60</sup> In unique events, actors can make at best an estimation of a situation which has the same form as a probability judgment. Making and forming subjective probability judgments and objective probabilities appear to be similar because both rely on determinate and random factors (Knight 2002 [1921]: 235). However, no means exist to separate true objective probability from a subjective probability judgment (Knight 2002 [1921]: 231).

“[...] [in singular events, IT] we do estimate the value or validity or dependability of our opinions and estimates, and such an estimate has the same form as a probability judgment; it is a ratio, expressed by a proper fraction. But in fact it appears to be meaningless or fatally misleading to speak of the probability, in an objective sense, that a judgment is correct.” (Knight 2002 [1921]: 231)

If objective probability and subjective judgment is not separable, how could a distinct event become calculable? As Knight points out, insurances are the most developed indicative for such an attempt (Knight 2002 [1921]: 247-250). Securable events, however, relate to risk. *Real uncertainty* is characterized by high contingency and high uniqueness of the event, and thus it is unmeasurable. It rather points to speculation and investment propositions than to insurable incidents.

In his theory of profit, Knight claims that real uncertainty is the origin of entrepreneurial profit. This profit, not to be confused with rents, wages and interests,<sup>61</sup> arises “out of the inherent, absolute unpredictability of things, out of the sheer brute fact that the result of human activity cannot be anticipated” (Knight 2002 [1921]: 311). Profits are generated through business judgments that deal with change and social progress. *Business judgments* are “organized dealings with our environment” (Knight 2002 [1921]: 295) involving the judgment of ones own and other’s power. They form the basis for knowing whether a specific investment is worth to be taken independently or jointly with guidance.<sup>62</sup> For this reason, the *specialization in uncertainty-bearing* on the part of groups of individuals with superior managerial ca-

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<sup>60</sup> Strictly speaking, the lack of information, which is needed to come up to a probability function, implies a “practical indifference whether the uncertainty is measurable or not.” (Knight 2002 [1921]: 235)

<sup>61</sup> Profit is determined by “the *marginal bid* of entrepreneurs as a class for all agencies as aggregates” (Knight 2002 [1921]: 284, italics in original). Unlike the rent, it is not a product residue (deduction of production costs) but of “a margin of error in calculation on the part of the non-entrepreneur or entrepreneur [...]” (ibid.)

<sup>62</sup> Social progress and change reflecting the dynamics of modern societies make the future different from the past. A law of change to the field of resources, technologies and affecting wants can not be identified in principle.

pabilities, as for instance venture capitalists, is vital (Knight 2002 [1921]: 255, 270).<sup>63</sup>

### **George L. Shackle**

For Shackle (1990 [1954]; 1969), uncertainty is induced by a lack of foreknowledge which is relevant to make decisions. This lack is fundamental in any given situation characterized by singularity. As a consequence, a previous set of judgment may render useless in the decision-making process under uncertainty.<sup>64</sup> Decision making under uncertainty does not only differ from decision making under risk with regard to expectations but it evokes a *different viewpoint on time and expectation* in general. Opposed to the risk-based probability approach, he suggests that economic time is different from physical time.

Economic time gives room for re-enacting decisions between alternatives in memory and any moment in time involves a distinct temporal viewpoint guiding a decision. Additionally, decision making will alter the circumstances surrounding the original choice itself (Ford 1990). In a series of articles about time and decision under uncertainty in economics, Shackle (1990 [1954]; 1959; 1976) points to the relevant but obviously neglected fact that every choice between alternatives are made at some moment but often relates to events distributed over a long time span. This obvious difference in time frames has its origin in two types of time, a *dynamic* and *imaginary time*, to which decisions refer. While dynamic time is “the locus of actual experiences [...] the actual occurrence of thoughts and feelings” (Shackle 1990 [1954]: 4), imaginary time relates either to memories and re-enactment of past moments (memory time) or to images of future moments (expectational time). Imaginary time allows for *imagination* where “the whole range of time that can directly concern the individual is in one sense brought within reach of each of his moments of dynamic time.” (ibid).

One central assumptions, which is vital to this thesis, is that imagination indicates that decision-making under uncertainty is not fully absorbed by ignorance but bears

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<sup>63</sup> Following Adam Smith and David Ricardo’s theory on labor sharing and competitive advantages, Knight recognizes uncertainty as a fundamental development principle in modern capitalistic economies. Uncertainty induces labor division and specialization on the basis of knowledge and judgment. Knight mentions four tendencies to select men and specialize functions: “an adaptation of men to occupations on the basis of kind of knowledge and judgment; (2) a similar selection on the basis of degree of foresight [...], (3) a specialization within productive groups [... risk-bearing groups, IT]; and (4) those [groups, IT] with confidence in their judgment and disposition to ‘back it up’ in action specialize [!] in risk-taking.” (Knight 2002 [1921]: 270).

<sup>64</sup> G. L. Shackle pursues Keynes’ idea about liquidity preference and adds further aspects to uncertainty.



“the essential freedom of the individual imagination to create afresh from moment to moment” (Shackle 1958: 33). However, imagination must conduce to choice making. Singular events presuppose inceptive choices that are not implicit in its summation and suggestion of what is already the past. These choices are based on subjective data which describe the situation instead of giving a completed list of information with an origin explainable.<sup>65</sup> In this light of doubt, a probability distribution is not available. Uncertainty leaves room for imagination that is required to make decisions. Or in other words, choosing between alternatives presupposes the imagination and creation of options (Shackle 1969: 16).

### 3.2.2 John Dewey’s theory of inquiry

John Dewey’s Theory of Inquiry originates from his treatises on scientific research and intelligence and is developed in numerous articles about experimental logic and in his seminal book “Logic: The Theory of Inquiry (1938)”.<sup>66</sup> Not truth and falsity but objects and events are the concern of any scientific proposition because the latter carry on *inquiry*, which is the leading principle and process in Dewey’s logic. It is in an act arising out of an *indeterminate situation* in which actors find themselves when they are confronted with uncertainty.

The indeterminate situation features the basic attributes of procedural uncertainty (see page 77).<sup>67</sup> Dewey (1938: 107) characterizes the “indeterminate or unsettled situation” as “disturbed, troubled, ambiguous, confused, full of conflicting tendencies, obscure, ...”. By “confused”, Dewey (1938: 106) means that the outcome of a situation cannot be anticipated whereas “obscure” means “its course of movement permits of final consequences that cannot be clearly made out” (*ibid.*). The situation is conflicting when “it tends to evoke discordant responses” (*ibid.*), and the significance of the conditions is indeterminate. The indeterminate character of the uncertain situation is, in line with Knight and Shackle, a constitutive element. For Dewey, it means that the “constituents [of the situation] do not hang together” (*ibid.*: 105). Indeterminate situations can be radical in the sense of unsettled and inescapable. They unfold in the eyes of the actors and evidences ignorance but, as Dewey argues, “it is the *situation* that has these traits. *We* are doubtful because the situation is inherently doubtful.” (Dewey 1938: 105-106, italics original).

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<sup>65</sup> For example, when actors make an investment decision between two financial assets the selection per se does not provide them with the knowledge contained in a probability distribution for its monetary yields (Ford 1990: xii).

<sup>66</sup> Among the articles are „Essays in Experimental Logic“ (1916), Studies in Logical Theory (1903), and „How We Think (1910)“.

<sup>67</sup> Indetermination implies high contingency and also a lack of information and knowledge.

Central to Dewey's (1938: 108-112) theory and to this thesis is that the resolution of indeterminate situations is active and operational. It requires a directed and controlled transformation into a determinately unified situation which he calls *inquiry*. Inquiry is a progressive act. First, it evokes the qualification of the troubled situation as *problematic* and the need for the inquiry of the situation to *identify a problem*. The formulation of a problem is an essential step to figure out which paths should be pursued to solve the problem. Second, inquiry impels the generation of *ideas* that present themselves as anticipated consequences of certain operations. It sets continuous *observations* of the situation in motion that may occur with new knowing and the detection of possibilities never entertained before. It ultimately results in *reasoning*, and with the provision of a sophisticated analysis the ideas and propositions are examined and refined. Propositions are "instrumentalities for reaching final warranted determination of judgment [..., they are, IT] provisional, intermediate and instrumental" (Dewey 1938: 283). They are intermediates because they are carried out through symbols. As instruments, they help to establish a "warrantably assertible" judgment (ibid: 311), which is the ultimate result of the inquiry process. *Judgment* is a "settled outcome of inquiry. It is concerned with the concluding objects that emerge from inquiry in their status of being conclusive" (Dewey 1938: 120). Thus, a proposition is not a stand-alone logical relationship, which is either true or false, but must be understood in its relation to inquiry.

Inquiry is a quest for certainty and distortion of reality. If inquiry is successful it results in judgments and knowledge. Yet, the warranted assertible judgment is not identical to objectively true statement. Much more it is the "actual transformation of the subject-matter of an indeterminate situation into a determinate one." (Dewey 1938: 135). The establishment of a judgment changes the quality of the situation from indetermination to settlement and thus, it indicates successful inquiry.<sup>68</sup> Knowledge, however, "*is the appropriate close of an inquiry [...]* it is a name for the production of competent inquiries" (Dewey 1938: 8, italics original) . In this vein, the cumulative and convergent effect of continued inquiry is knowledge production (ibid.). In fact, the pragmatist viewpoint suggests that knowledge allows us to perform and succeed better under similar conditions.<sup>69</sup> Yet, it does not yield a perfect or a rational conduct of action.

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<sup>68</sup> Dewey is cautious by characterizing a determinate situation as a stable equilibrium, instead he uses the notion "temporal equilibrium" (Dewey 1938: 135) once in a side sentence. A particular inquiry does not guarantee that "*that settled conclusion will always remained settled.*" (ibid.: 8, italics original)

<sup>69</sup> Knowledge unfolds in actions-in-the-world and is inseparable from experiences that actors gathered in the past. Experiences are originated in cultural values and social life that frame

Inquiry is not a mere adaption of ideas to reality but interaction with reality. It is a directed and controlled transformative activity that aims at a judgment. Yet, it is far from being smooth decision-making between settled alternatives. Troubled situations disturb and interrupt routines - our action-in-the world. The formulation of a problem and the generation of ideas render *difficult* for actors. Inquiry does not guarantee the prompt handling of problems, much more it aims at answering questions which arise in the indeterminate situation (Dewey 1938: 178, 533). Central to Dewey's thought is the proposition that inquiry should not only begin and end in the world (Boettke/Lavoie/Storr 2004). It is a continuous process and present in every day life, for instance contract negotiations. It is plausible to characterize inquiry as a systematic conduct of imagination and inspiration, characterized by Shackle, to reach a solution.

### 3.2.3 Lucien Karpik's concept of judgment devices

Chapter 2 has typified patents as singular goods that feature some characteristics of commodities. According to Karpik (2010), consumer markets for singularities are characterized by the use of personal and impersonal judgment devices, such as guides, labels, brands and critics on the one hand (impersonal devices) and personal, cognitive and practitioner networks (personal devices) on the other hand. When consumers face uncertainties about the quality of the good and commitments in contractual relationships, they rely on such devices to cope with those uncertainties. Hence, judgment devices are necessary to absorb uncertainty in markets and to make reasonable decision-making possible under these conditions. So, how do judgment devices help to cope with uncertainty?

For Karpik (2010), action is oriented to "the modalities of criteria of judgment" (Karpik 2010: 69) under the conditions of uncertainty. Judgment or judgment-making differs from decision. Similar to decision-making, judgment-making consists of a choice between alternatives and involves calculation. Yet, the choice is anchored in a reflexive process of discussion and persuasion.

*"Whereas the decision is lodged in a system of equivalences and, for this reason, can avail itself of the powers of calculation to arrive at objective or universal solutions, judgment generality is limited by the multiplicity of particular points of view."* (Karpik 2010: 41)

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social action and even regulate the conduct of scientific activities (Dewey 1960 [1929]: 18-20). The actor is the "participator in the natural scene, a factor in generating things known" (Dewey 1960 [1929]: 212).

As judgment responds to uncertain conditions, judgment is individual and particular in nature. Furthermore, it is highly social.<sup>70</sup> The judgment embodies a norm or *criteria*, “it is inseparable from all other judgments; because it is rooted in sociability” (Karpik 2010: 39). It is oriented to criteria that are constituted and shared by social groups (ibid.: 36-43). Since judgment is *reflexive and social*, “the choice can be reasonable and therefore ‘satisfying’” (ibid.: 39). It includes a proposition (or choice) which is either valid or invalid instead of objectively true or false. A judgment operation ultimately allows that “incomparables are compared, and the individual choice becomes reasonable.”

In the light of uncertainty, a judgment tackles the unmeasurable. The criteria of judgment often have a qualitative form. The more abstract of those are principles on values and evaluations for quality or on conduct of negotiations or best practice in business. Criteria of judgment can be replaced with the terms criteria of evaluation or of logics of action. Such criteria channel practices, and over time they “leave their imprint in the form of social regularities.” (ibid.: 69)

The notion of devices has its provenience and anchoring in cultural studies in social science. For Karpik, devices are “symbolic-material arrangements that ensure the products encounter their consumers” (Karpik 2010: 127). They are *representatives* of successful conduct of action and actors rely on them assuming they will not disappoint them. To act under uncertain conditions, actors renounce some exercise of freedom of action to the device “that will make a commitment on [their, IT] behalf” (Karpik 2010: 46). The relationship between actor and device is therefore a delegation, as Karpik claims. This delegation is possible because actors acknowledge and trust such devices. Devices are also a *cognitive support*. In order to overcome or reduce uncertainty actors must have access to *credible knowledge*, which is *external* to the uncertain situation (cf. Karpik 2010: 51, 200). Devices consist of knowledge stored in “cognitive artifacts” (ibid.: 49-51), such as formulas, tests, instruments, that help to increase the actors’ cognitive capacities. Or in other words, knowledge “presents itself in the form of implicit or explicit evaluations – ‘this is the right one’, ‘this is the best’ [...]” (ibid.: 49). Actor and device ultimately form a composite entity which jointly acts to overcome uncertainty. Furthermore, devices are *active forces*. “Devices inform, advise, teach, protect” (ibid.: 51-54).

Judgment devices are also trust devices because judgment and trust are mutually inclusive. “To be effective, the device must be credible. And to be credible, it must be trusted by those who use it.” (Karpik 2010: 55). Judgment devices convey and consist of *credible knowledge* oriented to specific viewpoints - namely criteria.

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<sup>70</sup> More than Dewey, Karpik stresses the social character of judgments.

Choosing a judgment device is to choose a criteria of judgment, “or a particular configuration of logics of action” (Karpik 2010: 71). Actors are able to choose and use cognitive artifacts or knowledge to judge risks, though uncertainty is not fully translated into risk. Furthermore, as Karpik (2010: 47, 57) emphasizes, actors *voluntarily rely on* a judgment device to overcome uncertainty, though they may not understand how it works.

This assumption has two important implications: First, it means that the individual actor is basically free to choose and is not governed by devices. In the same way, she may choose to escape from an uncertain situation and terminate a transaction stage. However, devices may well embody a “symbolic form of authority” (ibid.: 53) to actors. Second, reliance on a device presupposes trust in the functioning of the device and it facilitates the actor’s confidence to overcome uncertainty.<sup>71</sup> Even though actor and device interact, the device can be understood as the actual source or object of trust (Möllering 2008; Bachmann 1998). Karpik’s notion of trust is equal to confidence that a judgment device will help to overcome uncertainty.<sup>72</sup> In the world of judgment devices, this confidence *is based on a combination of credible knowledge and belief*. It varies in degrees similar to how uncertainty may vary. Strong trust or confidence is adherence to a set of criteria or logic of actions that is not put to question and test.<sup>73</sup> Moderate or weak confidence is founded on attachment to such a set, which may be modified in a specific uncertain situation.

To study judgment devices in markets, Karpik (2010: 45–46) developed a sophisticated classification of devices that cannot be discussed in detail here. Guidelines, techniques and programs that offer specific evaluations of goods are named as *cicerones*. *Confluences* are techniques to channel buyers, “range from territorial location, spatial organization and displays to selling skills” (ibid.: 46) Other devices are

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<sup>71</sup> Karpik argues that the symbolic system of trust is composed of knowledge and beliefs. Trust varies with belief. “Trust turns the world into a predictable reality; it turns uncertainty into certainty because knowledge receives the support of the belief that, inevitably, inhabits us.” (Karpik 2010: 77).

<sup>72</sup> In economic sociology, trust is likewise seen as interaction between a trust-giver and trust-taker. The trust-taker needs to gain the trust-giver’s trust through different strategies of self-presentation by the trust taker. According to Beckert (2005), these strategies refer to the producing of trustworthiness through commitments, emphasizing similarities between the both parties on the part of the trust-taker, signaling his competence and integrity to the trust-giver. These strategies, however, do not fully apply to cultural-material arrangements. Devices are not real trust-taker. They may have a signaling function to the trust-giver but they are not strategically creating trustworthiness through commitments. Consequently, trust should be replaced by confidence for this instance.

<sup>73</sup> This eventually results in a strong confidence in a belief that a statement holds, following Keynes.

rankings and labels or certificates (“*appellations*”) which signal quality to market actors and guarantee the public “that the singularity of the goods or of services is rooted in the mandatory use of specific means of production [...]” (Karpik 2010: 45). These devices are independent from personal contacts between consumers and producers and thus impersonal. Personal devices relate to social networks. They effect through interactions between actors. Personal and cognitive networks are formed outside the market sphere. *Personal networks* are made up by interpersonal relationships, composed by friends, work colleagues and contacts. *Cognitive networks* embrace personal networks and are composed of stable interpersonal relationship between practitioners and members of the same professions. *Trade networks* are formed inside the market sphere. They consist of sellers and buyers. Their interaction may replace distrust with trust and to exchange based on credible knowledge or reciprocal behavior. *Practitioner networks* are created outside and inside the market sphere. They consist of practitioners and professionals from similar disciplines and ensure the circulation of credible knowledge use similar criteria for judgment (Karpik 2010: 98).

### **3.3 Capturing the concept of uncertainty**

The last sub-chapters brought essential insights from the philosophy of economics, pragmatist theory and cultural economic sociology into the concept of uncertainty that is important to this thesis. These insights will be brought together in sub-chapter 3.4.1 (on page 91-93) in order to build a theoretical framework that connects these concepts. Prior to this step, different facets and sources of uncertainty in patent transactions are highlighted. While facets of uncertainty refer to particular attributes of uncertainty that imply different responses of actors, sources of uncertainty relate to the origin of uncertainty. In the pilot study, three facets were identified: Fundamental, procedural and strategic uncertainty. The sources of uncertainty were found in the innovation and patenting process, which is related to the good, and in the markets for patents.

#### **3.3.1 Facets of uncertainty in patent transactions**

##### **Fundamental uncertainty**

With fundamental or substantive uncertainty, actors lack information about probabilities which do not exist at the time of decision-making. High fundamental uncertainty characterizes real uncertainty, described by Knight. It has two implications: First, information on which calculations are based is not available in principle because the information is generated in the future - or in other words, the future has yet to be created (Dequech, 2000). Only with more relevant information accrued over

time, actors can align and realign their strategies. Second, it refers to singular and highly unique events with a high contingency of outcomes. Following Keynes and Shackle, the experiences of the past cannot be deployed in present actions. Thus outcomes of present actions are unmeasurable.

Fundamental uncertainty must be distinguished from ambiguity, as Dequech (2000; 2001) argues. Ambiguity is a lack of knowledge about the probability that could be assigned to a known event. It is caused by missing information that could be known *ex ante* (Camerer/Weber 1992; Dequech 2000). Similar to fundamental uncertainty, ambiguity disappears with the passage of time but this disappearance is predetermined. Actors are informed about all possible events and thus contingency is basically low (Dequech 2001).<sup>74</sup> With fundamental uncertainty, however, the information is not just missing to actors but not available in principle. Whether information is accumulating over time can only be witnessed *ex post*. Fundamental uncertainty is characterized by “significant indeterminacy of the future” (Dequech 2001: 916), and it is the basic precondition for a dynamic context allowing for structural changes (Dequech 2000; Dosi/Egidi 1991).

### **Procedural Uncertainty**

The second type is procedural uncertainty which relates to the actor’s inability to recognize and interpret the relevant information even when available (Dosi/Egidi 1991). Procedural uncertainty results in a competence gap in problem-solving procedures that arises when actors try to structure the relevant information, apply their pre-existing competences and identify alternative courses of action (Simon 1992; Dosi/Egidi 1991). This gap is caused by the bounded rationality of actors, as Simon (1992) asserts. However, bounded rationality, as Simon (1992) optimistically claims, can be overcome through the emergence of computing and technical devices. So bounded rationality does not point to the essential characteristic of procedural uncertainty. Procedural uncertainty embodies the “indeterminate or unsettled situation” (Dewey 1938: 107) in which actors are captured. Limited cognitive capacity and bounded rationality is much more a consequence from procedural uncertainty (cf. Beckert 1996: 821; Dequech 2001). This type of uncertainty has an impact on actors and on social interactions because the situational conditions are “disturbed, troubled, ambiguous, confused, full of conflicting tendencies, obscure, ....” (Dewey 1938: 105). The meaning and relevance of the situation to the actors are indeterminate and thus, actors are confronted with “discordant responses” (*ibid.*). As opposed to fundamental uncertainty, procedural uncertainty induces *reactions of actors* to the

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<sup>74</sup> Consequently, ambiguity must be negatively associated with contingency. The preference for liquidity rather points to ambiguity than to fundamental uncertainty.

uncertain situation (cf. Tversky/Kahneman 2000). As Dewey (1998 [1938]) argues, actors are doubtful and inquire to overcome this state.<sup>75</sup>

### **Strategic Uncertainty**

The third type is strategic uncertainty, which is vital for social action and social interactions (cf. Schelling 1960). It arises when some actors lack information about what others know or information they possess. Moreover, it is engendered when some actors are uncertain about the intention of others. Strategic uncertainty alludes to the asymmetric distribution of information among actors. Information asymmetry is a source of strategic uncertainty but this kind of uncertainty does not imply that actors withhold information or knowledge consciously (Troy/Werle 2008). Strategic uncertainty does not inevitably induce opportunistic intentions or encourages actors to hold information. This would imply that actors have the inclination to be opportunistic and hold information in general (cf. Williamson 2000). Again, strategic uncertainty is a notion for characterizing the situational conditions and not the disposition of actors. Much more it indicates that complete appropriation of knowledge by the other party (licensee) is severely constrained (Arrow 1985; Machlup 1984: 182-185; Hayek 1945: 521, 522).

### **3.3.2 Uncertainties in the innovation and patenting process: The example of drug discovery**

One source of uncertainty alludes to *the outcome of a R&D project*. “The process of research and development (R&D) is a example showing that perfect foresight of an invention or discovery is a contradiction in terms“ (Shackle 1959: 294). To begin a process of research and development means embarking on a journey with a highly uncertain outcome (Machlup 1984: 169). Innovative efforts may fail or produce inventions which are not exactly the ones sought (Van de Ven, et al. 1999). It is obvious that the R&D process in pharmaceuticals is pervaded by numerous sources of uncertainties which appear in the beginning, in the operating and outcome phase of the drug discovery process.

Fundamental uncertainty arises in the search of the optimal molecular drug target and the identification of a lead structure. Most of the currently approved drugs are based on well known human targets but in some cases new drugs address recently discovered targets which are in need to be further researched. The target validation process determinates the relevance of a target in a certain disease pathway. In fact, there is still disagreement on how many human targets exist at all (Overington/Al-

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<sup>75</sup> Procedural uncertainty is not identical with complexity (see for a detailed analysis in Dequech 2001).



Lazikani/Hopkins 2006; Rask-Andersen/Almén/Schiöth 2011). To test the interaction of molecules with the chosen targets, numerous assays have been developed. Assays can be carried out in different formats, thus the researchers need to find the right assay strategy from various assay technologies (e.g. inhibition, stimulation or binding). The type of assay is chosen according to scientific criteria and cost-related criteria (Stoekli/Haag 2009). Procedural uncertainty is high in this process.

The subsequent search for a lead compound, which is generally defined as a new chemical or biological entity, is connected to a complex screening process. In a high-throughput screening process (HTS), for example, large numbers of compounds are randomly tested for their biological activity against a disease-relevant target (Stoekli/Haag 2009).<sup>76</sup> For this purpose, large compound libraries are screened over and over again to identify a handful of leads that are subsequently optimized. The screening process selects the most suitable compounds for development. With every testing procedure of compounds the most fitting compounds are selected. Information and data management play a significant role in the lead discovery process. The enormous amount of data to be organized in target libraries poses a procedural problem to the researchers involved. Hence, researchers make use of bioinformatics and data mining to store and interpret data which facilitates the screening process (Stoekli/Haag 2009; cf. Ekins 2006). Before and during the multi-step screening process the lead compound is unknown.

After a lead compound or a series of lead compounds have been identified, the drug molecule needs to be further designed, tested and fine-tuned to be deemed suitable for the preclinical development (“lead optimization”). This optimization process is usually regarded as the hardest and least “road mapped” part of drug discovery. The researchers need to address pharmacokinetic, toxicological and stability requirements that have to be satisfied simultaneously (Brennan 2000). Lead optimization ends with the selection of a few drug candidates. Fundamental uncertainty about the candidates is high (Walpole 2009).

Fundamental uncertainty about the development outcome of a compound indicates high contingency inherent in the subsequent clinical stages. The history of pharmaceutical products is full of examples showing that the “output can never be predicted perfectly from the inputs” (Arrow 1985: 111), for example the breakthrough projects of Paclitaxel (Taxol), Flecainide (Tambocor), Omeprazol (Losec), Imatinib (Gleevec) and Trastuzumab (Herceptin) (cf. Rang 2009c). The discovery path of those products turned out to be long and their success was unexpected.

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<sup>76</sup> Other methods of drug discovery are structure-based virtual screening and drug design (Walpole 2009).

Sources of uncertainty refer to the *patentability* of a compound. In most industrial countries, patent law stipulates that an invention is fully reduced to practice and applicability prior to filing a patent application. Before applying for a patent, inventors need to determine whether the technology is still a concept or a proven invention. As long as the inventor does not have sufficient data to enable a proven invention, the stipulations of patentability are not met and a provisional patent can not be filed. Without sufficient data patent claims are not constituted and it is difficult to determine whether the concept is part of prior art. This clarification protracts the timeframe for filing a patent application. The uncertainty about patentability is fundamental and procedural. For a licensor, this uncertainty is often a reason to leave the risk of infringement and opposition to the licensee or to share it with him.

As we will see in the next sections, fundamental uncertainty about the outcome of the R&D process and patentability is crucial in patent transactions. However, there are a number of other sources that play a role:

Uncertainty is related to the *domain of technologies* and the *domain of national and international patent institutions*. Particularly with *cutting-edge or unexplored technologies* (e.g. biopharmaceuticals), carrying out freedom-to-operate analysis, decision-making regarding invent-around solutions and strategic patenting are challenging. In contrast to established technologies, as for example small molecules, the patent landscape of new biopharmaceuticals is usually blank. Researchers and patent attorneys, for instance, are confronted with the problem of how to present a protein or peptide sequence to obtain a valid patent. For those existing patents it is hard to judge how long patent protection will endure. Furthermore, it is far from clear how to identify and create road blocks from and against competing companies. Companies are less able to invent around a third party's patent because it is not obvious how to implement a slightly different solution from those provided by the few patent. A distinct patent may be valid, but legal rules about assessing non-obviousness (inventive step) are changing and court decisions about the patentability of new technologies may be pending for years. While the biopharmaceutical field is constantly changing, patent offices are confronted with the problem whether to alter principles and guidelines to assess non-obviousness and usefulness in the patent examination process, and thereby change the bar for patentable inventions. It is fundamentally open whether the principles still hold in the future.

Another prominent example of procedural uncertainty stemming from institutions refers to patents for *second medical indication*. Second medical indication basically means that a new use for a known compound is discovered (Scassa 2001). In general, a patent may be granted for new and inventive therapeutic application. The treatment itself would be unpatentable in most patent legislations (Scassa 2001).

*How* a separate patent is sought for a new application is far from being clarified by national courts. The example of the Swiss Type Claim in European patent law shows that national patent law allows for different uses of wording (Grubb 2004: 241-243).<sup>77</sup> This difference in wording is significant for the determination of patent infringement. So far, national courts, for instance in Germany, have not decided about the exact wording.

### **High and low fundamental uncertainty about the innovation and patent process**

Chapter 2 demonstrated that the patented technology is subject to a transition and selection process throughout the research and clinical stages. For a single compound, information about the R&D project or innovative product and patentability of a technology is likely to accumulate over time. In the research and preclinical stage the information about a drug candidate is vague (left area of figure 3). The therapeutic concept addresses a specific disease or class of diseases which is generally known. It tackles the aim of the project, strategic concerns and scientific and technological issues (Rang 2009a). Yet, the therapeutic concept does not entail complete and fixed information about the prospective drug and its market. Much more the concept suggests the intention of choosing a R&D project that is subject to change. The numerous steps from a therapeutic concept to a drug candidate are paralleled by the clarification of the patentability of a distinct compound. Researchers and patent attorneys usually lack information about similar inventive endeavors from other research groups undertaken at the same time.

This strategic uncertainty goes along with the patent application process in which fundamental uncertainty about the validity and scope of the patent claims comes into play. Granted patents are subject to opposition or re-examination proceedings. Ironically, strategic uncertainty about oppositions by third parties does not decrease before the patent is challenged by such proceedings. Only when the opposition of a third party fails, validity is endorsed (Harhoff/Scherer/Vopel 2003; Harhoff/Reitzig 2004; Lanjouw 1992). The validity of the patent, however, may still be challenged by a nullity suit, patent enforcement and infringement litigation soon after the grant of the patent (Lemley/Shapiro 2005).

The drug discovery process is information and knowledge-driven. As the R&D process progresses over the first stages of the pipeline it becomes apparent that *fun-*

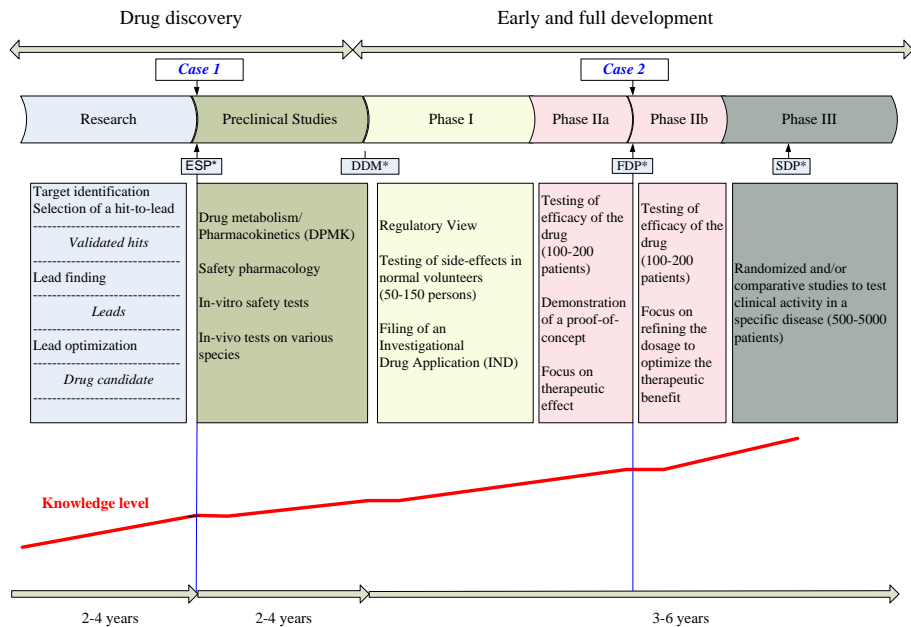
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<sup>77</sup> US patent law allows the use of a broader wording in terms of “use of substance X for treatment Z” instead of treatment Y. The EPO, however, restricts the use of X to “the manufacture of a medicament for treatment Z” instead of Y (so called “Swiss type claim”). A patent is more likely to be infringed in the wording of US practice than in EU law because the latter restricts infringement to the manufacturing of a drug.

*damental uncertainty about prospective innovative products and prospects of patentability is reduced in degrees over time* to the extent that information about the most fitting candidates increases. In the research and preclinical stage, the discovery of drug candidates is in the foreground. Drug discovery, however, is not just the selection of those compounds most likely to become a drug candidate but it is “invariably an exploration of the unknown [...] and there is a large component of ‘unplannability’” (Rang 2009b: 221). Some projects succeed even though they end up with a set of compounds different from those initially sought (ibid.). The research process is a feedback process that includes learning about the functionality of compounds. With every failure in testing, information about the functionality of a compound and the ultimate utilization of the drug is generated (ibid.). The accumulation of knowledge and relevant information about the utilization, attributes and functionality of a distinct compound provides further information and knowledge about the final product offered on a market.

Between the late research stages and the clinical stage IIa, fundamental uncertainty about the final product decreases. The complex interaction between the new chemical properties of a compound and a small number of patients is investigated for the first time. It may entail unexpected effects that are studied in light of existing therapies or other study layers (Goffin 2009). In phase I, efficacy studies are carried out in a small sample of patients. Further clinical studies on a limited scale bring forward new insight into clinical efficacy in man and the so-called “proof of concept”. At the end of phase II, the investigator should have a better understanding of the impact of the drug candidate on a disease and about the toxicity profile (ibid.)

With an increase of relevant knowledge about the efficacy of a drug candidate, the R&D journey becomes more *focused*. In contrast to drug discovery, development stages have a fixed goal and schema: to manage clinical studies for generating marketable products and to achieve regulatory permission as soon as possible (Rang 2009b). Any deviation from this route is regarded as detrimental to the development process. At the early selection point (ESP), which marks the boundary between late research and preclinical development, the fundamental decision is made about whether a compound is apt to be developed and large investments in (further) preclinical trials are incurred or not. This decision is made at a point in time when researchers have more information about a drug candidate than before, though the product market may not be fixed yet. Not before this checkpoint, regulatory concerns will play a vital role in the process. The full development decision point (FDP) at the end of stage II, however, is another landmark in which evaluation of the likely commercial returns, the chances of successful registration and the time and cost of the subsequent Phase III studies becomes possible (Rang 2009b).

**Figure 3: Knowledge levels in the R&D process of a new drug**

\*ESP = Early selection point; DDM = Decision to develop in men; FDP= Full development decision point; SDP = submission decision point. Source: Hägglöf and Holmgren (2009: 284), Rang (2009b: 223-225).

Relevant knowledge and information increases and the R&D journey becomes more focused but it is apparent that fundamental uncertainty is never fully transformed into risk. Awaiting regulatory approval, it is uncertain whether the drug candidate will ever enter the market. Other critical factors relate to the right number of patients and the dose selected in the clinical trials (Goffin 2009). Uncertainty and also contingency are even prevalent after the product has been launched in the market. It is still open whether undesirable medication effects appear. Stories of unsuccessful drugs withdrawn from the market, as for instance Bayer's Lipobay (2001) and Trasyolol (2007) and recently GlaxoSmithKline's diabetic drug Avandia (2010 for the European market), clearly demonstrate that uncertainty ultimately impinge consumers on product markets. Patent infringement issues can be solved early but they continue to exist during the life span of a patent. Freedom-to-operate problems for companies also persist in the near future. *Consequently, fundamental uncertainty about the drug and the validity of patents tends to decrease over time but it is never fully ruled out. This decrease may also affect strategic and procedural uncertainties.*

### 3.3.3 Uncertainties in markets for patents: Valuation and cooperation problems

The valuation and pricing of goods and a functioning cooperation between contractual parties are important elements for the coordination of economic action in markets. From the viewpoint of economic sociology, valuation and cooperation are basic preconditions for any functioning market (Beckert 2009). At the same time, they are found to be sources of uncertainty in patent transactions.

#### Valuation and pricing problems

Regardless of the structure of a market, the good subject to transfer must be valued to be eventually priced. Valuation is the attribution of subjective values to goods. It is strongly connected to the question of what a good is *worth* to the seller and buyer (cf. Stark 2009). Valuation is not just a matter of individual preferences but oriented to non-economic factors, e.g. qualitative criteria, scales, formulas and other measurements. From the viewpoint of the patent holder, pricing follows valuation in the intention of licensing or selling the patent to a company. In a “blind market” characterized by a lack of transparency, valuation problems are often reflected in pricing. If information about prices is either not available or costly to obtain, prices do not provide “crucial points of orientation for actors in market exchange that make heterogeneous objects and services commensurable” (Beckert 2011: 3). Additionally, patent valuation and pricing problems are caused by the uniqueness of patented inventions and the difficulty constructing comparability with other objects as a precondition to establish a market value of patents (Granstrand 2000: 80; Benunza/Stark 2004; Smith 1990: 21-50). Prices are formed and produced case by case in the course of negotiations (Razgaitis 2003: 3; Bidault 1989: XV). Other than in a functioning market, prices are not considered to be outside the reach and influence of economic actors, much more they are the result of social interactions.

What are the essential valuation-pricing problems in patent transactions?

*Multiple utilization of patents:* The patent’s value is not a fixed parameter. An important factor which affects the establishment of value is the intended utilization of the patent (cf. Hall/Ziedonis 2001).<sup>78</sup> The patent holder will assign different values if the use of a patent aims to acquire capital through a bank loan (asset value) or to facilitate blocking innovative activities of other firms (blocking value), to exclude potential competitors from the product market (monopoly value) or to license or sell

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<sup>78</sup> The *cost approach* calculates the total costs of developing and patenting new knowledge and is retrospective; the *market approach* makes comparisons with recent real market transactions involving comparable patents and is likewise retrospective; the *income approach* calculates future income derived from successful utilization of patented knowledge through a discounted cash flow analysis or a real-option based approach and is therefore prospective.

the patent as a bundle of pieces of technical knowledge (trade value) (Troy/Werle 2008). In the patent management literature cost, market, and income approaches for patent valuation prevail. However, the approaches come in with several different variants because the methods do not exactly purport the parameters integrated into the formula. The valuation of patents is oriented to three modalities of judgment criteria, to quote Karpik (2010: 69), emphasizing either technological-scientific, legal or economic aspects of the good. The criteria are constituted and shared by professional groups of patent lawyers, IP managers, and IP investor (Karpik 2010: 39, 69). Furthermore they are reflected in a variety of possible parameters. In fact, the combination of relevant parameters for the valuation of patents and their specification is large, ranging from the number of backward and forward citations, the kind of citation (science linkage versus market linkage) patent length, family size but also characteristics of the patent holder and technological cycle time of the invention (Ensthaler/Strübbe 2006: 64-91). As a consequence, none of the approaches represents the standard valuation method (Troy/Werle 2008).

*Shortcomings of retrospective and prospective valuation methods:* For patent licensing, the market and income approach are often regarded as useful (Ensthaler/Strübbe 2006). Generating comparability with similar patents is an elementary precondition to establishing a market value of patents and also to define a market for a good in economic terms. Valuing patents according to comparable patents is often found in practice but it has several drawbacks that make its application debatable. This approach is self-referential and reproduces *ceteris paribus* price conditions of established technologies. It does not cover the value of advancement in a radical innovation. If the time-span between the actual patent transaction and the launch of a product from which royalty payments are generated is long, comparable transaction will ultimately represent prices of the past. The dynamics of innovation let previous transactions become non-relevant and *ex post*, valuing according to comparable patents is retrospective. A novel and non-obvious invention may be compared exactly with those technologies from which the invention actually stands out.

The creative difference between prior art and a novel invention is described in the patent application in technical-scientific terms but it has to be translated into economic terms as an added value of the patent (Troy 2010). To constitute a monetary added value, the creative difference is either related to prior art for simplicity or the added value must be constructed by incorporating additional market and cost information on the advancement, for example additional sales derived from the advancement of the product or a reduction in production costs for internal use of the invention (cf. o. V. 2000 [1959]). This circumstance points to procedural uncertainty when a price is formed. Determining the value with respect to future incomes turns

out to be difficult if fundamental uncertainty about the invention is high, notably if the invention is part of a radical innovation and a market is not created yet.

*The search for a benchmark:* As of technologies in general, the eventual price of patents consists of a variety of continuous and lump-sum payments due over a long time-span. Industry-specific lists of standard royalties provide essential support to fix the payments. They are usually oriented to the inventor's compensation payment<sup>79</sup> for inventing or based on best practice in patent licensing. Other royalty rates are suggested by the Licensing Executive Society (LES) or the US Association of University Technology Manager (AUTM) which base their suggestions on surveys and market research. These suggestions can be used as a starting point in negotiations for setting royalties from sales and it is plausible that standard royalties help to cope with procedural uncertainty, which would be more acute in the absence of those standards.

However, valuation standards solve pricing problems only partly because it is still open to which base royalties should refer. If the technology consists of numerous patents and the patent to be licensed is a small part, it is debatable whether the net selling price of products should be proposed as a benchmark (Razgaitis 2002). It would be more appropriate to relate royalties to a fraction of the sales than to full net sales from the entire product. Then, licensors and licensees would have to figure out on an individual basis to what extent the patent contributes to the sale of the product. For compounds or drug candidates, this problem is partly mitigated due to the nature of discrete technologies (Reitzig 2004). Yet, the second medical indication problem, for instance, may raise similar questions because a known compound is licensed for a different use. In this case, actors are not confronted with strategic uncertainty but with procedural uncertainty. Actors need to find their own base or benchmark for the valuation of individual patents before they enter financial negotiations.

*Subjective value of the patent and private information:* Professional valuers and economists more and more claim to value or even evaluate patents systematically and objectively through a variety of methods (e.g. patent citation analysis, opposition and patent family analysis and surveys) (Reitzig 2003; Harhoff/Scherer/Vopel 2003; Gambardella/Harhoff/Verspagen 2006). Yet, in business practice the value of patents is often deemed to be subjective (Perez Pugatch 2004; Arora/Gambardella 2010; cf. Bidault 1989: 7). "Valuation is an idea", as Razgaitis (2003: xvii) points

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<sup>79</sup> For example in Germany, the Gesetz ueber Arbeitnehmererfindungen comprises a guideline for compensation payments and the determination of the value of inventions according to the licensing analogy and the in-plant benefit (BAnz. Nr. 169).<sup>79</sup> The guideline considers a royalty rate of 10% from sales for licensing in the pharmaceutical field as common. And it proposes a reduction in royalties in the case of high sales (o. V. 2000 [1959]).



out, and patent holders often follow their subjective valuation principles. Nonetheless patent holder may well determine the value from “*observable* as well as *counterfactual* information on prices, costs, and quantities sold of patent-protected products” (Reitzig 2003: 14, italics original). The relationship between the objectivity claim and subjectivity in practice is subtle and therefore tackled in chapter 4 and 5. Obviously, patent holders often lack the necessity to assign a systematically and objectively determined value to a patent. But does such a lack still hold in licensing negotiations?

### **Cooperation problems: Commercializing patents and obligations in patent licensing**

If a patent is considered for licensing, uncertainties in cooperation arise. They relate to projecting demand and supply, matching demand and supply, risk sharing and commitments in long-term contractual relationships.

*Projection of demand and supply:* If the patent holder considers offering a patent for sale or licensing it, she must ascertain a demand for the patent. Due to high asset specificity, the number of potential licensees for a given technology is limited. In some cases, the search for suitable licensees is a long and costly process (Contractor/Sagafi-Nejad 1981; Arora/Gambardella 2010). Potential licensees may not be financially fit to incur high investment or they have other drug candidates in the pipeline. Licensors lack information about the most suitable licensee candidate to commit themselves for a long-term contract with obligations and thus they encounter strategic uncertainty. In return, potential licensees and purchasers must detect appropriate inventions and explore the willingness of a patent holder to license out the patent. This may turn out to be as difficult as projecting the sales volume of a new product or service based on the patent (Troy/Werle 2008; cf. Arthur 2007). For instance, if a licensee detects freedom-to-operate problems, he lacks information about whether a distinct patent holder is willing to give a license at all. This strategic uncertainty may become acute when the potential licensor is a competitor on a market for products.

*Matching problem of supply and demand:* The projection of demand and supply is anchored in a dynamic innovation process which affects the pharmaceutical industry in particular. Patent transactions in the pharmaceutical industry seem to be situated between a global search for new chemical and biological entities on the one hand, and bi-monopolistic constellations in exclusive licensing agreements on the other hand (see chapter 4). This triggers the question for both, licensor and licensee, about how to efficiently reach the other side without disclosing confidential information. As indicated, TTOs at US universities appear to follow various commercialization and marketization strategies to reach suitable licensees in a changing environment.

Pharmaceutical companies incur high investments and act under pressure to succeed. Managers on both sides are concerned with finding the most suitable counterpart for licensing. This presumed matching problem unifies strategic and fundamental uncertainties.

*Risk sharing and moral hazard:* In the R&D process, licensors and licensees are both confronted with different kinds of uncertainties and calculable risks, and thus often mutually dependent. To alleviate risks, they may choose to cooperate and share the risks (Kogut 1989; Hagedoorn 1993). However, the sharing of risks leaves room for strategic actions and opportunism. Universities cede drug development beyond the preclinical stage to industrial firms and some pharmaceutical companies do not bring drugs to the product market. If they license a R&D project out to another firm, they are financially dependent on the development success of the licensee because the licensors will not generate royalty income if a project fails. Therefore they face similar problems to those which occur in a principal-agent relationship (Nishimura/Okada 2010). A licensor has good reason to believe that the licensee (agent) will not act in the interest of the licensor (principal) (Jensen/Meckling 1976). If the patent transaction is part of a larger R&D project with exclusive licensing, the licensee usually faces numerous obligations when developing the drug (see chapter 8). The licensor must reckon that the licensee is not willing to develop the technology but put it "on the shelf". For R&D projects, this means that the licensee rather wishes to secure freedom-to-operate in his patent portfolio instead of developing the technology further (Arora/Fosfuri/Gambardella 2002). Moreover, the licensor must fear that the licensee will file a suit against the patent to prevent licensing payments. She has reasons to suspect a licensee to hide information about her financial situation. For example, pharmaceutical companies operate in a precarious financial situation. If a R&D project fails due to a weak financial backing of the licensee, the licensor will go away empty-handed. Apart from these moral hazard problems, the licensee does not know how much effort the licensor (patent holder) intends to invest to enforce the patent against competitors. As licensors may negotiate with a couple of companies, the licensee can not be certain about a leak of information among bidding competitors (see the "winner's curse" below). The licensor is able to conceal or downplay such an information flow which is difficult to prove afterwards.

Connected to the problem of risk sharing are cooperation problems in contractual relationships at the time of contract closure. They refer to the *willingness of the parties to renegotiate obligations and commitments* of the parties in long-term contractual relationships. In general, licensor and licensee can set numerous incentives in the contract to cope with opportunism, hidden intention and information at the time of contract closure (Macho-Stadler/Pérez-Castrillo 1991; Macho-

Stadler/Martinez-Giralt/Pérez-Castrillo 1996; Macho-Stadler/Pérez-Castrillo/Veugelers 2005). To continue the patent transaction, both parties must comply with the obligations stipulated by the contract. However, a change in market or production conditions could lessen the incentive effect of contractual terms and induce both parties to hide the accession of new information at any point in the future. If the exogenous conditions are not beneficial to one of the parties, this party may deviate from contractual obligations and extract concessions from the party which invested more. This generates a hold-up problem and may prompt a break of the agreement. Since licensing contracts are never complete (Maskin/Tirole 1999; Hart/Moore 1999; Pagano/Rossi 2004), a break of the contract is prevented only if both parties are willing to renegotiate under new circumstances in principle. Since licensor and licensee are well aware about changing conditions from the outset, the willingness to renegotiate is a precondition for any contract closure. This problem hints at strategic and fundamental uncertainty.

### 3.3.4 Interaction of uncertainties

Valuation problems can cause cooperation problems and vice versa. The interaction of these problems generates further uncertainties and gears unintended dilemmas. The following section briefly highlights two dilemmas described in the contract theory literature (Arora/Gambardella 2010; Gonzales 2005) that can be assigned to the interaction of valuation and cooperation problems:

*Dilemma 1 - The fear of a “winner’s curse”:* Licensors often face a long and costly search process for suitable licensees. To establish a minimum competitive situation, they will strive to negotiate with many potentially interested companies parallel. Since all companies assign different subjective values on the technology, licensees fear a “winner’s curse”, as Arora and Gambardella (2010) argue. The licensor will optimally grant the exclusive license to the highest bidder. Anticipating this, it is likely that the company eventually licensing the technology fears to end up overpaying (cf. Kagel/Levin 2002). Therefore, potential licensees will lower the reservation value and place a bid that is substantially below their own assessment of the technology’s value. This creates a dilemma for the licensor: He has disclosed confidential information, which can not be reclaimed, and he has reached the maximum of all potentially interested companies. The licensor must choose between two possibilities, neither of which is optimal for him: either to license or sell the patent for a price below his estimated value or to leave the patent unexploited. Strategic uncertainty about the number of companies bidding and fundamental and procedural uncertainty about the value of the technology is inherent in this dilemma.

*Dilemma 2 – The fear of unexpected inquiries:* The licensor also struggles with uncertainty about the value of the patent. Gonzalez (2005) argues, the licensor avoids transferring a technology whose true value is unknown. The valuation problem increases the reservation value of the licensor and therefore, the licensor prefers to hold the patent unexploited. Consequently, a potential licensee would have to place a bid above the licensor's estimation of the value to attract the interest of the patent holder (Gonzales 2005). Similar to the last dilemma, the licensor lacks information about whether the licensee negotiates with other potential licensors. He does not know if the licensee has the option to choose the best offer for a drug candidate from a large or small group of potential suppliers (cf. Pisano 1990). In contrast to the last case, the licensor fears to be underpaid by the licensee and increases the reservation price. Furthermore, he will anticipate hidden intentions of the licensee.

This case can be extended as follows: If the licensor reckons that the licensee is a potential infringer of the patent, he will even raise the reservation price again. However, if the licensor is wrong he jeopardizes a patent transaction because the licensee will refrain from patent licensing. Hence, the licensor faces either a favorable or unfavorable outcome of his decision without fearing a real loss. Licensees confronted with a small number of potential licensors, however, will find themselves in a dilemma: Regardless of having infringed upon a patent right, they must either accept high royalty rates or reject the bid. If a licensee chooses to reject a high-priced bid, he is inclined to either not to use the patentable invention or risk a market entry while infringing the patent of the patent holder. The last option is very risky for the infringing party because the patent holder has uncovered his identity and is alarmed about illegal actions. Additionally, the infringer is no longer able to prove that the patent was violated unintentionally. As chapter 5 shows, this case happens in specific constellations of licensors and licensees. And it provides another explanation why markets for patents are blind and valuable patents are likely to be licensed than non-valuable.

### **3.4 A pragmatist-cultural framework for analyzing patent transactions**

The last sub-chapter overviewed facets and sources of uncertainty in patent transactions. These findings are now used to build up a pragmatist-cultural framework that connects concepts from pragmatist theory and cultural economic sociology. It can be used to compare different types of patent transactions and to answer the overarching research question of which uncertainties exist in patent transactions and how managers cope with them.

### 3.4.1 Connecting the concepts of uncertainty, inquiry and judgment devices

To come back to the concepts of uncertainty, inquiry and judgment devices, it is important to note that the concepts are jointly directed to *judgment (criteria)*, *confidence* and *trust* as suggested by Karpik. Bringing the conjunction to a point: In an uncertain situation characterized by a lack of information or knowledge (Keynes, Knight and Shackle) and confusion, actors inquire and identify a problem (Dewey), and thereby make use of knowledge inherent in devices that are essentially external to this situation (Karpik). This conjunction unfolds in a process with several stages that can be brought into a serial stage model to simplify the depiction of the process. In reality, however, this process entails feedback circles and loops.

A judgment can be thought as process and result likewise. As the last sub-chapters have shown, it is plausible that a reflexive process preceding a judgment result is akin to what Dewey described as inquiry. In this vein, judgment criteria guide the essential choice of how to proceed in order to transform the unique and uncertain situation into a terminate state. Judgment devices suggest a particular solution to an identified problem. Decision making under uncertainty follows different choice principles, as Shackle (1976) claims. Most likely for this reason, Karpik (2010) replaces decision with the notion of judgment. A judgment may well be connected to creative acts each introducing something new into the world process that is essentially not presented to the managers directly, following Shackle. As Karpik points out, the actor relies voluntarily on the devices they choose. For the manager, this perspective leaves room for imagination, which becomes vital against the background of long-term contracts. To be able to make a judgment under uncertainty, managers will possibly build scenarios of the future by creating images of subjectively possible consequences of their history-to-come in the solitary present (Shackle 1959).<sup>80</sup> The aim of scenario-building is to “clarifying present action in light of possible and desirable futures” (Durance/Godet 2010). The building of scenarios requires a tad of imagination and inspiration by actors (De Brabandere/Iny 2010). Thus, it is an attempt to translate uncertainty into risk.

Following Karpik, judgment and trust intertwine. The trust that a manager has in a judgment device is based on his state of optimistic expectation that the device helps

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<sup>80</sup> According to Shackle, there are is an outside and inside view of time. The outside perspective treats time either as linking sequences of moments which have an equal status of importance (mechanical view) or as an unity where every part of a process is as real as every other part (historian view). Whereas time, from the outside view, is the time about which an actor thinks, from the inside perspective, time is the actual moment in which an actor feels, thinks, imagines and decides (Shackle 1959).

to cope with uncertainty (cf. Möllering 2005). Other than trust between managers, confidence in judgment devices is an one-sided matter. Even though the manager and the device eventually act as an entity, the reflective or inquiring act paralleling the judgment process is initiated by the manager who plays the active part. In this sense, trust in a judgment *is* basically confidence that a specific judgment procedure or knowledge will yield insights into the value of the good (Keynes).

If we now incorporate uncertainty into *social interaction*, we may assume that uncertainty affects shared judgments and collective trust. The inquiry process becomes social and at the same time most likely to be laden with different suggestions, solutions and ideas about the value of the good on the part of the managers. Yet, the judgments and trust brought forth by licensor and licensee must in some way match up in order to become a contract closed. Both parties need to refer to similar judgment criteria or concur with the application of specific judgment devices. Different facets and sources of uncertainty interfere in the negotiation process but the result of this process is an agreement based on a common ground. On a cultural level, a difference in viewpoints of managers may engender a “battle of judgment, with each device attempting to win out over the others.” (Karpik 2010: 52). Under uncertain conditions, different devices appear to compete against one another about the correct way to evaluate goods and to match demand and supply. In this sense, devices may become counter-powers about which actors may debate.

The nature of business negotiations implies that the parties maintain contrary positions and have conflicting goals. The negotiating parties are confronted with strategic uncertainty and therefore lack information about the intention of the other party. Hence, uncertainty and the contrary backgrounds of managers make up a delicate constellation in which judgments are pronounced. Strategic action and market competition come along with competing judgment devices, as Karpik (2010: 53-54) suggests. So, transactions unite two sides. They combine a tension between different suggestions and judgments about the value of the good with joint action and cooperation in order to allow for similar valuations to come to a price. The negotiation process consists of a clash of viewpoints but it may also give room to either haggling or discussions to bring forward arguments to convince the other side. Yet, a balancing of these two sides appears to be important.

Furthermore, the matter of trust comes in for strategic uncertainty again. Since patent licensing agreements are incomplete and market actors may have the inclination to act opportunistically, long-term contractual relationship under the condition of (strategic) uncertainty hold ‘risks’ of deception and moral hazard (Pagano/Rossi 2004). Trust becomes a vital factor here. Trust is actively generated by the managers involved in the transaction because “[i]t [trust, IT] is also an idiosyncratic accomplishment, actively constituted in more or less institutionalized contexts” (Möllering

2005: 6). Managers decide whether they are willing to trust the other party and thus trust is akin to an effort (Luhmann 2000 [1968]: 39). If a manager lacks information about the other party she may defy this lack to act successfully even though this approach is “risky” (see for a detailed analysis of trust and deception in: Möllering 2006; Möllering 2008; Luhmann 2000 [1968]).

### 3.4.2 The transaction process as object of research

A transaction is a transfer of rights and obligations between two partners (Commons 1936). A transaction process has a *time-line* and is inherently *social*. By analyzing the negotiation process as a series of phases it is possible to locate the dominance of different facets and sources of uncertainty in a time-line. The same accounts for the transaction that additionally includes contacting before the negotiation and renegotiations after years. The *sociability* of the phases is likewise important. This aspect alludes to the way managers either oriented to the other party or jointly cope with valuation-pricing and cooperation problems.

Patent licensing and sales transactions usually entail the following phases:

1. Contacting phase: This phase includes all efforts of seeking, contacting and initiating first conversations with potential licensors or licensees. The corporations will select realistic options regarding the potential licensor or licensee and the technology subject to licensing. This phase entails ex ante costs for corporations.
2. Due Diligence phase: Due diligence typically follows initial conversations. In the case of patent transactions, “rigorous and informed due diligence of IP assets” (Rivette/Kline 2000: 169) is advised. It is the process of gathering, auditing and assessing the object of transfer on the part of the licensee. Due Diligence is a procedure that obliges the patent holder to provide all the available information the potential licensee asks for. The recipient decides whether and which parts of the patented technology is of interest to the firm. At the same time, the patent holder attempts to assess, for instance, the willingness of the firm to develop the technology further or to use the patent. The due diligence principle is widely accepted by companies and by courts alike, though it also involves strategic decisions about the information requested and provided (Parr 2006).
3. Financial negotiation phase: In this phase, the contractual parties have basically agreed upon the good being transferred and transacted. This phase entails negotiations about the amount of lump sum, milestone payments and royalty payments as well as the payment dates.

4. Legal or non-financial negotiation phases: This phase follows the financial phase. The party will fix contractual obligations for the long-term relationship, for instance the milestones, a non-challenge clause or obligations in the case of a patent infringement.
5. Contract closure: The contract closure may extend beyond a point in time when the decision requires the approval of numerous executive managers or the corporate board.
6. Renegotiation: The licensor will most likely monitor the performance of the technology development and his adherence to the agreement, while the licensee typically controls whether the financial terms still match with his performance. If the exogenous conditions change, either the licensor or the licensee may ask for renegotiations of the contractual terms.

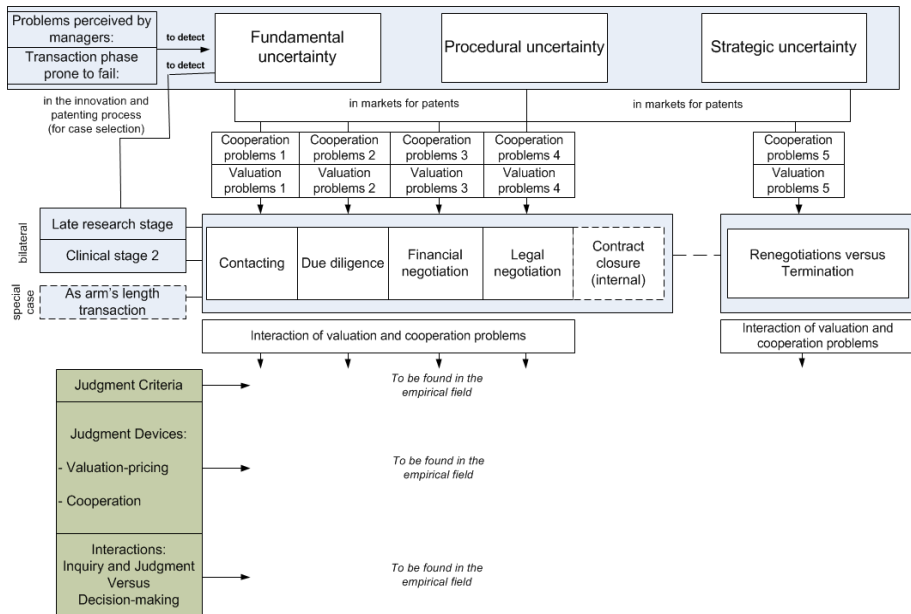
This process-oriented viewpoint allows to focus on typical phases in which specific issues and judgment criteria come into play. In a descriptive process model, a previous phase needs to be completed before the subsequent begins, though a re-coupling of phases in licensing negotiations is common in practice. This viewpoint may help to detect critical junctions in transactions and conveys insights why transactions are terminated.

Uncertainty also affects the course of the transaction process itself. On the level of transactions, the transaction is regarded as an emergent entity. The indeterminate situation may shift the transaction to unintended directions and even lead the process astray. One may discern that the uncertainty let the process abandon its actual purpose in order to inquire problems. If uncertainty aggravates decision making, uncertainty is a causal factor for a *failure* in a transaction stage and an ultimate termination of the patent transaction. For instance, it could be that joint action in the inquiry was not successful. Furthermore, it could be that the inquiry does not end in a conjoint judgment. This viewpoint underpins the impeding effect of uncertainty on transactions, judgments, trust and joint action, though *not* every failure of a transaction results from uncertainty.

### 3.4.3 The theoretical framework

The theoretical framework should serve as instrument to analyze business actions and interactions in patent transactions characterized by uncertainty (figure 4).



**Figure 4: Theoretical framework for analyzing patent transactions**

*The explanatory variable is fundamental uncertainty that has its origin in the innovation and patenting process. More precisely, it is fundamental uncertainty about the innovative product and the patent. Accordingly, the case selection in chapter 4 and 5 are oriented to high and low fundamental uncertainty. High fundamental uncertainty is associated with deals at the late research stage of a compound, while low fundamental uncertainty is associated with deals at the clinical stage IIa. The variables to be explained are fundamental, strategic and procedural uncertainties that have their sources in the markets for patents: Valuation-pricing and cooperation problems. It is assumed that judgment devices differ with the degree of fundamental uncertainty about the patent and the product.*

In the course of a typical bilateral patent transaction in both cases (high and low fundamental uncertainty), a researcher should first reveal cooperation and valuation problems and their interactions along different phases in the empirical field. The basic assumptions of Dewey, Keynes, Knight and Shackle may guide the researcher here. Which kind of decisive information and knowledge do managers lack? Do the managers qualify these uncertainties as problems? And vice versa: Can the problems articulated by the managers be attributed to uncertainty?

In a second step, he should identify – on an abstract level - judgment criteria that obviously play an essential role in the transaction phases. Popular literature on pa-

tent management as well as expert interviews are helpful in this part because the expert knowledge delivers insights into structural conditions of judgment devices. In a third step, he should focus on the practices in transactions from two viewpoints, the seller/licensor and buyer/licensee, in order to capture different judgment devices, which reduce cooperation and valuation-pricing problems. How do managers solve a particular cooperation problem? In doing so, he should focus on the two logics proposed by Karpik - inquiry and judgment on the one hand and decision-making on the other hand. This last step should help to identify a difference in the role judgment devices play in the two cases. Are judgments and inquiring acts replaced by decision-making when more decisive information accrues? Where does credible knowledge come from? What does it mean if different judgment criteria are in place and collide? Moreover, it should help to reconstruct the interactions between managers of both sides along the transaction phases. In a last analytic step, the researcher may compare the cases of high and low fundamental uncertainty about the patent and product.

The same analysis may well work for typical arm's length transactions and deals with third parties, so-called intermediaries, involved. Which types of judgment criteria and devices are in place? Do they differ across various types of transactions, e.g. bilateral licensing versus multilateral sales transactions? What is the role of third parties in reducing uncertainty?

### **3.4.4 Propositions for the investigation of uncertainty in patent transactions**

Whether and how uncertainty plays a role in transactions is an empirical question. Uncertainty is an abstract term that needs further clarification on how to study the concept in the empirical setting. How is the theoretical framework realizable in research?

#### **Capturing uncertainty in empirical research**

For the purpose of empirical investigation, a three-step methodological approach is suggested that should increase validity in the empirical field research. It comprises an *objective-observer perspective*, a *subjective perspective* and a *transaction perspective*.

*Objective-observer perspective*: Keynes', Knight's and Shackle's notions of uncertainty are focused on the availability of information and knowledge. In their view, uncertainty is independent from the perception of individual actors and thus "objective" (Jauch/Kraft 1986). This implies that the researcher first identifies contingencies, a lack of decisive information, different facets of uncertainties and observes knowledge gaps of managers throughout transaction process phases. Sources of

uncertainty are typified and it is assessed whether different degrees of uncertainties exist.

*Subjective perspective:* In line with Dewey, the uncertain situation is likely to be qualified as problematic by the managers who will first identify a problem and then try to solve it. Thus, a subjective perspective allows to couple uncertainty to the perceptions of the actors affected by uncertainty (cf. Milliken 1987; McMullen/Shepherd 2006; Meijer/Hekkert/Koppenjan 2007). This way is plausible because uncertainty is associated with ignorance on the part of actors. Only the managers involved are able to give account on missing information that impedes decision-making. This approach is also necessary to reconstruct imaginative acts of actors along the patent transaction and to understand imaginative social interactions. Managers are directly or indirectly affected by uncertainties, and so they provide valuable information about obstacles in the managerial practice. These obstacles should be assessed in relation to the objective perspective and vice versa because some problems do not result from a lack of information or knowledge but, for instance, from different goals, interests, power relations or institutional or corporate backgrounds of the managers.

*Transaction perspective:* Transaction processes are likely to be terminated if managers face uncertainties and lack judgment devices. The termination of a transaction phase may indicate the impeding effect of uncertainty, though not every termination is caused by a lack of information or knowledge. This approach is most likely to identify those uncertainties that impose the most severe problems on managers or cause high transaction costs. Managers will not invest resources in unreasonable negotiations and terminate the transaction phase. Again, to alleviate the shortcomings of this viewpoint, the causes of termination must be validated through the objective and subjective approaches.

### **Commingling of uncertainty, risk and certainty**

It is likely that managers have a different notion of uncertainty or conflate it with risk in everyday speech (Jauch/Kraft 1986).<sup>81</sup> However, a distinction is intuitive if we consider Knight's notion of uncertainty: Uncertainty is a lack of information about quantities to make probability judgments, whereas risk is assigned to an event if the probability of the argument is calculable or given (for example in a lottery game as a risk to lose). However, there may be intermediate states. As Keynes theory on li-

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<sup>81</sup> The commingling of those concepts can be attributed to the fact that actors are likewise affected by uncertainty, risk and certainty and show aversion to the first and second (Epstein 1999).

quidity preferences suggests, the accession of relevant evidence or the detection of information by actors over time may lead to a (re)formulation of tentative subjective probability judgments, given that the information does not provide different accounts. Thus, the basic question is whether new events or more information would offer a better estimation of probabilities. If this is the case, the accession or accumulation of relevant information and knowledge helps to form expectations and make informed decision. This transition could be characterized as a state of *low uncertainty*. If this is not the case, managers deal either with risk or with high uncertainty. However, this transition is observed from an *ex-post* perspective. Ex-ante, actors do not know for sure whether information and knowledge accumulates over time.

Moreover, the range between high uncertainty and certainty is rarely conceived as a continuum (cf. Dequech 2000). For instance, the literature in economic sociology shows that people often treat probability calculations or the adequacy of calculative models and statistics as hard facts (cf. Beunza/Stark 2004; MacKenzie 2006; MacKenzie 2007; Zorn 2009). A similar case is strong confidence in professional judgments. Finally, it is also the belief that a specific calculative procedure will yield good insights if we constantly improve and fit the procedure or model. Designing computer simulation models, for instance, underlies a dynamic process of formulation and reformulation of parameters and their composition in order to capture high contingency. Despite the attempt of constantly fitting the model, uncertainty prevails.

### 3.5 Discussion and reflection

This chapter develops a framework that should serve to study how managers deal with uncertainties in patent licensing transactions. The framework has its initial starting point in the critics of mainstream economics that uses an one-sided concept of uncertainty. However, uncertainty may differ in sources, facets and degrees. It is assumed that fundamental, procedural and strategic uncertainty impede patent transactions and that the conditions in which managers value, price and cooperate differs along high and low degrees of fundamental uncertainty.

*The core hypothesis developed here is that fundamental uncertainty, which has its origin in the innovation and patenting process, explains valuation-pricing and cooperation problems in the market for patents. “Symbolic-material arrangements” (Karpik 2010: 127), also known as judgment devices, help managers to cope with these problems. It is assumed that an increase of relevant information and knowledge about the outcome of the invention and the patenting process causes a shift in the way managers value and price patents and cooperate in the contractual relation-*

ship - or in other words, how managers and judgment devices operate to overcome uncertainty.

In the theoretical framework, which is suggested as an analytical instrument, different concepts in pragmatist theory and cultural economic sociology come into play. The chapter attempts to show that the concepts, despite the difference in paradigmatic provenience, are directed to judgment (criteria), trust and confidence respectively. The notion of judgment partly replaces decision and decision-making when uncertainty is high. Judgment is a process and a result that allows for imaginative acts.

However, the chapter raises the following three concerns that still need to be addressed:

First, combining concepts of uncertainty and devices means that a lack of information or knowledge (uncertainty) is mitigated with knowledge that is actually useless in the uncertain situation. Karpik (2010: 51) emphasizes that devices are *external* to market exchange. However, devices are only helpful if the credible knowledge applied is either very general or designed to a class of similar problems identified under uncertainty. The last aspect implies that devices are market or trade specific. Some knowledge may not be applicable under uncertainty. Inquiry *is* the act that makes the judgment reflexive and it may also be the bypassing act to reduce uncertainty if confidence in a set of criteria (or logic of action) is moderate or weak. However, Karpik assigns reflexivity to the device whereas Dewey and also Shackle point to imaginative and creative activities of actors involved. This aspect shall be tackled in the first study (chapter 4 and 5).

Second, if we assume that uncertainty is reduced in degrees with an accumulation of information over time, how can judgment devices reduce uncertainty? Moreover, judgment devices also serve to control uncertain situations but high or real uncertainty in Knight's and Shackle's viewpoint implies that such situations are not controllable in principle, so how does this work? One reason for this clash is that Keynes, Knight, Shackle and Dewey do not recognize the social dimension of devices. As philosophers they address epistemological questions. And the critical philosophers among them are chiefly concerned about the truth of propositions and a fit between objectivity and subjective beliefs and judgments. Insofar they all differ in their perspective on knowledge. However, Karpik, who must be conscious about this concern, explicitly refers to credible knowledge - shared and validated by social groups and communities - that is *external* to the uncertain situation. This knowledge foremost enables actors to make reasonable choices (Karpik 2010: 49). Apart from that, information may still accrue over time due to changing conditions of markets and technologies.

Third and most notably, judgment devices themselves may become a source of uncertainty. For example, if the value of a good changes with the use of different judgment devices, the same category of good is exposed to a variety of viewpoints, and so it loses its unity (Karpik 2010: 52). Uncertainty about the right device may create a battle of judgment devices. This contradiction hints at the fact that judgment devices are not simply given but change over time. Competition and battles, which temporarily create uncertainty, transform judgment devices and also change market conditions. A change in the perception of the object of trade often has an impact on market and industry creation (Lawrence/Phillips 2004; Zelizer 2009).

The process model in the framework leaves a few crucial questions open that need to be addressed in the empirical field: How do both, the licensor and licensee come to a joint judgment on the value and find a price? How do they respond to cooperation problems that affect both likewise? Which phases seem to be problematic for the licensor and licensee managers? What are the consequences of a failure in a transaction phase? To study these questions, a combination of objective, subjective and transaction-related viewpoints is suggested as all have their blind spot. While the objective approach neglects the perspective of the managers involved, the subjective approach is vague or even invalid because some problems raised by the managers do not result from a lack of information or knowledge. The transaction-related approach helps to identify the most crucial sources of uncertainty. However, the termination of a transaction phase may also be caused by intra-organizational or hierarchical frictions or corporate policy.

## 4 Dealing with high fundamental uncertainty: Patent transactions at the late research stage

### 4.1 Introduction

Uncertainty is a key factor in transactions of patents for drugs. In the last chapter it was assumed that fundamental uncertainty about the innovation and patenting process, namely the innovative product and the patenting process, explains valuation-pricing and cooperation problems in patent transactions. With fundamental uncertainty, managers lack information about probabilities of outcomes which do not exist at the time of decision-making. The information is not available in principle because it is generated in the future - or in other words, the future has yet to be created (Dequech 2000).

In the late research stage of a drug, fundamental uncertainty about the innovative product and the (provisional) patent is high. At the end of this stage a target and a lead in the organism are identified and often validated and optimized (so-called "lead optimization") (Rang 2009a).<sup>82</sup> However, clinical studies are still lacking yet and so information on safety, tolerability, bioavailability and pharmacokinetics in man are not obtained (Easdale/Vose 2009). Furthermore, the medical indication of a drug candidate is not entirely clear and set. Consequently, the product market is not fully fixed nor is it possible to determine the likely commercial returns, the chances of successful registration and the time and costs of development in this stage.

This empirical chapter investigates patent transactions under the condition of high fundamental uncertainty when decisive information about the innovative product and the patenting process is not available. The central proposition is that fundamental uncertainty is associated with the stage of a distinct compound or drug candidate and the stage of the patenting process (cf. Allain/Henry/Kyle 2010). The patent transactions investigated in this chapter comprise *non-collaborative exclusive licensing of drugs, notably based on established small molecule technology*. In the pilot study, a set of valuation-pricing and cooperation problems has been identified which relate to different facets of uncertainty (fundamental, procedural and strategic uncertainty). The central question here is how managers value and price provisional patents of a late research stage compound (valuation-pricing problem), how licensors and licensees find the right match in the light of lacking market transparency and

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<sup>82</sup> It should be recalled that the demarcation between the (pre-)clinical stages is not clear cut. Late research often ends with the identification of a drug candidate but it may lead over to the start of preclinical development to address pharmacokinetic, toxicological and stability problems as soon as possible.

cooperate throughout the negotiation of a 15-year contractual relationship (cooperation problem). The following sub-questions are tackled:

1. *How do TTO and BD managers price patents when some relevant information is not available in principle, while other information is available?*
2. *How do the managers price patents in the light of a high variety of possible valuation criteria?*
3. *How do the managers find the right technology offered or required by the most appropriate licensor and licensee?*
4. *Which information is suspected to be held or hidden by the other party? And how do managers cope with hidden information in financial and legal negotiations?*
5. *Which valuation and cooperation problems interact? (The role of the “fear of a winner’s curse dilemma” and the “fear of unexpected inquiry dilemma”)*
6. *Which parts of the licensing contracts are more thoroughly negotiated? And why?*
7. *What are the most severe uncertainties that TTO and BD managers perceive in the transactions?*

By studying these questions, the pragmatist-cultural framework presented in chapter 3 is used. I chose exclusive licensing transactions of patents for drugs between public US universities and German pharmaceutical companies which do not require close collaborations between the organizations as a case. Public US universities represent the supply side in these transactions. They license out drug candidates which qualify for preclinical development, and thereby usually retain ownership of publicly funded technology. German pharmaceutical companies, which seek to license-in small molecule compounds at the end of the late research stage, form the demand side of the market for patents on early-stage drugs. They bring drug candidates into preclinical development and continue with clinical trials in man.

This chapter highlights the argument that different valuation criteria emerge along the patent transaction process reflecting different viewpoints on the patent value. Given the lack of a standard valuation method, technology transfer managers from universities (henceforth TTO managers) and business development managers from companies (henceforth BD managers) need to agree upon basic assumptions to finally negotiate a price that consists of a complex set of payments. It is shown that both parties need to discuss this base but at the same time they are cautious not to reveal too much confidential information. When TTO managers approach companies, they lack information about the willingness of a company to further develop



the compound. In the light of dynamic development and market conditions, BD managers must trust TTO managers in providing the opportunity for negotiations later. In some instances, TTO managers are less informed and knowledgeable than BD managers while in other instances, BD managers are disadvantaged. In principle, managers on both sides are likewise captured by high fundamental uncertainty about the good.

The first sub-chapter (4.2) briefly sketches the technological and institutional background of US TTOs and German pharmaceutical companies and also briefly discusses the literature on the late research stage. Sub-chapter 4.5 presents the empirical results. It commences a dense description of organizational processes and practices on both sides, universities as licensors and companies as licensees who seek to license patents exclusively. This description leads over to a typical patent transaction in the early stage of a drug candidate which is presented for simplicity as a serial sequence of phases. The role of patents as the primary good of transaction, the involvement of managers and inventors and their inter-organizational interactions in patent transactions are thereby reconstructed. Sub-chapter 4.6 aims to detect critical transaction stages which are prone to fail due to uncertainty and to identify judgment devices that help to overcome valuation-pricing and cooperation problems. It answers the research questions and summarizes the findings.

## **4.2 Background of patent licensing at the late research stage**

### **Technological background and the valuation of early stage compounds**

The research stage of a drug comprises target identification and the selection of a hit-to-lead, though the crossing point to preclinical research is not clear cut. The demarcation between research and preclinical development may also be placed at the complex process of lead optimization<sup>83</sup>. And the end of the late research stage may involve a first series of in-vitro safety tests to predict adverse and toxic effects in humans after lead optimization (Rang 2009b). The preclinical stage usually marks the interface between research and development of a drug compound and is usually initiated at the early selection point (ESP). At the ESP the drug discovery team makes the decision whether a drug candidate compound should be taken to preclinical development or not. Only with a positive ESP decision the drug candidate will finally enter the subsequent clinical stages (Rang 2009a). However, this decision may be deferred until data from Phase I trials have been obtained (ibid.). In the subsequent preclinical stage, in vitro and in vivo studies on various species (e.g. mice)

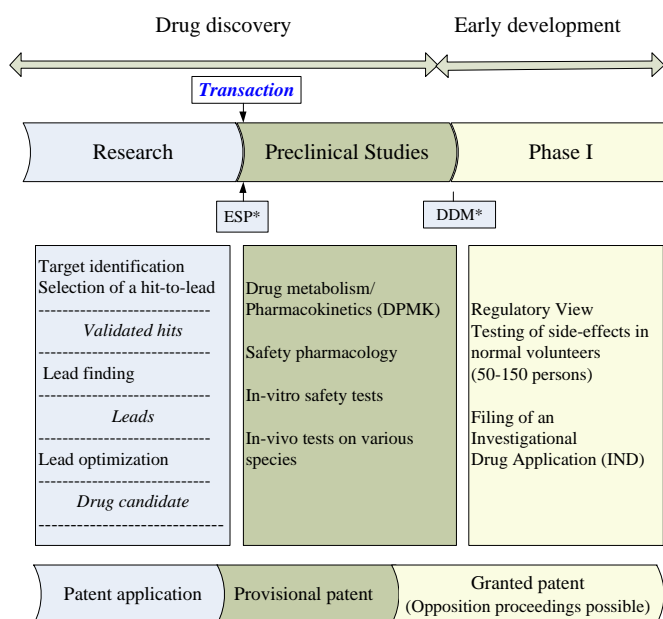
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<sup>83</sup> Lead optimization is defined as the process that is required to optimize a screening hit to a pre-clinical candidate.

are carried out, pharmacokinetics (DMPK) and safety issues are tackled. The pre-clinical stage reveals plenty valuable information about preliminary toxicological, safety-related and pharmacokinetic attributes of the drug candidate. It finally reaches the decision to develop in man (DDM) which opens the avenue for the actual clinical stages. The company will usually file an Investigational New Drug application (IND) with the FDA and ask for authorization with the EMA.

In the late research stage, the invention or discovery is a drug candidate. Due to the long patent application time, the drug molecule is usually, if at all, preliminary protected by patent law. It is in the one-year grace period granted by US patent law and a PCT application has often not been filed by that point in time. A provisional US patent allows the university to preliminarily assert ownership rights on the outcomes of the inventor's innovative activity. It is less expensive than the full US patent application.<sup>84</sup>

**Figure 5: The field of early stage patent transactions**



**Based on Rang (2009a: 225), \*ESP= Early selection point; DDM= Decision to develop in man.**

The value of drug candidates increases over subsequent development stages reflecting the incremental value being created from development activities. The LES

<sup>84</sup> USPTO provisional patenting fee amount to 220 Dollar as opposed to 330 Dollar for a basic utility patent filing fee excluding other fees (USPTO 2008).

Biopharmaceutical Royalty Rates and Deal Terms Survey for the USA and Canada 2008<sup>85</sup> reports that average fixed royalty rate for preclinical products to be 4.3%. The range of tiered royalty rates by stage of development changes from 5-8% for preclinical products to 7-10% for pre-proof of concept. Fixed rates are obviously most common in early stage pre-clinical and smaller deals, while the frequency of tiered rates increases with sales estimates. Average royalty rates for biological products are slightly higher than small molecules (The Licensing Executives Society 2008).

Using the commercial database Recap (Alliances Database), Edwards et al. (2003) compared 112 downstream deals in the early-stage (discovery or lead-generation) and mid-stage deals (preclinical or phase 1 stage). They find that average upfront licensing fees for early stage compounds are 3 million USD and 9 million USD in clinical milestone payments in 2003. For mid-stage deals average upfront licensing fees are 2.5 million USD and 17 million USD in clinical milestone payments.<sup>86</sup> The data also show that sales figures have increased in the late 1970ies to the years since 1995. Upfront licensing in a typical university-biotech license have tripled, from 20,000 USD to over 70,000 USD. License maintenance fees have even quadrupled, from 40,000 USD to 180,000 USD over an assumed five-year period of payments. According to the authors, clinical milestone payments have gained more relevance during this period, amounting to 1.6 million USD through the commercial launch of a therapeutic product. The effective (fixed) royalty rate, however, has stayed constant at 4%<sup>87</sup> over time. As a result, universities are able to receive higher royalty income when the fraction of licenses executed at preclinical stages is high (Thursby/Jensen/Thursby 2001).

Universities and pharmaceutical companies are likewise challenged by developing more robust and sophisticated methods for dealing with the uncertainties inherent in R&D projects at the research stage. Both sides have to cope with fundamentally lacking information at a point in time at which important project decisions are required. This information is necessary to value patents but also to evaluate complete projects and assess their risks (Jacob/Kwak 2003). The literature on valuation methods recognizes that future-oriented calculation models are not helpful when assessing early-stage R&D projects (Jarrett 2000) and that “trying to assess the com-

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<sup>85</sup> The survey includes an industry sample of 150 deals completed between 2006 and 2007. 28% of the respondent firms were pharmaceutical companies, 26% biotechnology companies, 35% academic institutions and 11% other. 90% of deals included US patent rights and 70% were worldwide.

<sup>86</sup> Sponsored R&D was 11 million USD while equity investment amounted to 5 million USD for early-stage deals, both figures reached 10 million USD for mid-stage deals.

<sup>87</sup> This rate is based on 100 million USD in assumed annual sales.

mercial value of a project in the conceptual or discovery phase is pointless” (Jacob/Kwak 2003: 295). This applies for early provisional patents in general. Scholars in the respective field propose soft approaches and emphasize the role of learning, “project reviews should evaluate what has been learned” (ibid.). Other scholars attempt to tailor valuation methods to scenario building and flexible optimization-based methods which offer capacities to realistically represent the complexity of portfolio selection problems under uncertain conditions (George/Fabrid 2008).

#### **Institutional background and cooperation at the late research stage**

Under the provisions of the Bayh-Dole Act (1980), passed through US congress in 1980, US universities are entitled to obtain ownership of intellectual property resulting from federally funded research. This legislation removed many restrictions on exclusive licensing to industrial firms. The Bayh-Dole Act and the establishment of TTOs at universities have significantly spurred licensing activities and other forms of technology transfer to industry (Sampat 2006).<sup>88</sup> Parallel, other factors further contributed to this trend - the patent granting practices of the USPTO and court decisions that leveraged the range of patentable research results as well as the advent of biotechnology and information technology (Mowery, et al. 2001). In return, the Bayh-Dole Act has supported the role of patents in facilitating technology transfer. The legislation was enacted under the assumption that useful university research results need follow-on development in industry and thus require patent protection (Colyvas, et al. 2002). Therefore increasing patenting goes along with growing commercializing activities of technologies.

While public US universities and TTOs commercialize under similar social and political conditions, TTOs’ missions, universities’ policies and the organization of technology transfer widely differ across universities (Cohen/Nelson/Walsh 2002; Bercovitz/Feldman 2006). TTOs are highly heterogeneous regarding their management and commercialization strategies (cf. Plan/Siegel 2006). And they differ with respect to the number of personnel and financial resources to fulfil their purposes. University policy has an impact on the commercialization of research outcomes and on activities of TTOs to spin-out and license-out technologies (Degroof/Roberts 2003; Lockett/Wright/Franklin 2003). Research on technology transfer provides evidence that universities active in the commercialization of research outcomes and those having a clear strategy towards commercialization are more successful. These

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<sup>88</sup> Even before the enactment in 1980, prominent universities strived to commercialize patents by creating start-up companies or licensing patents (Mowery, et al. 2001; Mowery/Ziedonis 2002).

institutions often possess greater expertise and networks (Lockett/Wright/Franklin 2003).

In the field of early-stage technologies, universities are not the only suppliers. Target identification and lead optimization may be carried out by contract research organizations (CROs), and specialized biotechnology companies likewise perform late research on small molecules (Clark/Newton 2004). Lead optimization is a complex process involving high expenses. Pharmaceutical companies increasingly consider the outsourcing of these tasks to professional firms (*ibid.*). The market for lead optimization tools and services has grown recently and was worth 1.63 billion USD in 2003. It is expected that the market for lead optimization will expand further (Anonymous 2003). This development, however, does not downplay the role of universities as suppliers in this field because the strength of universities is the provision of new chemical and biological entities.

The pharmaceutical industry is characterized by industry-wide outsourcing of research activities to universities and specialized biotechnology firms (Cavalla 2003; Getz 1997), while the search for suitable drug candidates and therapies tends to be driven by marketing-oriented considerations (Drews 2003). This means that particularly large companies are focused on detecting and developing blockbuster drugs. Even in the preclinical stage the selection of a R&D project and profile of a particular drug candidate is largely aligned to meet the requirements and specifications of the marketing department, namely to identify blockbuster drugs. Consequently, drug candidates are often chosen because they fit to the marketing planning of the company but not vice versa.

Since various organizations are potentially involved in carrying out R&D activities, different company constellations on the demand side are possible. A public US university may license-out to small and mid-size pharmaceutical firms, which have a strong biotech arm, or to large multi-national incumbent players in the field. It is frequently argued and shown that small companies are eagerly advancing compounds in preclinical studies but are progressing significantly slower through the clinical stage II (Jacob/Kwak 2003; George/Fabrid 2008). These companies are particularly successful when they develop in strategic partnerships with larger companies that provide financial resources (Nicholson/Danzon/McCullough 2005). Large companies obviously tend to develop new drugs fast and effectively through later clinical stages. This circumstance may result from the focus on exploiting drug candidates that have a blockbuster potential. Other studies are cautious suggesting that large companies are characterized by long decision making processes and often acting slow (Drews 2003). Some companies may restrict their development activities to certain clinical stages while other firms perform the full range of development

activities from late research to the commercialization of the drug - either alone or in strategic partnerships with other firms.

### 4.3 Propositions

#### Valuation-pricing problems

Chapter 3 argued that valuation-pricing problems in patent transactions basically result from the multiple utilization of patents, their subjective value, the shortcomings of retrospective and prospective valuation methods and various benchmarks on which royalties can be based. For provisional patents on early-stage drugs, expectations for market and technological conditions would refer to a 15 year time span. In light of the dynamic environment of markets and technologies, TTO and BD managers would need to bring either a high portion of imaginative power or advanced valuation models to be confident enough that the value is at least approximable. Due to changing market conditions a mark-up on costs cannot be found for the long future. Thus, fundamental uncertainty prevails. If licensor and licensee are exposed to strategic uncertainty, as described in chapter 3, each party makes a different prediction about the reservation price<sup>89</sup> of the other. Consequently, predictions are imprecise and can be quite volatile, and "leading to impasses when profitable trade could have taken place" (Arora/Gambardella 2010: 16). In the light of high fundamental uncertainty, the calculation of the net price value of a drug candidate is reckoned useless (Jacob/Kwak 2003; Jarrett 2000). So, how do TTO and BD managers come to a commonly shared value and a price? As opposed to sales, licensing allows to disperse valuation problems over a long period. The managers may accept that the financial terms of the contract basically remain incomplete (Maskin/Tirole 1999; Hart/Moore 1999; Pagano/Rossi 2004), even though the IP literature provides managers with numerous solutions. Instead, they may choose to negotiate a contingent solution to valuation-pricing problems.

*Proposition 1: If TTO and BD managers value and price the provisional patent and early stage compounds they do not strive for a systematic valuation. Furthermore, they do not aim at arriving at precise predictions on the net price value. Instead they strive for a bilateral contingent solution which is based on their subjective valuation principles and is subject to renegotiations in the future.*

The basic question challenging proposition 1 is *how* the parties arrive at a contingent solution when both rely on their subjective valuation principles and experience.

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<sup>89</sup> The reservation price is the maximum price at a licensee is willing to pay for a good and it is the minimal price at a licensor is willing to sell a good.

Even if a patent is the primary object in an exclusive licensing agreement, it may turn out that the patent transaction becomes a part of a larger venture or strategic alliance with other companies in the long run. The valuation of one drug at a given time is not sufficient, much more licensees need to take the entire portfolio into consideration (George/Fabrid 2008). The anchoring of patent transactions in larger R&D projects has following implications for the valuation of patents: In a R&D project, technologies are further developed to bring a drug to the product market. As a consequence, the value of the patent is established by the development activities in the project and milestone payments play an important role. In general, asymmetric information in patent transactions can be fully overcome if the contract involves only milestone payments because the licensee will pay the licensor as soon as the milestone is reached (Allain/Henry/Kyle 2010). However, this kind of payment initiates moral hazard problems. Consequently, the business plan including regulatory measures, financing of preclinical tests and trials, marketing and product launch compiled by the licensee may be an important information source for the university.

*Proposition 2: If TTO and BD managers negotiate financial terms, they primarily refer to the success of the entire development. Thus, the milestone payments of the project as well as information about product launch and related factors to product launch are the key subjects of the negotiation. Consequently, royalty rates play a minor role in the financial negotiations.*

However, proposition 2 leaves open why royalties should play a minor role at all and to what extent they should be judged from the viewpoint of information asymmetry and moral hazard problems.

### **Cooperation problems**

In the search of a suitable licensor and licensee, both sides operate under strategic uncertainty because they lack information about the capabilities of the other side and about the potential prospective relationship. It is plausible that managers prefer to cooperate with universities and companies known from prior contractual relationships and that networks are the essential devices to cope with cooperation problems. Popular and scientific literature on technology transfer and IP management basically acknowledges that managers rely on networks for initiating licensing contracts (Bidault/Fischer 1994) and that trust between the parties are a precondition for successful R&D team building (Gassmann/Reepmeyer/Zedtwitz 2008: 120-121) and contracting. Membership in broader scientific network and frequent interactions with investigators prove to be particularly helpful to companies, while a lack of such links impedes deals (Colyvas, et al. 2002). Formal and informal relationships do play a role for contacting and any other gatekeeping processes (Debackere/Veugelers 2005).

*Proposition 3: Social networks play a significant role for overcoming cooperation problems. TTO and BD managers use different kinds of networks in the search of technologies. Furthermore, they strive to make licensing agreements with companies they know from prior transactions.*

However, impersonal devices may also help to find the right technology because they channel licensors and licensees (Karpik 2010). What is the role of impersonal devices? Are they secondary for contacting or do they offer solutions to other transaction-related problems?

Licensing is a risky business and the idea of risk sharing between both parties is implicit in the labor division between universities and companies (Dimitri 2008). Potential licensors are promptly affected by a failure in the patent application procedure and licensees are concerned about opposition proceedings after the grant of a patent. In the long run, an issued patent may cease to apply and protection of know-how is no longer given. These and other concerns are part of the legal negotiations of the contract. Licensing contracts are basically incomplete and contractual incentives may not be effective. Yet, it is debatable or even implausible that the managers will close a long-term patent licensing agreement with good faith and a handshake (Williamson 1979). Instead, they may rely on standardized contractual clauses, which offer a set of solutions to known cooperation problems, and focus their negotiations on specific details. The Association of University Technology Manager (AUTM) and the International Licensing Executive Society (LESI) and many other intellectual property associations and organizations equip their participants with a body of agreements that can be used in legal negotiations, e.g. disclosure and transfer of know-how, collaborative technical development and arbitration agreements. Furthermore, the World Intellectual Property Organization (WIPO) and many other governmental and semi-governmental agencies provide mediation services and arbitration in case conflicts arise while the contract is being completed.

*Proposition 4: In legal negotiations, TTO and BD managers rely on a standardized set of contracts. The key point of the negotiation is the detailed form of the contract while the contractual frame is widely accepted by both parties.*

Proposition 4 implies that a set of shared formal and informal rules, conventions, contractual norms and supportive institutions govern legal negotiations, cooperation and the way transactions are carried out. Major stumbling blocks and concerns of legal negotiations would relate to contractual details. As indicated in chapter 1, obstacles in the market for patents can be attributed to a lack of institutional backing (Gambardella/Giuri/Luzzi 2007), and in the case of early stage transactions between



public US universities and German companies shared formal agreements may not be fully in place. This objection challenges proposition 4.

Finally, it is worth to look at interactions of valuation and cooperation problems and the relevance of the “winner’s curse” and the “fear of unexpected inquiries” dilemma between US TTOs and German pharmaceutical companies described in the last chapter. While the “fear of unexpected inquiries” dilemma may be negligible because one may assume that TTO managers are open to inquiries from firms, the ‘winner’s curse’ dilemma is indeed vital here.

## **4.4 Methods**

In this chapter, a qualitative research strategy was used to get an in-depth understanding of valuation-pricing and cooperation problems in exclusive patent licensing transaction at the late research stage.

### **Case selection and data collection**

In the sampling procedure, I formed three groups of TTOs and companies. Initially, I used a qualitative sampling plan to structure the sample according to the size and resources of the companies and TTOs in which the managers work. I chose experienced TTO managers from TTOs at public US universities representing licensors and BD managers from German pharmaceutical companies as licensees. All managers were involved in transactions of pharmaceutical patents. The sample included only managers who were trained in natural science,<sup>90</sup> and had at least five years experience as a manager. All TTO managers have gained experience in industry prior to their employment in the TTO. The interviewees were told to refer to drug compounds and therapies based on small molecule technologies and non-collaborative exclusive licenses with either US universities or German companies.

The methods of data collection consisted of expert and practitioner interviews with TTO managers and BD managers. Interviews lasted between 40 to 100 minutes, with an average of 60 minutes. Due to confidentiality reasons, the majority of managers wished to be anonymous and was not willing to accept a tape recorder during the interview. For this reason, all interviews were made anonymous and are quoted as affiliated to one of the three groups of TTOs and companies (details in appendix 1). In order to get a better understanding of the valuation of patents and the different perspectives of licensors and licensees I initially conducted five expert interviews with three German IP law firms and two US intermediaries active in the pharmaceutical field and university licensing. Additionally, 24 practitioner interviews have been carried out with TTO and BD managers, both sides equally repre-

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<sup>90</sup> Among them are biologists, chemists, biochemists and chemical engineers. Seven German managers were certified patent lawyers (“Patentanwalt”).

sented. Besides, I collected corporate reports and websites of TTOs and companies. Whereas TTOs extensively post information about their procedures and policies on their websites and reports, companies rarely publish their licensing activities in corporate reports (Gu/Lev 2004). These reports were used as secondary source of information.

The interviews focused on the course of transactions between managers along six phases: Contacting, due diligence, financial negotiation, legal negotiation, contract closure and renegotiation. The questions and sequence of questions in the interviews were oriented to the analytical framework described in chapter 3.4.2 and 3.4.3. In expert interviews, I referred to the interviewees as “experts” so that they acted as informants about practices of others (see e.g. Zelditch 1962; Gläser/Laudel 2006). Expert interviews and document analysis delivered account on the decisive information and knowledge that TTO and BD managers lack from an objective-observer perspective explicated in the previous chapter. These sources revealed judgment criteria and devices that help to cope with valuation-pricing and cooperation problems. Moreover, I attempted to identify the most critical stages of transactions that are prone to fail due to uncertainty (transaction perspective). In practitioner interviews, I focused on transactional practices of the managers and thereby addressed the TTO and BD managers as “practitioners” in the field. In this type of interview, I was interested in the subjective interpretation of managers involved in transactions. These interviews served to find out whether TTO and BD managers qualify uncertainties as problems and vice versa, and to examine whether problems mentioned by the interviews can be attributed to uncertainties. Then I tried to find out how managers solve valuation-pricing and cooperation problems when using judgment devices.

For confidential reasons I did not witness how licensors and licensees cooperate and value and price patents in real-time transactions. Hence, I was not able to validate my findings against the observation of a transaction. However, I assume that the systematic process proposed in the analytical framework was helpful for reconstructing typical practices in patent transactions through the descriptions of managers from three sides, licensor and licensee and partly by intermediary organizations - either as experts or as practitioners in the field.

### **Data analysis**

In the data analysis, I basically applied the qualitative content analysis according to Mayring (2007). This method strives to preserve the advantages of quantitative content analysis for a more qualitative text interpretation. The procedure used in this chapter was the deductive category strategy which was aligned to the analytical framework presented in chapter 3.4.2. and 3.4.3. In this procedure, I explicated the interview transcripts by utilizing additional documentary material about the context

of transactions. Then I formulated paraphrases which were generalized and bundled to arrive at a sound conclusion (cf. Mayring 2007).

While analyzing the descriptions of the practices in licensing transactions, I proceeded as follows: First, I organized the material and interview transcripts by revealing valuation-pricing and cooperation problems and the type of uncertainty (fundamental, procedural and strategic) for each of the six transaction phase. Then I focused on the interaction of valuation-pricing and cooperation problems (“winner’s curse dilemma” and “the fear of unexpected inquiries”). Second, I identified judgment criteria and judgment devices for each transaction phase and analyzed the role of inquiries and judgments in the interviews. Third, I analyzed the significance of valuation-pricing and cooperation problems and judgment devices throughout all phases. In doing so, I paid regard to the sequential order of a typical transaction process and the time-frame for each phase. I reckoned that many contacting attempts fail in the initial phase when both parties have not invested much effort and resources, while a break of financial and legal phases indicates the opposite and is more likely to be judged as severe by the managers. Financial and legal negotiations require enormous resources and involve sunk costs for the university and the company. In the last step, I analyzed the material with a view to confront, extend and modify the propositions 1 to 4.

## **4.5 The patent transaction process at the late research stage**

At US universities, the patent transaction process is initiated when publicly funded inventive activities of researchers yield an invention. The Bayh-Dole Act stipulates that researchers notify the technology transfer office (TTO) of the invention through the submission of an *invention disclosure form*. This form contains a technical abstract of the invention, a description of the assumed superiority of the invention to existing technology and the notification of a non-confidential disclosure of information about the invention. TTO managers in the respective technological field review invention disclosures for patentability and commercial potential. They carry out a patent literature search to determine the status of the prior patent art and make a preliminary evaluation of novelty, inventive steps and usefulness of the invention as well as patentability on a national level.

The patent application is usually prepared either by the IP department of the TTO or often externally by an IP law firm. Since TTOs have limited budgets for the process of patenting, managers must make informed decisions about which inventions have most potential to be legally protected and become valuable products (group #S1.1, #S2.2). TTO managers typically balance the costs of a provisional US patent application against the prospects of finding a company interested in the invention. If they regard a patent or a patentable technology to result in revenues to the university

that will exceed the expenses incurred in obtaining it, patent protection is usually advised to the university administration (e.g. the General Counsel or a scientific committee). This cost-benefit-balance is probably one of the most critical elements in making a decision to pursue provisional patent protection and the commercialization of a technology. It is a systematic selection procedure of patentable and commercializable inventions as well as an institutional requirement to justify further steps in the commercialization process towards the University Regents.

TTO managers often evaluate inventions with the inventors to explore potential developments and commercialization strategies (group #S3.1, #S1.2). In contrast to TTO managers, inventors are able to provide a better technical evaluation of previous patents and publications in their field. In the patent application process inventors supply further information to the patent attorney when patent claims need to be reformulated or improved. Inventors' expertise is especially helpful to TTO managers in assessing industrial interest in technologies (the role of the inventor is discussed in chapter 8 on page 269).

When inventions stem from different sources of funding and diverse research teams have been involved in the research process, clarification of the ownership of the invention is a vital step in this process. TTO managers first identify all inventors involved in the making of the patentable technology to comply with 35 U.S.C. 116 and to any other royalty sharing agreement amongst the investigator. Under most employment contracts employees are required to assign their invention to the university (group #S3.2, #S2.2). If researchers from different institutions have contributed to the invention TTO managers from both institutions then negotiate an agreement with the inventors to determine how the two organizations intend to manage and commercialize the technology. The TTO managers also examine potential conflicts with concessions of sponsors or privileges of other university departments. For this purpose, the investigators must report in detail on all sources of the invention's funding, either grants, cooperative agreements or other sponsorships. Only if inventorship is clarified and the invention is assigned to the university, ownership of technical knowledge or an idea can be constituted and a preliminary legal protection from infringement is formally guaranteed.

The decision to license a given set of provisional patents to an established company is followed by the commercialization of the provisional patents. TTO managers seek to identify the most appropriate licensees for the technology that match up with the TTO's missions and goals. To pursue the licensing of an invention, they contact suitable companies to assess their interest in obtaining a license to the provisional patent. However, if a private company contacts the investigator directly she is supposed to refer the company to the TTO, which coordinates any further contact. This

is typically the case, as we will see, when companies approach scientists at conferences and symposia.

On the part of the company, identifying promising technologies of interest, either for in-house development or the prevention of a rival's engagement, requires constant monitoring. Large pharmaceutical companies have *scouts* who constantly observe what is being presented and published in peer reviewed journals. In small and mid-size companies having fewer resources, however, the business development staff (BD staff) is often engaged in the search of technologies. Managers seek to identify the supplier of the most innovative and pioneering chemical entity. They also strive to gain access to refereed papers, conference presentations showing work-in-progress which is related or similar in nature to the scientific field of interest, and grey papers with a semi-public content.

The mission of a scout is to find new chemical and biological entities which may allow for advantages over competitors. Scouts, who are seeking in the late research stage, are hired to assess the scientific and market potential of drug candidates. Moreover, they approach scientists in a diligent way. They fight out the race for the most recent and promising compounds and mechanisms to strengthen the company and weaken or block rivals (group #D3.1). Hence, they constantly communicate with scientists to discuss the potential of specific therapeutic methods and compounds. Since many inventions in the early stage have recently entered the patent application process, patent databases are not the right source of information for the identification of potential licensors (group #D2.1, #D1.1).

Companies invite prominent scientists as opinion leaders to advisory panels and appoint them as assessors and consultants. On the one hand, such panels can open new avenues for future R&D projects, contribute to the generation of ideas and new insights in the companies. On the other hand, R&D executives are more likely to gain first-hand information about recent inventions and research outcomes. Meetings of that kind are regularly held and should bring experts together. They should allow for a confidential atmosphere to exchange information (group #D3.1).

In some instances, scientists are temporarily hired by the firm to assist the licensee in transferring the technology from the academic to the private sector. Consulting contracts are personal agreements between the investigator and the company, and TTOs neither advise nor negotiate the terms of these agreements (group #S3.2). Universities do not usually become party to such consulting agreements (group #S2.2., #S3.2). Hence, advisory panels are beyond the influence of universities. The company seeks experts because it expects, for instance, trustful inputs and competent assistance in scientific evaluation of R&D projects (group #D3.1). The exclusive character of those meetings additionally helps to exchange trustful information under controlled conditions (group #S2.1, #S2.2).

For connecting unrelated organizations, conferences in partnering events play a crucial role. BIO, for instance, hosts the annual BIO International Convention, one of the world's largest events of the biotechnology industry. As the largest biotech organization, BIO also organizes partnering meetings which attract corporate members (1,200 members worldwide), venture capitalists and many other organizations in the field (BIO 2010). Furthermore, TTO managers use non-confidential information to marshal bids that are offered either on the website of the TTO or on commercial online platforms, as I-Bridge and Yet2com which was described as a passive marketing strategy by the TTOs.

When the technology is in need of further development, TTOs usually ask for a business plan in which the company informs the TTO about development steps and product launch. The preparation and submission of a business plan means a substantial workload for BD managers because they need to consult a team that notably consists of the financial and marketing department, regulatory and safety personnel and pharmacokinetics specialists. TTOs may request information about the competitive landscape, development costs and a proposed market approach (group #D1.1, #D3.1). The company makes, if necessary, a proposition about the anticipated date of product launch. The set-up of a business plan is complex if numerous departments with different interests are involved. In the business and development plan the company also demonstrates that it intends to thoroughly develop and market the technology which will ultimately result in financial rewards to the university (group #D2.1, #D3.1).

However, BD managers often spot university technology in the course of a *first freedom-to-operate analysis* to prevent roadblocks<sup>91</sup> as to achieve competitive advantages over other companies. To secure access to promising therapeutic fields and the respective provisional patents, companies usually ask for an exclusive licenses or even seek to buy the technology despite restrictions stipulated in the Bayh-Dole Act<sup>92</sup>. However, if a company has a number of drug candidates in the pipeline and thus does not intend to develop, companies attempt to avoid license agreements with universities (group #D1.1, #D3.1). First, BD managers eschew long-term obligations in conjunction with the development of a drug when clinical trials of other products in the pipeline already cause significant costs. Companies attempt to allocate their resources to the most promising drug candidates and so patent licensing in the early

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<sup>91</sup> A roadblock is a barrier to innovating and IP-driven firms caused by one or several patents of third parties which inhibit the build-up of a strategic patent portfolio in a pivotal technical field. It instigates a freedom-to-operate problem.

<sup>92</sup> According to the Bayh-Dole Act universities are not permitted to sell patents that stem from federally funded research.

stage is a “nice to have” (#D2.1) but often not regarded as vital. Second and apart from any licensing consideration, it is often more advantageous to identify options to invent around a patent - if possible. Assisted by IP lawyers, BD managers pursue a first freedom-to-operate analysis to assess the risk of infringing a third party’s patent and the impact of patents on competitors. At the early stage of the compound a first freedom-to-operate analysis is regarded as necessary because it reveals useful information about the strategies of other companies at a time when companies have not incurred high investments (group #D2.1, #D3.1).

Once a company has expressed continued interest, the TTO arranges further conversations between the company and the inventors in which non-confidential information are exchanged. When the company wishes to explore the possibility of licensing the technology TTO managers arrange face-to-face meetings to discuss the objectives, needs and desires of both parties. During this review process, a company may determine that it would like the scientists to continue further development within the university laboratory. In this case, TTO managers will ascertain the need and willingness of one or more university inventors to work with the licensee.

The submission of the company’s business plan is the first part of a wider due diligence process in which both parties gather information and assess the potential of the technology, and the ability of the licensee to develop the technology further with a view to concluding an agreement for licensing. This process is often a team approach involving both, the TTO managers and the investigator. The TTO typically permits evaluation of an invention by potential licensees prior to the issuance of a patent through the use of a non-disclosure agreement (NDA), which is executed by the university and the potential licensee. The NDA allows inventors to interact with their technical counterparts in the licensing company and to provide confidential and proprietary information, as for example unpublished research proposals, data, drawings, materials or any other confidential details on chemical mechanisms and compounds. It may also include industry visits, discussions with industry representatives and multiple party attendees (group #S2.2., #S3.2).

The conversion of the provisional application to a full patent application is usually initiated by the TTO after a potential licensing partner has signed a NDA. The costs of full patent application, translations, legal consultancy in the USA and abroad are often reimbursed by the exclusive licensee. Consequently, TTOs save financial resources if exclusive licenses are offered. In return, the licensing company will want to ensure that any detriments to the patents are inhibited on the part of the university. For instance, BD managers insist on the continuance of novelty, the formulation of robust patent claims to abet the grant of a patent for major European markets (group #D1.1, D3.2).

Often a company desires additional time to explore potential commercial opportunities and thus wishes to preserve its right to negotiate a license for a limited period of time. In this case, an *option agreement* is signed between the university and the company. The company pays the university an option fee as a money consideration for preserving exclusivity. The fee is typically stipulated by the TTO. In return, the university will not grant to any other third party any license. The university may limit the information for assessment when other research entities are involved, and may give the option for a specific territory and period for which the non-use of the technology by third parties is guaranteed.

In licensing negotiations, the actor constellation slightly changes. Usually, scientists from the university and the company do not participate in the actual negotiations of license agreements with potential licensees. TTO and BD managers are usually supported by an assigned internal legal specialist. Licensing negotiations consist of a financial and legal part. In the financial part, option fees, upfront payments, milestone payments and royalties are negotiated. As indicated, royalties are continuous payments as a percentage of market net sales. Milestone and upfront payments relate to the performance of the potential licensee and are typically negotiated on a case-by-case basis (group #D3.1, #D2.1). Additionally, a variety of royalty types are charged: a license execution fee and a sublicense fee from any non-affiliate sublicensing agreement. In the final legal part, rights and obligations of both parties are specified. These obligations refer to representations, indemnifications and warranties, and the control over sublicenses.

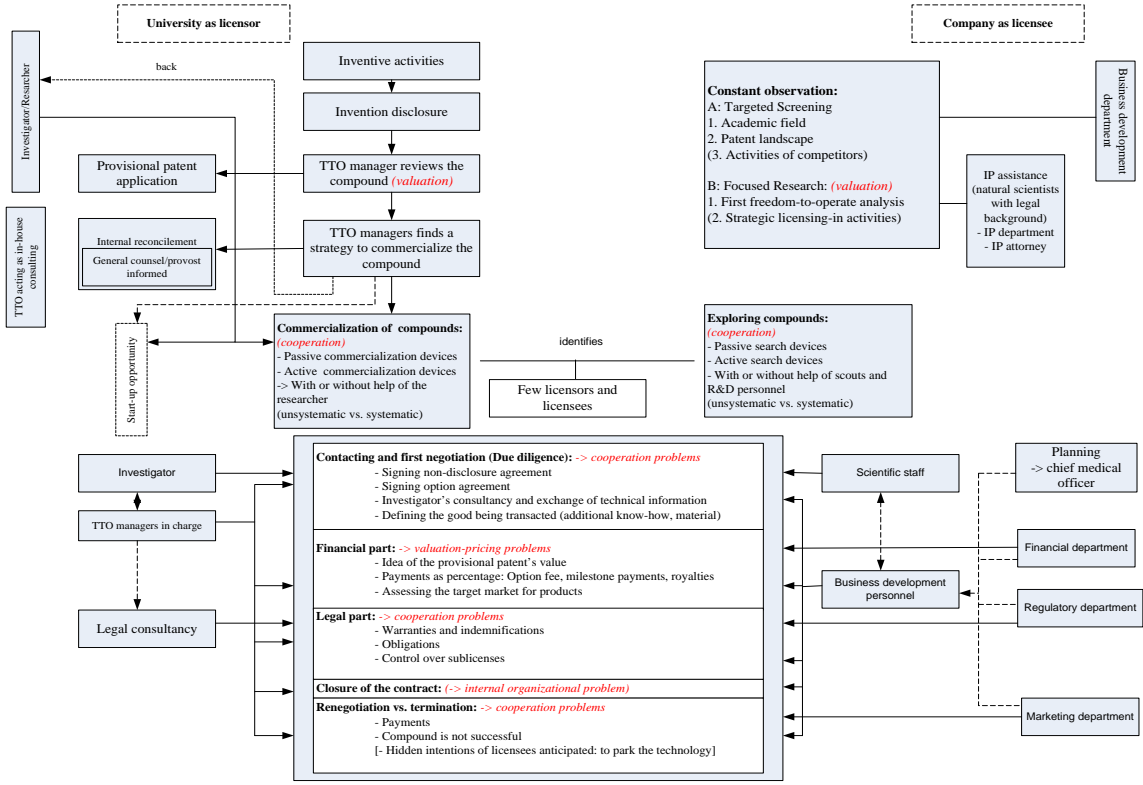
With the closure of the contract, managers on both sides are assisted by licensing associates. TTO managers negotiate and execute the licensing contract on behalf of the regents. On the part of the company, the closure of the contract may require the approval of the executive board. Once the licensing agreement is in place, the technologies provide profits to licensees, and universities share in that benefit in the form of license issue fees and royalties. The revenues, which the university receives from a patent or know-how will also be applied to reimburse the university for any incremental expenses incurred by it for maintaining patents and for marketing, licensing, and, if necessary, defending patents (group # S2.2).

TTO managers continue to make sure that the licensees are in compliance with the terms in the licensing agreement. Companies are obliged to submit regular milestone reports and to maintain records of revenues stemming from sublicense agreements. TTO managers are monitoring regular and irregular payments and any change in the sublicense agreement. In some cases, companies are required to permit an independent accounting firm to examine records, books and ledgers (group # S1.2). A major deviation from the business plan can be a reason to ask for renegotiations on the part of the licensor and licensee.



Since the value of the most successful patents increases along the clinical pipeline adjustments of prices are usually anticipated. In renegotiations, both parties attempt to adjust the contract to changing conditions, which often refer to the scope of the technology and the amount of regular and irregular payments. Occasionally, the compound turns out to be applicable in other medical fields or as an orphan drug, and thus the licensing contract may need some adjustments as well. A delay in the development, regulatory or manufacturing process and changing conditions in product markets are further reasons to negotiate the contract (group # D2.2). TTO managers report that the licensing agreement is usually terminated in the case of bankruptcy and if the licensee does not pay royalties. Some TTOs even terminate the contract when the licensee is placed in the hand of a receiver or trustee (group # S1.2).

**Figure 6: Patent transaction process at the late research stage**



## 4.6 Valuation and cooperation problems at the late research stage

### 4.6.1 Valuation-pricing problems in patent transactions at the late research stage

In the early stage of drug development, which coincides with the late research phase, valuation problems occur when TTO managers review the invention disclosure, BD managers seek valuable technologies of interest, and both parties negotiate financial issues.

#### **The invention disclosure: Uncertainties about the cost-benefit balance**

The decision to file a patent for a university invention is based on a cost-benefit-balance that would require a complete listing of patenting costs on the one hand, the estimation of cash flows from royalty payments that account for revenues on the other hand. The calculation of a cost-benefit-balance is not only aggravated by the estimation of future cash flows for which information is fundamentally lacking but also by costs. Whereas national and international patent filing fees are known, rejections by the patent offices, and reformulation and resubmissions of the application increase the costs of patenting to an unforeseeable but payable amount. Despite limited patenting budgets in TTOs, uncertainty about the cost-benefit-balance is reported to be temporarily significant because exclusive licensees are often willing to support TTOs in the full patent application process (group #S2.1, #S3.1.).

Similar to the patent application, TTO managers take minor steps in the valuation of patents even if the prospect of licensing is positive. TTO managers describe the systematic valuation of patents as “an art”, as a “strange world” and throughout as “very difficult”. The valuation of patents according to the cost approach, which takes into account total costs of a research project, is regarded as unreasonable. First, those costs are foremost documented in line with the stipulations of the funding research sponsor and not for the patent valuation. Second, TTOs attempt to save financial resources.

*“My colleague and I do the best we can, with the help from the professors. I’m trying in a preliminary way to determine which ideas are worth for a patent.” (#S1.1)*

In general, TTOs use a market valuation approach for preliminary patents that follows a retrospective logic. In order to value the invention, TTO managers systematically search comparable technologies and deal terms - including companies, patents and human targets across different therapeutic areas - in commercial databases, as for example “Biopharma” and “Thomson Reuters Pharma”. This means that manag-

ers make comparisons with prior market deals involving functionally similar patents. TTO managers consider the approach of comparable technologies as a pragmatic way to classify the invention and to compare patents on the basis of similarity (group #S2.1, #S3.1). In either way, the quest for comparable technologies described by TTO managers is a focused screening process.

TTOs rarely use sophisticated future-oriented valuation models and if they do, they are obviously used as an in-house tool on which managers occasionally elaborate (group #S3.1.). With regard to future-based valuation methods, some TTO managers seem to be more enthusiastic than others.

*Interviewee: “We do a deep guide that's the answer, take a close hard look at it.”*

*Interviewer: “and you have a model to calculate?”*

*Interviewee: “we do, we have a model that we use. It's something that we developed in-house, and we believe it works. And now we are in our third version to modify some factors [...]. We modified it over the time, we started with something that was fairly basic. [...] The basic concept is predicting the today's value of future royalty strings. But it's always as good as your guess is.” (#S2.1)*

*“We do not waste time upfront trying to figure it [the value] out. We have tons of comparables for different technologies at different stages of development. That said, many technologies just need some sponsored research so its value is really just not yet realizable but may come later.” (#S3.1)*

*“Well, we don't evaluate anything until we have some conversation with someone who is interested. Because we don't have the time nor interest in trying to evaluate everything if there is no one else that should be interested in it.” (#S1.1)*

The early stage character of the technology, however, let them act throughout pragmatically with regard to patent valuation.

### **Seeking valuable technologies of interest**

On the part of the companies, BD managers do apply sophisticated future-oriented valuation models to assess the value and they use discounted cash flow or a real option based approach. However, similar to TTOs, the systematic valuation is often regarded as an attempt in the early stage. BD managers consistently described the valuation of patents in this stage to be primarily based on an informed guess from R&D and marketing departments. Final decisions often derive from internal factors.

*Interviewee: “Usually we do not really calculate. The question is if one calculates a net price value and, that's just reading tea leaves in the preclinical phase.”*

*Interviewer: “Yes?”*

*Interviewee: “We consider this as totally absurd. We have our rule of thumb, where we say what we are willing to invest and that's a statement we require from our colleagues from the R & D and marketing department. That we say how much is*

*this invention, this patent worth to you. And this is often just a ball-park value, in the sense that it is not derived from a market value but what does the budget yields. This is as unscientific as it could be.*“ (#D3.1, translated by IT)

BD managers in companies described the quest for valuable knowledge as targeted. Scouts are well informed about recent publications, and the academic affiliation of opinion leaders. However, the unexpected emergence of inventions let them seek thoroughly. Scientific journals provide an easily available source of information about ongoing research in a specific field. Due to protracted peer-review procedures and long patent application processes, the search is yet focused on up-to-date sources, as for instance presentations on conferences and symposia to meet opinion leaders. Presentations allow scouts and BD managers to learn about the value from a technological and scientific viewpoint. First, they make sure whether the invention adheres to the company's product portfolio and pipeline. Second, they are able to assess the originality of the research outcome and the prospectives of a drug candidate for preclinical and clinical development in a preliminary way. Furthermore, they find out more about the amount of test data available (group #D2.1, #D3.1). However, patent and university policy typically impedes the disclosure of plenty technical data by scientists in the public sphere of a conference. Hence, BD managers have incomplete information about the value of the technology.

A first freedom-to-operate analysis also serves as a device to detect patents and inventions, which may have a high blocking value for companies. Even in the early and vague stage of the drug, pharmaceutical companies are inclined to secure advantages over competitors. If a roadblock is detected and the patent has a blocking value to the company, they inquire an exclusive license as quickly as possible (group #D3.1). However, as we will see in chapter 5, this instance is not typical for early stage drugs.

### **Financial negotiations and the most critical stage: Sharing similar assumptions**

While TTO managers benchmark comparable deal terms for similar technologies before they enter in financial negotiations, comparable technologies play a minor role for companies' valuation of technologies in principle. Comparable deals are less decisive for companies. And so TTO managers aim to tie their economics to the company's success in the due diligence process (group #S3.1). When a technology needs significant development, negotiating financial issues is a matter of setting payments in different agreements, as for instance material, service and licensing agreements.

Important deal terms in license agreements apply to revenues from sales and the company's success in the clinical stages. Negotiating royalty percentages of company's income or revenues from sales was described as the easiest part of the finan-

cial negotiation because “most universities ask for something between 5 to 10% in licensing [for drugs, IT], and so we simply stay in this area” (#S2.1). Royalties are reported to be based on industry standards and some TTO managers referred to “reasonable notions” in royalty payments. High upfront payments are often not easy to achieve when decisive data from in-vivo tests for DMPK are still lacking (group #S1.1).

Valuation and pricing of patents are a major reason for the termination of transaction processes before the completion of a deal. How and why does this happen in the early stage of the technology? The most critical point consistently mentioned by interviewees, either small or large organizations, was the assignment of numeric values to patents in financial negotiations using future-oriented valuation approaches. Conventions on royalties do exist as a percentage of data which is still missing at this point in time. As opposed to a sale of patents, licensor and licensee can widely omit discussions about the price of a patent that has to be paid at once. However, managers on either side can not entirely evade discussions about numeric figures and calculations of a patent’s value because the investment decision is ultimately dependent on a fixed figure and benchmark.

*“It is less the issue of milestone-payment, upfront-payments: yes or no. But rather the question that one says 500,000 upfront-payment and the other side says 5 million. Then you have a gap with a factor of 10.” (#D2.1, translated by IT)*

*„But if they argue and one says it costs about 100 million and the other, it cost 10 million, then they will never agree.“ (#D3.1, translated by IT)*

Managers on either side report that discussions about a patent’s value stem from enormously different ideas about payments. This renders financial negotiations difficult. The clash of ideas results from different assumptions in the financial models that both use. It can be a reason to break up the negotiation process ultimately when both sides are not willing to understand the underlying assumption of the other party.

Licensees and buyers typically have more information about product markets than universities do because they are closer to the product market (group #D2.1, #S2.1). As they bring the patented technology to the marketplace they possess crucial information about development projections, regulatory procedures and manufacturing capacities. The fundamental lack of information about the future can be partly mitigated by internal planning data of licensees. Consequently, licensees have an advantage over universities which result from specialization, labor division but also a lack of resources to keep track of details.

*“Companies know that universities have limited resources and are likely not to do market research on size, pricing, etc. but we all know at least a little. We know cancer is big. The challenge for the TTO is to position the technology and communicate its status clearly so the company knows what the risks to development are without doing much diligence.” (#S2.1)*

High risks in subsequent clinical stages but also the lack of decisive information may contribute to the tendency of BD managers to attribute a significantly lower value to patents than TTO managers do (group #D1.1, #S2.1). BD managers characterized some TTO manager’s idea about a patent’s value as unrealistic and not market-conform. Universities have scientific-technical information and TTO managers operate with retrospective approaches to determine the value of patents. Companies use information from internal R&D projects and data on prospective markets (group #S2.1, #D3.1). Both sides possess and operate with different information and thus TTO and BD managers make different assumptions in the valuation. The information that either of the side has marks two viewpoints from which seller and buyer judge the value.

The difference in viewpoints on the value of the patent results from structural but also from processual conditions. Each phase of a transaction entails different valuation criteria of a patent. In the due diligence process scientific quality criteria play a vital role and the scientific viewpoint on the patent’s value is stronger because the investigator is still involved. As soon as both parties enter the financial part of the licensing negotiations financial criteria, regular and upfront payments come into play. In the final legal part, the amount of payments has typically been set, and the rights and obligations of both parties are now further specified. Since the patent application is either provisional or not fully pursued, the breadth of patent claims seems to play a minor role for pricing, if at all (group #S2.1, #D3.1).

For pricing, future-oriented valuation methods, notably the NPV and real option-based methods, are guiding. Interestingly, the calculation of a NPV is rarely regarded as applicable by the managers, but at the same time, TTO and BD managers both consider future-oriented valuation methods to be the most adequate form to value patents systematically. As royalties derive from future sales or income, the NPV is in fact relevant even though the assumptions used are imagined results of future market conditions, and the range of future outcomes is not objectively given to the parties. When managers clarify details of the business plan, they form expectations of the development of costs and prospective sales volume for the next five years. Both parties discuss the base of their assumptions in the financial models but at the same time they are cautious not to reveal too much confidential information (group #D2.1, #D3.1).

*“Then you have to stop eventually to be able to clarify what assumptions were used in the calculation, why is it more or less. And what assumptions were used by the other party. Only when both sides agree upon the underlying assumptions for the simulation of a market and a number of future revenues, you can achieve an agreement.” (#D2.1, translated by IT)*

*„And if you say, ‘okay, I’ve understood, if the market is developing in this direction and you will believe me, then you get something out of 2 billion in revenues or what pharmaceutical or diagnostic offers.’“ (#D3.1, translated by IT)*

The managers also reported that conversations on expectations about the remaining time span until the commercialization of the drug, which is another ten years after all, are restrained. Such conversations serve to “envision the long future“ (#S3.1) or to interactively build scenarios about possible outcomes (group #D3.1).

#### **4.6.2 Cooperation problems in patent transactions at the late research stage**

Cooperation problems arise in different phases of the transaction and they come into play when TTO and BD managers approach each other in the search of the right licensor and licensee, exchange confidential information and negotiate and renegotiate legal issues.

##### **Approaching and contacting each other**

TTO managers more or less actively identify companies that might be interested in the invention through extensive databases developed in-house, commercial databases, industry contacts and support of the scientists. They reported that they typically know the companies active in the field, their clinical pipelines and projects. They use expensive commercial databases on pharmaceutical projects as well as free databases by the National Health Institutes to find information about existing clinical trials in which potential licensees are involved (group #S3.1, #S2.1). Furthermore annual reports of companies usually document current and planned R&D projects and the success of clinical trials. This information source is valuable to the TTO managers. For instance, if a company develops a number of candidates in clinical phase III and IV, which understandably requires high financial resources with a still uncertain outcome, TTO managers assume that the company is less willing to make further investments in early stage drugs. Hence, these sources are also valuable to identify companies which are potentially interested in a given therapeutic field.

Since the investigators and TTO managers often act jointly in the contacting stage, the provision of information by the scientists regarding potential licensees is important to this process. TTO managers mentioned that often the best potential licensees are those already known to the scientists. Consequently, scientists are encouraged to



give TTO managers old copies of materials from meetings they attended, and any other information that relates to the marketing of the technology. If inventors inform them about competing technologies as well as the potential commercial advantages of the invention, the managers are in a better position to give a full and accurate picture of the technologies to potential licensees.

*“It's reported that 80% of university licensing deals begin with the researcher's relationships in industry. Your active involvement can dramatically shorten this process.” (Website Cornell University, 05/28/2010)*

Contacting ensues over a variety of channels and encompasses *active and passive marketing strategies*. TTO managers actively reach out to companies via cold calls and regularly distribute executive summaries of the technology currently available to BD departments. The information offered by inventors is used to compile these summaries with non-confidential information about the technology. Apart from that, TTOs occasionally host invention events to connect university and industry. These events are not limited to companies as potential licensees but they should also attract angle investors to start up a company and sponsors for university programs (group #S3.1, #S2.1). While scouts seek valuable knowledge they constantly contact scientists in hospitals and universities to discuss the potential of therapies and compounds. Inventions may arise unexpectedly but the field of research interest of academics, academic institutes and hospitals rarely changes without prior notice. Thus scouts are well informed about research activities in those institutions.

For contacting, TTO and BD managers take into account companies and universities known from prior or established commercial relationships as potential licensees and licensors but the search is not confined to those relationships. Approaching unknown universities or those that did not have former relationships with the organization is reported to be a key element in the contacting phase for both sides (group #D3.1, #S1.1). TTO and BD managers reported that market research is not restricted to local companies and industries, contrary to angle investors, but basically a global hunt. Scouts search internationally in global scientific communities and TTO managers distribute their executive summaries worldwide. In principle, companies and TTOs strive to broaden their quest to unrelated companies and universities, and the flow of information in informal social relationships plays an important role. BD and TTO managers usually have a similar educational background, and TTOs as well as companies strive to recruit managers who bring new connections and network relations with them. If those connections are not successful, TTOs occasionally hire intermediary brokers that help to establish further contacts to companies (group #S1.1, #S2.1).

However, throughout the contacting phase finding the “right company” and the “right manager in the company” was mentioned as a problem by TTO managers.

The rightness of a potential licensee refers to a bundle of issues that match up with the missions and goals of universities. Table 1 lists issues of concern mentioned by TTO managers and on TTO websites, though not in a strict order:

**Table 1: Issues of concern for universities**

	Issues:	Sources:
	The potential licensee's...	
1	intention to diligently develop the technology instead of parking for an indefinite time,	#S3.1, #S2.2, #S1.2
2	overall ability to commercialize the technology,	#S2.2#S3.2
3	intention to develop and commercialize the technology for the benefit of the public,	#S2.2, #S2.1
4	ability to obtain additional funding to support development of the technology,	#S2.2, #S1.1
5	ability to leverage its other activities to assist in commercialization of the technology,	#S2.2, #S1.2
6	to provide management and technical personnel,	#S2.2, #S3.2
7	business plan for commercialization,	#S3.1, #S3.2
8	prior and ongoing relationships with the university (and other licensees with non-exclusive licensing),	#S2.2, #S1.2
9	acceptance of license terms required by the university.	#S2.2

If a previous or current relationship to a company does not exist, TTO managers have a vested interest in the company's motives for licensing. Exclusive licenses usually oblige licensees to exploit patents internally but TTO managers fear that companies park the technology for a while. The willingness of a company to prepare a detailed business plan is regarded as a signal by the TTO managers that the company is seriously interested in a deal (group #S1.1, S3.1). However, the provision of solid information about product launch and the estimated total development time is laden with imponderables and depends on multiple organizational, regulatory, clinical and production-based factors. As a consequence, crucial parts of the business plan remain rather vague and provisional than definite. Thus, the signalling function of the business plan is regarded as imperfect (group #S3.1).

Beside the vague information in business plans TTO managers are typically confronted with small numbers of companies seriously interested in a less advanced technology. Competition is a term that was hardly mentioned by the managers. Even TTOs of the third group characterized the typical bidding process as non-competitive and bidding wars for patents as an "attempt" or "ideal situation [...]" because this is a market where you typically don't have more than one bidder." (#S3.1).

Finding the right manager in large companies is aggravated by two circumstances. First, a variety of departments is involved with licensing, and the BD or IP depart-

ment is not always the most qualified addressee for executive summaries. In some cases, TTO managers approach a good deal better when they reach a revisor in the R&D department directly. Second, pharmaceutical companies rarely announce details about the person in charge that a TTO manager could address. The identity of scouts is (unsurprisingly) not disclosed to the public, and TTO managers are provided with scarce information about the department in charge and the licensing process. Pharmaceutical companies release exposures that list therapeutic areas of interest but this information is very general (group #S1.1).

Contrary, TTOs strive to make themselves visible in the public domain and provide comparably comprehensive information about university policies, licensing procedures, the staff, contract templates and industry concerns. The BD managers did not indicate problems in finding the right contact person in TTOs. Instead they are concerned about encountering less qualified and non-professional personnel in a TTO who put the patent application procedure at risk. If TTO managers hamper the patent application process, strategic patenting is not possible. BD managers regard this step as vital and thus they judge TTOs and universities with respect to a professional conduct of the patent application.

*“And then you eventually get a call, so that almost only happens with universities, especially Non-American universities, you get a call from the respective manager, and he says, ‘Well, we do not know how this could happen. But the journal brought this article forward because there was an article missing in the previous edition. And unfortunately, this article is published now and therefore the entire procedure fails because it was not yet being patented.’” (#D3.1, translated by IT).*

Apart from these concerns, BD managers seem to be focused on finding the right technology and competent scientists. The commercialization strategy of TTOs and universities play an inferior role.

### **Contract negotiations**

Renegotiation and termination of the contract was mentioned as a minor problem by TTO and BD managers. BD managers usually contact the TTO when milestones are not met and key figures in the business plan changed. TTO managers get in touch with the company if regular reports and payments are lacking.

The termination of the contract is another option. TTO managers mentioned various reasons for a termination: The refusal to pay on the part of the licensee, parking instead of developing technologies, bankruptcy, termination due to an unsuccessful product line, unanticipated change in the product portfolio as typical reasons for the termination. About the half of these reasons is subject to a breach of the contract whereas the other half is caused by exogenous factors. However, in many cases the termination is regarded as last option. And only if both parties are not willing to approach each other or refuse to comply with basic terms of the contract the transac-

tion is at stake. TTO and BD managers are aware that they jointly enter a long path with an unknown outcome. Renegotiations and the termination of the contract are obviously regarded as a less difficult part of the transaction because they are considered to be an integral part of the transaction from the outset of the negotiations. Both parties acknowledge that a patent transaction is a venture that requires confidence and substantial investments in the business relationship.

*“A license agreement is like a marriage for several reasons: First, after the whole flirt is over we will have to live with each other for a long time. Secondly there is going to be, particularly with early-stage technologies, there are a lot of unknowns in the future and what you are going to work together that comes out. Third, like a marriage getting out of it is a lot harder than getting into it and only the lawyers get rich.” (#S3.1)*

In summary, contacting and exchanging information could be identified as cooperation problems that affect TTOs and companies to different extents. Which uncertainty, however, is most likely to terminate a transaction process? In contrast to valuation managers mentioned more and diverse issues but most salient appeared to be warranties and indemnification in legal negotiations. The key clauses involving warranties, indemnifications and representations refer to patents, IP and protected know-how.

#### **Critical point: Warranties and indemnifications**

Potential licensees are promptly affected by the non-issuing of patents and opposition proceedings after the grant of a patent. In the long run, an issued patent lapses and protection of know-how is no longer given. Whereas the latter incidence does not harm the licensee because licensees are no longer obliged to pay royalties and universities also supply know-how for free, problems arising from the first incidence may impair the performance of licensees. BD managers reported that the procedure of patent application is an issue of concern. In general, TTO managers are responsible for the patent application. Yet, they hardly ever assume liability for complete and error-free prior art research and warranty for a flawless patent application. Only if the non-issuance of the IP can be attributed to a wrong conduct of the university, companies have a chance to receive indemnification.<sup>93</sup>

Public US universities have rigid regulations concerning warranties and indemnification in licensing that aim to diminish liabilities. These regulations obviously do have an impact on legal negotiations in patent transactions. TTO and BD managers attribute difficulties in negotiations to a lack of flexibility on the part of the university. More often than not companies need to accept terms by the licensor.

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<sup>93</sup> For instance according to German law: §§ 281 ff., 280 BGB.

*“[With the regulations, IT] it is what it is, and there is nothing I can do about it, take-it-or-leave-it [...] and some [firms] can change. Everything else: treat the deal as a whole and horse trade: if you don’t have upfront money, then we want a larger share of sublicensing revenues. If you need diligence flexibility, we get more oversight. Things like that” (#S2.1).*

In a very strict sense, public US universities do not extend warranties and representations as to the validity or scope of patents. They do not guarantee that a university license agreement and anything made and used under the license does not or will not infringe IP of third parties. Furthermore, universities often do not assume obligation to bring or prosecute suits against third parties (group #S2.2). The obligation and right to prosecute is relinquished to the exclusive licensees. In return, university policy requires that the licensee does not harm the university and its staff.

*“LICENSEE agrees to indemnify and hold harmless LICENSOR, and all staff, agents and employees of LICENSOR and LICENSOR’s agents and contractors, from and against any and all claims, damages and liabilities, including legal fees asserted by third parties (whether governmental or private) arising from the manufacture, use or sale of any Licensed Product by or for LICENSEE, or arising from the use of any such Licensed Product by any third party, including any consumer or any customer of LICENSEE.” (Option agreement, University of Maryland)*

More than universities, companies are directly affected by the negative effects of a patent infringement. BD managers want to know whether third party’s IP rights are known to the TTO managers at the time of the contract which could cause to impair the grant of a patent or prevent a freedom-to-operate maneuver (group #D2.1, #D3.1). Yet, TTO managers regard such an engagement as a part of a company’s diligence (group #S2.1). To guarantee that any third party rights are not known to be detrimental to the licensed patent, TTO managers would need to observe the ongoing production of ideas and to monitor patents on a continuous basis. This requires skilled personnel and resources that most TTOs lack.

Less disputable clauses refer to the economic exploitation of patents. For obvious reasons, universities do not extend warranties for economic exploitability and profitability of patents. A variety of court decisions in Germany have found such liabilities to be undue (e.g. Bundesgerichtshof 03/15/1973, Bundesgerichtshof 11/26/1954). In the legal part of negotiations, clauses about legal uncertainties dominate as point of contention. Those clauses appear to present the contractual part that is stipulated and documented in detail by the universities (group #S1.2, #S2.2).

#### **4.6.3 Interaction of valuation and cooperation problems**

##### **The fear of the “Winner’s curse”**

The winner’s curse is not vital in the early stage. In general, the parties use non-disclosure and option agreements to prevent the leakage of information among com-

panies. Moreover, TTO managers reveal confidential information stepwise over the transaction phases with general information in the beginning and details in the course of the contract negotiations. Usually, companies and TTOs strive to avoid parallel negotiations with multiple parties to demonstrate confidentiality. Due to the small number of potential licensors and licensees, mostly one candidate enters the due diligence phase if at all. In this stage a competitive situation usually does not exist (group #S3.1, #D2.1).

### **The fear of unexpected inquiries**

To be successful, TTO managers usually strive to reach as many potential licensees as possible. Responding to unexpected inquiries is part of the job of TTO managers. In some instances, however, companies aim to license technologies in to prevent roadblocks or, more general, to block rivals. In this case, the development of a drug candidate is either not intended or plays a secondary role. As we will see in chapter 5, companies act fast if they come across a roadblock. As BD managers approach TTOs they will be confronted with licensing strategies of TTOs that strive to provide non-exclusive license contracts for key technologies and attempt to prevent the non-use of the technology. If BD managers contact TTOs directly without contacting the inventor and express urgency throughout the transaction phases, they signalize their intentions to the TTO managers. TTO managers are aware about this situation (group #S3.1, #S1.1). Since they act on behalf of the university regent, they are supposed to examine the intention of firms thoroughly. In doing so, TTO managers attempt to prolong the first phase in order to encourage the firm to diligently assess the technology. Additionally, they strive to ask for details in the business plan (group #S3.1).

## **4.6.4 Interpretation of the results**

At this point, I come back to the research questions and propositions.

- 1. How do TTO and BD managers value and price patents when some relevant information is not available in principle, while other information is available?*

Future-oriented calculation methods and the attempt to relate patents to the product market are accepted for valuing and pricing. Many parameters - except for upfront payments and patenting reimbursement - refer to the future, as for instance milestones for the licensee's performance or royalties from sales. However, the calculation method is conventional and highly contingent at the same time. The conventional part comprises a normative span of royalty percentages for the licensor predefining the room for negotiation. The contingent part relates to future market scenarios from which sales and profits arise for both.

2. *How do the managers value and price patents in the light of a high variety of possible valuation criteria?*

For the TTO, valuation tends to be backward-looking whereas for the company valuation is foremost forward-looking. Pricing requires a common ground for profit sharing and a tacit agreement on a specific valuation method on which pricing is based. Interestingly, pricing combines backward and forward looking methods with industry specific conventions. Market data from comparable technologies help to categorize the technology and to figure out how the market has priced similar technologies and projects in the past and present. However, these data rather serve as orientation and as initial point for the financial negotiation than as a fixed price list.

3. *How do the managers find the right technology offered or required by the most appropriate licensor and licensee?*

A variety of devices come into play when TTO and BD managers search and contact one another. Most effective are personal devices. The practitioner networks from university-industry collaborations and cognitive networks in the scientific community and personal networks between TTO and BD managers are most helpful here. Inventors are asked to contact fellow researcher working in industry and vice versa. Impersonal devices are foremost efficient. Notably prominent conferences and symposia with exclusive access play a vital role in the contacting phase. They can be understood as “appellations” (Karpik 2010: 45) because they guarantee that the research outcomes presented on conferences are rooted in the mandatory use of scientific knowledge production and belong to a specific research field. At the same time, they also serve as a “confluence” because they bring together different members of departments involved in licensing. Whereas scientific conferences are open to a wider audience, partnering events are often initiated by an intermediary organization. Partnering events offer dating services that permit managers and inventors to exchange confidential information. Numerous BD and TTO managers from different organizations meet one another in an exclusive sphere which often allows to communicate with more than one party. Less successful are executive summaries of the technology and online technology platforms.

4. *Which information is suspected to be held or hidden by the other party? And how do managers cope with hidden information in financial and legal negotiations?*

In the due diligence phase, BD managers and the R&D personnel of the company audit the technology. Furthermore, inventors are often asked to advice the company in specific subject matters. The scientist is knowledgeable in the respective therapeutic field while BD managers are often better informed about the development stages and the product market. Both parties basically possess different kind of in-

formation that is more or less confidential. Yet, negotiations are more affected by procedural uncertainty about how to value the patent and the fundamental lack of information about the drug candidate and patents. Both aspects are exogenous to the transaction.

Due diligence leaves room for strategic action (Parr 2006). Thus, TTO managers can not be sure about the intention of the company to develop the technology further, while BD managers do not know the general willingness of the TTO managers to renegotiate parts of the contract if the exogenous conditions change. As both sides are confronted with hidden intentions, a long-term contractual relationship in the light of high fundamental uncertainty and procedural uncertainty can only begin when licensor and licensee trust each other.

5. *Which valuation and cooperation problems interact? (The role of the “fear of a winner’s curse dilemma” and the “fear of unexpected inquiry dilemma” revisited)*

The fear of unexpected inquiries seems to be justified only in rare cases. If companies detect a roadblock in the late research stage that seems to be vital, they contact the TTO directly. Since companies do not necessarily intend to develop the technology further, TTO managers are cautious about urgent inquiries on the part of the company. As long as TTO managers are aware of this conflict and take the mission of the university seriously, this instance does not affect the reservation value of the licensor. If not, the managers are inclined to raise the reservation price (group #S3.1). This finding, however, is subject to further qualification.

6. *Which parts of the licensing contracts are more thoroughly negotiated? And why?*

The empirical findings provide evidence that the legal part of the negotiations is most thoroughly negotiated. Both parties must be willing to commit themselves for a long time. TTO and BD managers obviously focus their negotiation on specific points, notably legal uncertainties. However, the stumbling stone in legal negotiations often refers to the rigid regulations of universities about warranties and indemnification. Companies must accept university policy otherwise they cannot reach an agreement. As opposed to the financial part, the stipulations do not give much room for negotiations. Yet, this part is reported to be long-lasting because the parties often do not agree on contractual details. In the contract, licensee and licensor regulate rights and obligations if a third parties’ infringement of the patent will be discovered. The costs of a potential settlement can be roughly estimated but the outcome of a dispute is uncertain. In the legal negotiations licensor and licensee determine how the costs of a settlement are to be split when the patent collides with other rights. Both parties specify how profits from successful litigation are shared among them.



The financial part is described as difficult but foremost with regard to the clarification of assumptions to arrive at a shared judgment about the patent's value and price.

7. *What are the most severe uncertainties that TTO and BD managers face in the transactions?*

As the last sub-chapters show, the most severe uncertainties refer to commonly shared assumptions of prospective developments and risk sharing between the parties.

At this point, the findings should be analyzed with a view to confront, extend and modify the propositions 1 to 4:

*Proposition 1: If TTO and BD managers value and price the provisional patent and early stage compounds they do not strive for a systematic valuation. Furthermore, they do not aim at arriving at precise predictions on the net price value. Instead they strive for a bilateral contingent solution which is based on their subjective valuation principles and is subject to renegotiations in the future.*

TTO and BD managers act pragmatically in the valuation because they understand that the calculation of the net price value (NPV) is restricted. Yet, it is interesting to observe that TTO and BD managers nonetheless strive for a systematic valuation of patents.

This is plausible for two reasons: First, it seems logic for both sides to derive the value of the drug candidate and the provisional patent from future conditions. From the viewpoint of the licensee, a forward-looking valuation of patents is necessary for decision-making because any risk arising from further development can be integrated into the NPV and real option-based models. Yet, fundamental and procedural uncertainties are inherent in the calculation process when information is basically lacking. Second, in order to arrive at a commonly shared base for pricing, both parties have to approach each other. AUTM and LESI do provide sweeping lists on average deal terms of previous transactions which could serve as shared information. Commercial providers of databases offer more sophisticated information, including company and industry data, which both parties could use to make assumptions jointly for a market simulation. Yet, the calculations are perceptibly based on private information based on the manager's experiences, on informed guesses and internal budgets. Hence, a calculated NPV reflects the conditions of one of the two parties. A contingent solution for pricing can only be reached when both parties reveal the assumptions of their financial models or informed guesses to the other. In doing so, they will need to clarify the relevance of certain factors used in their models or guesses. As their judgments stem from different sources, they must explain their future scenarios and interactively make their ideas about relevant factors plausible.

To sum up, sharing the same assumptions implies that both parties share similar ideas and visions about the future despite different judgments.

Since sharing similar visions and ideas matter for pricing in the early stage, proposition 1 can be extended by integrating the managers' competence to communicate their assumptions and subjective valuation principles in the light of a fundamental lack of key data.

*Proposition 2: If TTO and BD managers negotiate financial terms, they primarily refer to the success of the entire development. Thus, the milestone payments of the project as well as information about product launch and related factors to product launch are the key subjects of the negotiation. Consequently, royalty rates play a minor role in the financial negotiations.*

The object of due diligence is not confined to the provisional patent but comprises the entire R&D project and the company's business plan. Companies gather information foremost to identify and assess material, services and know-how needed for a successful technology transfer. The business plan is indeed an important signal to TTOs, though it is recognized that such a plan is subject to change. Does this mean that royalty rates are not vital in the negotiations? The answer is no. The negotiation of royalties was described as haggling within an accepted span of 5 to 10%. Royalty rates are barely flexibly negotiable beyond this span in practice. Negotiating royalties is less difficult because TTO and BD managers obviously agree on industry-wide established royalty rates. This does not mean that royalties are not important to TTOs. TTO managers are rather compliant to the amount of lump sums than to minimum and running annual royalties because these payments are part of the regular income of universities. Thus it appears that royalty rates in conjunction with other kinds of payments serve as suitable instruments to handle information asymmetry and moral hazard problems.

*Proposition 3: Social networks play a significant role for overcoming cooperation problems. TTO and BD managers use different kinds of networks in the search of technologies. Furthermore, they strive to make licensing agreements with companies they know from prior transactions.*

The findings of this study have shown that proposition 3 is partly valid because the pool of academics is supplied by practitioner and personal networks that comprise experts in similar research fields. Additionally, scientific conferences and symposia and partnering events are relevant.

TTO managers reported that scouts rarely reach the office via the log-on button of web-based tools but prefer to contact preferably the inventor or the TTO manager directly (group #D3.1, #D2.1). BD managers reported that they use these sources but

do not really expect a new chemical or biological entity to be on a public or semi-public website.

*„But if you are looking for a blockbuster for your business, then you might also be looking in online platforms but you will not really expect that you'll find it there. Because you will not find the very product on the internet... because you do not get the exact data there.“ (#D3.1, translated by IT)*

And even if it was the case, the (preliminary) patent would be considered with caution and reservation (group #D1.1, #D3.1). Companies want to ensure that confidential information does not leak out to rivals. TTO managers define non-confidentiality of information on a general basis and specific non-disclosure requests of companies cannot be considered (group #S3.1). TTO managers remarked that bids on websites and open commercial platforms serve to make themselves visible to companies. The costs of bidding are reasonable (group #S2.1), thus websites and some online platforms are also used as marketing instruments that allow TTOs and universities to present the organization and the technology to the public.

Trade networks are often the first address to contact. Yet, the search is neither confined to acquainted suppliers of technologies nor to a small number of academies with international reputation. Given the unexpected generation of path-breaking drug candidates and therapeutic methods, the search for compounds or new biochemical entities is not restricted to the trade networks. Against the background of global competition in the pharmaceutical industry and internationally scientific communities in academia, licensors and licensees act internationally. Because both parties face a small number of potential licensors and licensees, they are open to reach out to other organizations. The dynamic setting of pharmaceutical let them search flexibly.

*Proposition 4: In legal negotiations, TTO and BD managers rely on a standardized set of contracts. The key point of the negotiation is the detailed form of the contract while the contractual frame is widely accepted by both parties.*

The results from the field study indicate that proposition 4 is basically valid but has some shortcomings. In general, the legal part of the negotiation is described as the most difficult and often long-lasting part. Many clauses used in licensing agreements between TTOs and companies are standardized in the sense that they address similar subject matters. However, the templates vary significantly from each other when public US universities and German pharmaceutical companies enter into negotiations. Difficulties in legal negotiations between the parties result from different policies on risk sharing, liabilities and management of uncertainties. University policy aims to shield academic institutions from damages that have their origin in the legal sphere. Universities seek to cede obligations arising beyond the first clini-

cal stage to industrial firms in order to curb legal uncertainties. Corporate policy of pharmaceutical companies is less rigid, though BD managers need to ensure that the patent filing procedure is prepared in a diligent way.

BD and TTO managers are usually assisted by assigned IP lawyers who set up the contractual details. Both parties seem to spend much time in negotiating details, as the financial compensation in the case of an infringement shows.

*“Surprisingly difficult is how companies and universities would split litigation recoveries. When I was on the corporate side, I thought it was ridiculous that we would spend an hour of time (in aggregate) going back and forth about who gets what in a law suit over infringements on a drug that needs 12 years to get developed.” (#S2.1)*

It is interesting to observe that both parties invest much effort in such conversation even though the likelihood of infringement is low over all compounds. One may best speculate why such issues are negotiated thoroughly. One reason may be that IP and IP licensing agreements are still the prominent field of lawyers and legal studies. Transactions rarely fail due to contractual details but they are still a major concern and stumbling block to the parties. Another reason is that the potential damage from the negligence of such details is enormously high once a blockbuster drug is successfully developed. Apart from that, legal negotiations also help to mutually envision eventualities that may arise in the contractual relationship. In the early stage of the drug, both parties are captured by high fundamental uncertainty about the technology and patent, and most often than not their concerns relate to exogenous conditions of technology and the market. By fixing contractual terms, both parties also learn about the perspective and concerns of the other side. Implementing both viewpoints also strengthens trust between the parties.

## **4.7 Discussion**

This chapter investigated valuation-pricing and cooperation problems that occur in patent transactions of a drug candidate in the late research stage. The analysis and results will be further specified in chapter 5 to learn about the effect of high fundamental uncertainty on valuation and cooperation problems in patent transactions.

So far, the findings showed that valuation-pricing problems come into play when TTO managers review the invention disclosure, BD managers seek valuable technologies of interest, and both parties negotiate financial issues. Cooperation problems arise when TTO and BD managers approach each other in the search of the right licensor and licensee, exchange confidential information and negotiate and renegotiate legal issues. The most critical point for valuation and pricing was the

assignment of numeric values to provisional patents in financial negotiations using a future-oriented approach.

Why is this problem so crucial? Future-oriented calculation methods offer a specific form of evaluation that imposes the imagination of future outcomes on both actors in the early stage. The communication about the assumption can be conceived rather as a discursive act that serves to agree upon assumptions than as haggling about them. When TTO and BD managers interact, the array of possible outcomes is interactively constructed by the licensor and licensee. Only if both parties intend to approach each other in their assumptions, the negotiation about royalties and other payments is successful. Numeric figures are relevant in the negotiation process for several reasons:

First, it obviously makes a difference, particularly for internal decision making, whether a company intends to invest in a product with expected revenues of hundred million or one billion Euros. A patent “is like a lottery ticket before the inventor has information on the quality of the invention” (Bessen/Meurer 2008: 104). The lack of information about the product market, however, is comparable to a lottery game with an unknown jackpot. In order to agree on a price both parties need to communicate about numbers. Second, measurable figures are obviously more likely to provide an objective base for negotiations than soft qualitative criteria. Numbers are results of market simulations or scenarios and they provide a metric measurement for calculations and bargaining. Yet, they are not hard facts. And they are obviously not treated as hard facts by the managers who make their figures plausible to the other party. There are reasons to assume that managers conceive and recognize the tentativeness and incompleteness of their assumptions. Third, in the financial negotiation process licensor and licensee reach each other through numeric outcomes of those models even if the underlying assumptions of a model may be grounded on a guess and a rule of thumb. The significance of future-oriented valuation methods could be interpreted as an attempt to near future developments by including the most realistic assumptions in the light of doubt and ignorance (Dewey 1998 [1938]). This process is rather an effort to gather the most robust data available in the early stage than to fit realistic conditions into financial models. The robustness and relevance of assumptions are judged by the experienced managers.

The managers mentioned various cooperation problems but agreed that warranties and indemnification in legal negotiations cause a major barrier in legal negotiations.

It seems that TTO and BD managers often operate between two poles:

*1. Acting fast versus acting confidentially:*

BD managers and scouts have various reasons to act fast in the contacting and negotiations phase. Global competition in the pharmaceutical industry and the quest for valuable and promising drug candidates are certainly key drivers for acting fast.

Furthermore, if a provisional patent seems to have a blocking value to the company - either as a roadblock or as a means to block competitors - BD managers inquire an exclusive license as quickly as possible. At the same time, they risk to signalize their intention to the TTO managers who fear that company won't develop the drug candidate further. Since TTO managers are aware about strategic motivations of companies (even in the early stage!), BD managers have to act cautiously as not to reveal their intentions.

TTO managers try to prevent a leakage of information among companies by using non-disclosure and option agreements. They often signal confidentiality to the potential licensees by avoiding parallel negotiations with multiple parties, though this performance is not necessary at all. In the early stage, a competitive situation hardly exists and so the signaling of confidentiality is rather a demonstration or even a social norm than a vital precondition to prevent a leakage of information.

*2. Global quest for technologies versus using the strengths of networks:*

TTOs rarely find more than one company for a given technology. This and the tendency for a stronger commercialization and acquisition of patents might explain why universities and firms consider a combination of social devices as useful. Both rely on personal and impersonal means of contacting, e.g. established practitioner and cognitive networks, conferences and online platforms which leave numerous options in a dynamic setting. Managers seem to know the global scientific community well and typically start their search of the right licensor and licensee from there. Thereby, TTO and BD managers strive to broaden their search nationally and internationally and take into account organizations they do not know from prior deals.

*3. Fixing financial and legal terms in long-term contractual relationships versus maintaining flexibility through renegotiations:*

Negotiating even simple agreements is a dynamic process. The timeframe of a transaction can vary with the complexity of the agreements, sophistication of the negotiating parties, priority of the agreement for companies and their response time and funding cycles. Licensing negotiations can endure three months to three years (National Cancer Institute 2009). Long negotiations also prompt companies to abstain from complex development contracts, particularly if they attempt to block the product launch of competitors in the early stage.

The empirical findings indicate that restrictive policies concerning warranties and indemnification on the part of the university are a major stumbling block. The stipulations should primarily protect universities from uncertainties and eliminate financial risks. Through this policy, the imponderables are shifted to the licensee. Companies must be willing to accept the basic terms stipulated by universities. At the

same time, both parties reckon that renegotiations do occur in the long run. Renegotiations and the termination of the contract were mentioned as a minor problem by TTO and BD managers. One may speculate whether the managers spend much time and long conversations in order to sort out as many potential problems and eventualities as possible right in the beginning of the contractual relationship and then choose to remain flexible to imponderables in the future. This question, however, was not explicitly addressed in this study.

Finally, the findings about restrictive policies indicate a clash between the private and public sector in legal negotiations. This clash cannot be attributed to uncertainty per se but to different policies and regulations that serve to absorb uncertainty in patent transactions. This and the role of the investigator in patent transactions will be further discussed in chapter 8.





## 5 Dealing with low fundamental uncertainty: Patent transactions at the clinical stage IIa

### 5.1 Introduction

The last chapter aimed to show that high fundamental uncertainty about the product and about the patentability of a compound has an impact on how patents are valued and priced and licensors and licensees cooperate. Thereby it was assumed that uncertainty can be differentiated ex-post into high and low degrees of uncertainty. High fundamental uncertainty is characterized by a lack of decisive information about the product and the patent, while the accession of relevant information over the preclinical stage indicates low fundamental uncertainty. The characteristics of the clinical pipeline suggest that the concept of uncertainty admits two different degrees.

This chapter deals with low fundamental uncertainty about the innovation and patenting process. It aims to explore low fundamental uncertainty in order to learn about the effect of high fundamental uncertainty on valuation-pricing and cooperation problems in patent transactions. So, even though the chapter deals with low fundamental uncertainty, the overall interest is in high fundamental uncertainty. It serves as a comparative case to the last chapter in order to validate the effect of high fundamental uncertainty on valuation-pricing and cooperation problems in patent transactions. It analyzes whether the set of valuation-pricing and cooperation problems detected in the late research stage of a compound still holds in the clinical stage IIa. Or in other words, it is asked whether *a decrease in fundamental uncertainty may also affect strategic and procedural uncertainties in the valuation and pricing of patents and cooperation between licensor and licensee*. In doing so, the chapter contributes to a broader understanding of the overarching research question.

The case study investigates transactions of patents on drugs which have a proven therapeutic value (phase IIa and beyond) and are deemed to be valid by opposition proceedings or are no longer pending. Throughout the preclinical stage and clinical I and IIa, information about the product and the patent accumulates, as I asserted (cf. Hägglöf/Holmgren 2009). With a shift to stage IIa, the constellation of supply and demand in patent licensing slightly changes. As chapter 4 highlighted, only a fraction of companies develop throughout all R&D stages and bring the drug to the market for products without taking into consideration in- or out-licensing of patents.

Contrary to the last case, transactions and transfers of patented technologies may take place in different constellations of companies. On the one hand, pure suppliers of patented technologies face either licensees without upstream R&D capacities (pure licensees) or licensees having those capabilities (non-pure licensees). On the

other hand, companies with downstream production capacities may act as licensor and as licensee likewise. Understandably, only pure licensors and licensees outsource R&D activities completely, while other firms may consider the in- and outflow of development outcomes as option (cf. Chesbrough 2006). In the course of this study, it turned out that valuation-pricing and cooperation problems differ along two constellations of transactions and companies respectively. Therefore the chapter focuses on two main constellations of transactions along the R&D chain:

- a) *Constellation 1*: The licensors lack downstream capabilities in the R&D chain; i.e. patent licensing transactions between companies as *pure licensors* (not having downstream R&D capacities) and either pharmaceutical companies as *pure licensees* (without upstream R&D capacities) or *non-pure licensees* (with upstream R&D capacities).
- b) *Constellation 2*: The licensors have downstream capabilities in the R&D chain; i.e. patent licensing transactions between companies as *non-pure licensors* and either companies as *pure licensees* (without upstream R&D capacities) or *non-pure licensees* (with upstream R&D capacities).

Similar to the last chapter, this empirical case relates to licensing of patents on drugs to be developed for profitable markets, e.g. cardiovascular, metabolic and neurologic therapeutics (Rang 2009b), and which are notably based on established small molecule technology. Platform technologies are excluded. The patent is the primary object of the transaction, though the transaction is usually embedded in a larger R&D project. It should be mentioned that the licensors are not in any case the patent holders. Consequently, the license contract may be a sublicense contract. For simplicity, problems arising from sublicenses are widely omitted. The research questions to be investigated for the clinical stage IIa are akin to those in the last chapter:

1. *How do BD managers price patents when relevant information, which was missing in the late research stage, is now available in principle?*
2. *How do the managers price patents in light of a high variety of possible valuation criteria?*
3. *How do the managers find the right technology offered or required by the most appropriate licensor and licensee?*
4. *Which information is suspected to be withheld or hidden by the other party? And how do managers cope with hidden information in financial and legal negotiations?*

5. *Which valuation and cooperation problems interact? (The role of the “fear of a winner’s curse dilemma” and the “fear of unexpected inquiry dilemma”)*
6. *Which parts of the licensing contracts are more thoroughly negotiated? And why?*
7. *What are the most severe uncertainties that TTO and BD managers perceive in the transactions?*

I attempt to show that with the generation of information about the innovative product and the patent, valuation-pricing and cooperation problems do not diminish but change in nature. An increase of procedural uncertainty is attributed to factors that are not directly related to valuation and cooperation, notably regulatory procedures, organizational hierarchy, the high value of the patent, high investments before product launch and competition in the market for products. The chapter aims to show that the accession of relevant information about the patent and the technology allows for a variety of strategic actions and interactions in patent transactions. Judgment devices help to reduce cooperation problems but in this stage, they become a strategic cue ball in financial and legal negotiations too. Future-oriented valuation models are acknowledged to be applicable but at the same time they become themselves an object of strategic action. Confidential information gains in importance and is suspected to be hidden from other market actors. The interplay of valuation-pricing and cooperation problems appears to be more vital than in the early stage of the compound.

The chapter begins with a brief description of the technical and institutional background of German pharmaceutical companies and typical patent transactions in the clinical stage IIa (5.2 and 5.5). This sub-chapter also briefly discusses the interplay of the market for technologies/patents and the market for products. Sub-chapter 5.6 aims to detect typical valuation and cooperation problems and critical transaction phases in the clinical stage IIa and partly beyond. To avoid recapitulations, contrasts to the late research stage are highlighted. The following sub-chapter (5.7) investigates whether and how similarities and dissimilarities between the two stages are caused by fundamental uncertainty. In the final chapter 5.8, the effect of high and low fundamental uncertainty on patent transactions is assessed and discussed.

## **5.2 Background of patent licensing in the clinical stage IIa**

### **Technological background and the valuation of late stage compounds**

The preclinical stage, phase I and IIa of clinical studies are designed to complete toxicological, safety-related and pharmacokinetic testing (Goffin 2009). In these stages, side-effects and efficacy of the drug are tested for the first time. The testing procedures must identify the most qualified drugs according to various pharmacoki-

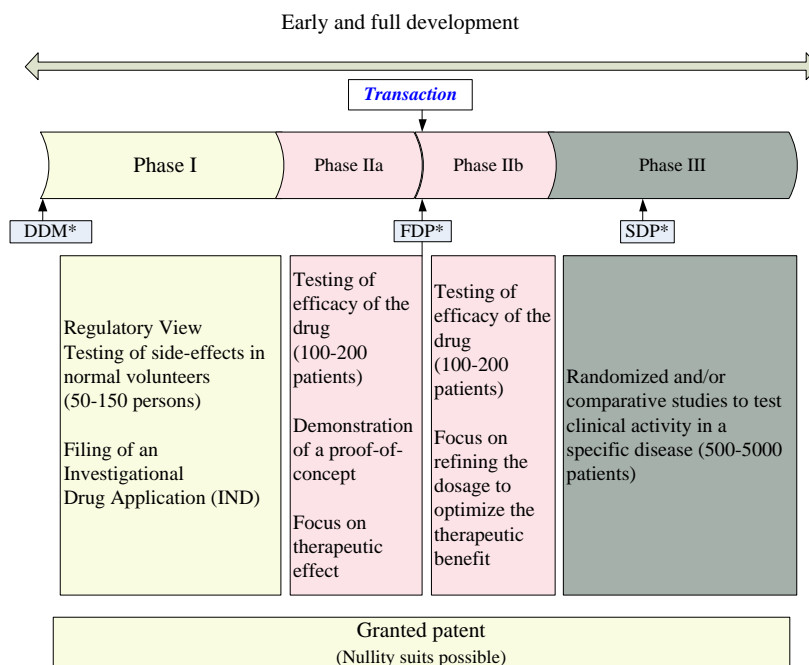
netic and toxicological criteria. Phase I should reveal side-effects in normal volunteers. Phase II, however, tests for efficacy of the drug which means that the therapeutic effect of the candidate is preliminary tested. The studies are stronger designed according to the characteristics of a specific disease (e.g. vaccine study, heart diseases and oncological studies) and thus, studies significantly vary. Phase IIa offers the opportunity to investigate side effects of drug candidates on a larger number of patients. If the compound is based on a novel mechanism of action, a first “proof of concept”<sup>94</sup> must be demonstrated. This proof sets a significant milestone for the development because clinical efficacy in man is obtained. Only if clinical efficacy in man is obtained and a first proof of concept for drugs is given the full development decision point (FDP) is reached. This point leads over to the subsequent more expensive clinical trials (Phase IIb, III and beyond). The selection process of qualified and unqualified compounds is basically continued, though with a lower number of drug candidates.

If the drug enters stage IIb and III, other factors influencing the project and the patent come into being. In general, stage II should be designed as precursors to stage III studies. In some cases, randomized studies with experimental and control groups may be conducted, or different doses of the experimental arm itself are tested (Goffin 2009). Phase III studies are randomized studies designed to test clinical activity in a specific disease on a high number of patients. Furthermore, stage III studies are decisive for regulatory approval and also critical in testing a specific hypothesis and proving efficacy and also effectiveness.<sup>95</sup> The difficulties are in selecting the appropriate patient population for this testing and in demonstrating a clinically meaningful and statistically measurable improvement in outcome (ibid.).

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<sup>94</sup> Proof of concept is reached with the full decision point (FDP) in clinical stage IIa.

<sup>95</sup> Efficacy measures how useful the drug is in the population. Effectiveness described how well the drug works in real life when patients are heterogeneous and aware of the treatment they get (Rang 2009c).

**Figure 7: The field of late stage patent transactions**

Based on Rang (2009a: 225), \*DDM= Decision to develop in man; FDP= Full decision point, SDP= Submission decision point.

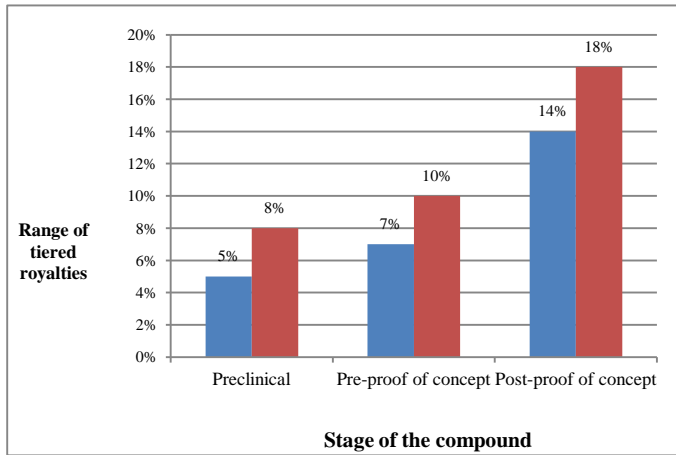
Contrary to the late research stage, the international (or PCT) patent application procedure is completed and the patent is granted by the patent office (EPO, USPTO etc.). In some cases, patents may have been challenged by an opposition proceeding. As indicated, an opposition proceeding is usually a touch-stone for the legal validity of patents. Thus, not all drug candidates entering the preclinical stage and their related patents will successfully attain stage IIa. For each new drug that is finally approved, roughly 250 enter preclinical testing and five reach human clinical trials. Even drugs in phase III trials fail and there is still a high level of attrition at subsequent stages. Thus, pharmaceutical companies seek to raise the percentage of compounds that succeed in clinical trials (Nicholson/Danzon/McCullough 2005). Since the 1990ies, there has not been a commensurate increase in Phase III drugs (Drews 2003).

The costs of clinical trails in stage III are highest across all stages due to the high number of patients required for testing and due to the drop-out rate in the initial non-randomized period. In the mid 1990ies, a clinical stage III lasted on average 3.5 years and the probability of passing of a compound is estimated to be about 67% for this period (Centre for Medicines Research International 2000; Rang 2009b). In

1995, the total costs of clinical trials in phase III per drug was about 170 million USD including the costs of failure (70 million USD) (ibid.).

The value of the drug and licensing payments increase between the late research stage and clinical stage IIa. The LES Biopharmaceutical Royalty Rates and Deal Terms Survey for the US and Canada 2008<sup>96</sup> reports that average tiered royalty rates for post-proof of concept drugs amount to 14-18%. This is a rise of seven percentage points in contrast to pre-proof of concept drugs in the late research stage (see chapter 4.2, page 103-107).

**Figure 8: Tiered royalty rates across different stages of the compound**



**LES Biopharmaceutical Royalty Rates and Deal Terms Survey for the US and Canada 2008.**

How are drugs and the respective R&D projects valued? The respective literature lists a number of tools ranging from unstructured peer review, scoring, economic models on the net price value (NPV) and internal rate of return (IRR), decision analysis based on multi-attribute utility theory, decision trees, risk analysis, and interactive methods as Delphi and Q-sort (Tritle/Scriven/Fusfeld 2000; Jacob/Kwak 2003). A pharmaceutical project is often modelled as a series of sub-projects where the results obtained from previous steps are decisive for investments in subsequent steps (Pandey 2003). Returns on investment are not reached until the drug is marketed in the product market. The probability of success at each clinical stage and in

<sup>96</sup> The survey includes an industry sample of 150 deals completed between 2006 and 2007. 28% of the respondent firms were pharmaceutical companies, 26% biotechnology companies, 35% academic institutions and 11% other. 90% of deals included US patent rights and 70% were worldwide.

market performance is usually assigned according to historical data, medical need and the pharmacological profile of the molecule (*ibid.*).

Valuation of R&D projects is commonly oriented to portfolio optimization in which a proposed project is considered concomitantly with other projects in a portfolio. In many cases, the NPV method is used to evaluate sub-projects, though this is often considered to be static because the method does not value the abandonment of projects and does not take into account managerial decision-making with project progression. Consequently, the NPV tends to undervalue projects (Jacob/Kwak 2003; Pandey 2003). Real option models are regarded as superior because they see projects as a multi-stage process with decision points at the end of each stage. Options cumulate and later investments are made only if results from previous stages seem to be satisfactory (*ibid.*). Other models are not optimization-based, for instance scenario building. This approach offers significant depth of analysis to selected strategic scenarios (George/Fabrid 2008). The aim of scenario building is to “clarifying present action in light of possible and desirable futures” (Durance/Godet 2010). The building of scenarios requires a tad of imagination and inspiration by actors (De Brabandere/Iny 2010).

#### **Institutional background and cooperation at the late research stage**

In the past decade, the German pharmaceutical industry has faced numerous political, regulatory, legal and financial challenges, ranging from changing health care policies, stricter and often unclear approval procedures, high R&D costs and expiration of patents on blockbuster drugs. According to a study of the Bundesverband der Pharmazeutischen Industrie (2005) on the situation of German pharmaceutical companies, the vast bulk of respondents (87%) judged the image of the pharmaceutical industry in the public as flawed. Many companies operate under instable conditions and are confronted with the dynamics of biotechnological innovation. In the long future, hardly any drug will enter a product market without the support of biotechnology in one or several clinical stages (Reiss/Hinze 2000; Drews 2003).

The German pharmaceutical industry is aware of two chances: The development of innovative products and new application fields through intensive R&D, and growth in foreign markets (Bundesverband der Pharmazeutischen Industrie e.V. 2005). In order to raise the percentage of compounds that succeed in clinical trials, companies are willing to incur high investments and to establish contacts with universities and companies worldwide. R&D activities are focused on compounds that are likely to generate a high sales volume. As indicated, pharmaceutical companies channel their investments and activities in areas where blockbusters are most expected. Projects are often abandoned if a high success is out of reach or if the project does not fit to the company’s portfolio (Centre for Medicines Research International 2000). This means that companies strive to overcome competitive compounds while

putting the main emphasis on fast worldwide development and on effective marketing (Drews 2003). The blockbuster-focused approach is often criticized, though it is rational since 70% of the industry's profits come from 20% of the drugs marketed (Grabowski/Vernon/DiMasi 2002). This highlights the importance of blockbuster drugs.

The identification of promising compounds brings about two interconnected problems discussed in the literature on pharmaceutical licensing: The supply of non-valuable drug compounds ("lemons") and motives of companies to license-out patents on drug compounds that still need further development. In the respective literature, it is commonly argued that licensors have privileged information about the patented drug while the licensee suspects the licensor to withhold information about the patent's value and to offer non-valuable drugs. Following the winner's curse dilemma described in the previous chapters, the licensor is thus inclined to lower the reservation value. Consequently mediocre drugs will prevail in the market for technology (Mason/Savva/Scholtes 2008). This assumption raises the question of why a pharmaceutical company wants to sell or license-out a drug. A reasonable motive refers to difficulties in financing a R&D project for small pharmaceutical companies. However, the company may well decide to get rid of a non-profitable project (Allain/Henry/Kyle 2010). Since drugs developed by small (biotech) companies are less likely to enter the product market than by a large company, small companies tend to out-license low-quality products (Pisano 1997). This finding, however, needs further clarification (Nicholson/Danzon/McCullough 2005).

Another background of patent licensing alludes to competition in the market for patented technologies and the market for products which has a substantial impact on the likelihood and speed of licensing a patent (cf. Allain/Henry/Kyle 2010; Arora/Fosfuri 2003). The following section briefly deals with the role of competition between firms and the interplay of markets for technology and products discussed in the literature. This excursion aims to elucidate why transaction constellations matter.

### **Excursion: Competition and the interplay of markets for technology and products**

Patent holders can profit from licensing their technology even to competitors - other factors being constant - if licensing revenues compensate a decline in profits that licensors would face in their own business on the product market. Arora and Fosfuri (2003) and Fosfuri (2006) explain the licensing propensity of patent holders by relating to "revenue effects" and "rent dissipation effects"<sup>97</sup> in a two phase game.

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<sup>97</sup> Fosfuri (2006) uses the notion of "profit dissipation effect"; the authors refer to licensing in the chemical industry.



Patent holders are forced to balance licensing and royalty revenues net of transaction costs (revenue effect) against a decrease in the price–cost margin and reduced market share due to increased competition from the licensee(s) (rent dissipation effect). Hence, in a competitive product market where rent dissipation effect is relatively small, companies show a higher licensing propensity. This is even the case when joint profits of incumbent companies are well higher in the absence of any licensing.

Based on Arora and Fosfuri (2003), Fosfuri (2006) argue that the trade-off between the two rents changes when many technology holders compete in the market for technology. More often than not technology holders compete in the product market *and* in the market for technology which is the case in constellation 2. Licensing technologies means a potential threat to the licensor when new market entrants appear in either of both markets. Thus, a monopolist in both the product and technology market is not inclined to license patents. If a new downstream producer enters the product market, monopoly profits shrink *ceteris paribus*. If the entrant holds a similar technology and opts to license this technology to a third potential entrant in the market for technology, the monopolist would face another loss in profits. Consequently, as the authors find, competition in the product markets can spur licensing activities and thereby generates a competitive market for technology as a side effect. Firms that normally would have not licensed their technology are likely to do so because the market of technology exerts competitive pressure on them.<sup>98</sup>

Additionally, if the market share of the licensor in the market for technology increases for whatever reason, the licensor is able to extract higher rents from the licensee due to greater bargaining power. Weaker competition in the market for technology, however, implies fewer incentives to license-out for monopolists. And it may also lower the incentive to license-in if the licensee has upstream production capabilities. The monopolistic or oligopolistic structure of product markets facing the technology recipient or user in a country renders the market for technology as a highly imperfect one (Contractor/Sagafi-Nejad 1981).

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<sup>98</sup> Fosfuri extends the scenario by assuming that the potential entrant could strike a deal with the second technology owner and ultimately compete with the monopolist in the product market. As a consequence, the monopolist might suffer both, eroded market share and reduced price–cost margin, and he does not receive any royalties because he has chosen not to license the technology. If the monopolist, however, would have offered the technology he had at least increased his profits on the market for technology under the condition that the new potential entrant lacks downstream production capabilities. The situation may also change for the licensee with the presence of strong competitors. He may expect future profits to decline and thus is less willing to pay for the technology (Fosfuri 2006). This situation may be mitigated when the technology is valuable and complementary assets exist.

### 5.3 Propositions

The results of chapter 4 indicated that the most critical point for valuation and pricing of early stage drug candidates refers to the assignment of numeric values to provisional patents in financial negotiations using a future-oriented approach. Cooperation problems arise when TTO and BD managers approach each other in the search of the right licensor and licensee, exchange confidential information and negotiate and renegotiate legal issues. Legal negotiations about warranties, indemnifications and representations proved to be major stumbling blocks. The latter issue, however, cannot be attributed to uncertainty per se but to differences in policies and regulations between the private and public sector which serve to absorb uncertainty in patent transactions. With lower fundamental uncertainty about the R&D process and about patentability some of these problems may be subject to change. The following propositions should mainly confront the findings from chapter 4.

#### **Valuation-pricing problems**

One may assume that the application of future-oriented valuation approaches in the clinical stage IIa is less challenging compared to the late research stage. The accession of information about the product and patent may mitigate valuation-pricing problems perceived by the managers. With a successful defeat of an opposition proceeding, the patent value is higher and also less contestable. The licensor is rather able to demonstrate the legal validity of the drug than before. The time span between clinical stage IIa to product launch is shorter and thus financial forecasting refers to a shorter period - approximately five to eight years. The marketing departments of both companies now focus on a few promising drugs instead of a high number of drug candidates. Efficacy of the drug has been proven by various tests and the product market is widely specified. The fundamental lack of knowledge about the value has decreased and the prediction of values may be perceived as less demanding by the managers. This circumstance may have an effect on the valuation problem. With more robust data, the calculation of the net price value (NPV) and the application of the option-based approach are facilitated and also pricing seems to be less demanding. If more relevant information about the good is available to the managers in principle, licensor and licensee are able to form similar expectations about the development of profits and costs. For the licensor and licensee, it seems to be more obvious that the other party does have specific technical information as well as more detailed information about the patent landscape from a second freedom-to-operate analysis.

*Proposition 1: The calculation of the net price value (NPV) is no longer perceived as problematic by the managers. Informed guesses and internal budget restrictions*

*lose their relevance. The managers aim at precise predictions on the net price value and strive for a bilateral contingent solution which is based on information available to them. The financial phase is less prone to fail than in the first case.*

In business practice the value of patents is often deemed to be subjective (Perez Pugatch 2004; Arora/Gambardella 2010; cf. Bidault 1989: 7) and patent holders often lack the necessity to assign a systematically and objectively determined value to a patent. The findings of chapter 4 indicated that licensors and licensees do strive for a systematic valuation in financial negotiations despite a fundamental lack of data. With an accession of relevant data, there are reasons to assume that both parties have more room for negotiating a price that is based on commonly shared or even objective valuation principles. In the light of lacking market transparency, calculations of licensors and licensees are based on private information about the use of the technology and about the costs of the negotiating parties (Arora/Gambardella 2010). In order to negotiate a price, it seems plausible that the parties either disclose at least a fraction of privately held information or apply other tactics to overcome strategic uncertainty.

*Proposition 2: If BD managers negotiate financial terms, they have potentially more and enhanced information available that is used in financial models. To negotiate a price that is based on commonly shared or even objective valuation principles, they reveal a fraction of confidential information.*

Apart from this assumption many other factors come into play in financial negotiations, e.g. the amount of other services and know-how that is transferred but also the bargaining power of the firms and their business objectives. These factors have a substantial impact on the price. Consequently, the value and price differ from company to company (Jacob/Kwak 2003) or deal to deal. The essential question is how the managers use their valuation models and how they approach each other in the process of pricing. It should be recalled once again that the actual success of the R&D project – measured by the cash flows from sales - remains unclear beyond the launch of the product because pharmaceutical companies must still reckon on a withdrawal of the drug from the product market. Hence, this uncertainty persists and is still perceived by the managers.

### **Cooperation problems**

The contacting of companies may cause problems to licensors and licensees in the clinical stage IIa phase, though this may differ in the two constellations. In constellation 1, pure licensors and pure licensees both may be better informed about the supply and demand of patents than in constellation 2 provided that they strive to commercialize technologies actively. In constellation 2, pure licensees will most likely

communicate a specific demand for patented technologies to the market (2a) while non-pure licensees may not accentuate the need for doing so (2b, see table 2). The role of judgment devices in contacting may thus differ in the two constellations. For pure licensors and pure licensees, a combination of personal and impersonal devices may be useful to outreach established trade networks. Less under strain to commercialize and acquire patents, non-pure licensors and non-pure licensees may not be inclined to assure that information about the patents circulated to the market is the same for everyone (Karpik 2010: 98). Since they face competitors in the market for technologies *and* products, they may have a vested interest in providing information about the good to a preselected number of market actors. Consequently they rather profit from personal devices than from impersonal devices. Personal devices, notably social networks, convey personalized knowledge, interpersonal trust and professional excellence by means of direct interaction and reciprocal behavior so that the circulation of knowledge is not the same for every market actor (Karpik 2010).

*Proposition 3: In the search of technologies, social networks play a pivotal role for non-pure licensors and non-pure licensees (constellation 2b) and a complement in constellation 1 and 2a. For constellation 2b, initiating licensing agreements with companies known from prior transactions is essential.*

In constellation 2, the essential point for the licensee is whether a potential licensor is willing to grant a license. If the licensor is a supplier in a non-competitive product market, which impedes licensing activities (Fosfuri 2006; Gambardella/Giarratana 2009), or if the licensor lacks information about the intention of the licensee, she may abstain from granting a license. The willingness to grant a license must be taken into account when testing proposition 3.

Chapter 4 found that warranties and indemnification concerning the patent application and the initial development risks are impeding factors in patent transactions. It was shown that licensors and licensees discuss these issues in detail before they commit themselves in a long-term contractual relationship. These factors may lose their vital role in the clinical stage IIa if a proof of concept is obtained and managers are better informed about toxicological effects and pharmacokinetic attributes of the drug. A company that adheres to previous milestones can demonstrate its capabilities and trustworthiness. In addition, the business plan becomes a better indicator for good performance. As the time span of the contractual relationship is shorter and the project more focused, managers may be less uncertain about a change in the contractual relationship and obligations. As a consequence, uncertainty about the right licensee and licensor decreases with the achievement of milestones in the project.

*Proposition 4: The development steps in the clinical stage IIa are clarified and thus a change in commitments is not at issue. Licensors and licensees have more information available to demonstrate and assess the capabilities of actors. For the managers, it is easier to infer from those information to the capabilities of the other party.*

Moreover, it is plausible that a change or shift in valuation and cooperation problems is overlapped by the impact of other factors: First, clinical stage III studies are critical and other sources of uncertainty arise which have an effect on valuation and cooperation problems: The right design of the clinical study to test and demonstrate the efficacy of the drug, regulatory hurdles, marketing and production-related uncertainties. To assess the risks of different issues, different departments from both companies are involved. Second, the high costs of further clinical trials may aggravate and protract financial and legal negotiations.

## **5.4 Methods**

The research of this chapter is focused on a qualitative testing of hypotheses. By qualitative testing, I mean that I assess the effect of fundamental uncertainty about the patent and the product on patent transactions by choosing a counter-case and thereby examine whether the research results still hold in this case. The counter-case is chosen to consider a variation in the explanatory variable, namely high and low fundamental uncertainty about the patent and the product. A variation of the explanatory variable in degrees of uncertainty serves to examine the effect of the variable on patent transactions (valuation-pricing and cooperation). The comparison of the two cases allows to confront the findings of the first case investigated in chapter 4 with a change in conditions (Creswell 2003; Gschwend/Schimmelpfennig 2007). The findings may be modified and their scope more exactly determined. Second, a comparative case extends the knowledge about fundamental uncertainty. In this chapter, the counter-case is connected to a change of the institutional setting, and thus other factors come into play. Qualitative research must yet be open and flexible enough to comprehend the complexity of the new setting and the interpretation of the managers (Flick 2002). Hence, the empirical setting of the counter-case also helps to assess the relevance of institutional factors, though they are not explicitly addressed. As in the last chapter, uncertainty is investigated from objective, subjective and transaction-related angles.

The qualitative research is centered on typical phases of transaction processes which comprise contacting, due diligence, negotiating financial issues, negotiating non-financial issues and renegotiating of contracts. As indicated, I considered two

main transaction constellations that involve four combinations of supply and demand (see table 2 and appendix 2).

**Table 2: Transaction constellations**

Number	Constellation
1a	Pure licensors (without downstream capabilities) -> pure licensees (with upstream R&D capabilities)
1b	Pure licensors (without downstream capabilities) -> non-pure licensees (with upstream R&D capabilities)
2a	Non-pure licensors (with downstream capabilities) -> pure licensees (without upstream R&D capabilities)
2b	Non-pure licensors (with downstream capabilities) -> non-pure licensees (with upstream R&D capabilities)

### Short case description of constellation 1

Pure suppliers of patents in the clinical stage IIa produce for a market for technology because they lack downstream capabilities. In many cases, pure suppliers are previously founded start-up companies, spin-offs of large pharmaceutical companies or a result from a joint venture. They are created to shift the technology to licensees on the market for technology, frequently in strategic alliances with other companies. Some small and mid-size companies are specialized in therapeutic fields and thus the pipeline is usually adjusted to the market niche in which the companies supply. Other companies are active in various biotechnological or diagnostic fields. The survival of pure supplying companies depends on a successful commercialization strategy and on the realization of a high price in transactions in the stage IIa.

Constellation 1a: Similar to pure suppliers of patents, licensees lacking upstream development capabilities rely on a flow of development outcomes from firms. Their success on the subsequent clinical stages is also based on in-licensing activities in stage IIa. Their motives for licensing often relate to the acquisition of projects. Besides, these companies may require a license if they potentially infringe upon a third party's patent.

Constellation 1b: For licensees with upstream capabilities, patent licensing is often connected to numerous strategic considerations, for instance a make-or-buy decision or the blocking of competitors on the market for products. As indicated, the awareness of external projects is often decisive about whether a company considers an in-flow of development projects or choose to pursuit development activities in-house (Chesbrough 2006). Competition and blocking appear to be important motives for these licensees. Since the licensees develop in previous stages, they compete with pure licensors in the market for patents.

### **Short case description of constellation 2**

In this constellation, licensors have upstream and downstream capabilities. The companies are typically large, have high economies of scale and scope and are thus capable to develop along numerous clinical stages. Transaction or transfer of patents within this chain of stages can be caused by various factors, e.g. a merger and acquisition, bankruptcy, strategic realignment of a partner or termination of the alliance. Hence, the transaction may not always be initially intended. If both, licensors and licensees have upstream and downstream capabilities, they are basically both active in the same market for technology and market for products (constellation 2b). So companies in this constellation are competing in two markets.

### **Data collection and data analysis**

With regard to the selection of managers and German pharmaceutical companies, I used the criteria mentioned on page 111. As information source, I used foremost practitioner interviews with business development managers (BD managers) from German pharmaceutical companies that license patents. In sum, I conducted interviews with 20 managers from small, mid-size and large German pharmaceutical companies. The interviews lasted between 30 to 100 minutes, with an average of 50 minutes. Additionally the sample covered three expert interviews with intermediaries involved in such transactions. Corporate reports and websites of companies served as a secondary source, notably for analyzing judgment devices. The questionnaire was much more focused than in the earlier analysis. The questions should confront the managers with the findings from the previous study so that I could finally examine and modify the results. To guarantee anonymity of the managers, the companies were made anonymous as well. Only company reports and information on websites are quoted distinctively as sources. I did not witness how licensors and licensees cooperate and value and price patents in real-time transactions.

The case selection and number of interviews are not evenly spread among the two constellations. In sum, I conducted more interviews with managers from companies active as licensees. Small and mid-size companies are overrepresented in the licensor sample. For the licensees, it was vice versa. Since I explain patent trading on the level of transactions and interactions between BD managers, I did not regard this incident as decisive.

In the data analysis, I used the qualitative content analysis described in the last chapter, though with a stronger focus on the effect of fundamental uncertainty on cooperation and valuation-pricing problems in exclusive patent licensing transactions. In principal, the data analysis proceeded in the same way as chapter 4 but the elaboration of differences and the comparison between the two cases were more pronounced. Furthermore, the analysis takes much more into account the difference between patent transactions in two constellations.

## 5.5 Patent transaction process at the clinical stage IIa

The following description is based on the assumption that patent transaction processes in the clinical stage IIa differ in transaction constellations, the size and the resources available to companies.

For pure licensors, selling and licensing activities are part of the company's core business. Small and mid-size companies often lack personnel for a directed commercialization of their products. In small companies, chief executive managers are more or less directly involved in the commercialization. In some cases, small companies are assisted by intermediary firms which strive to arrange patent transactions, to broker patents and to match supply and demand (see chapter 6 on page 183-220). In mid-size pharmaceutical companies, BD managers are usually responsible for in- and out-licensing in a number of clinical stages, and the same personnel is in charge of different types of transactions, e.g. strategic alliances and licensing without collaborations. Larger companies, however, usually have a labor division along the development stages. In clinical stages, scouts fulfill additional functions. They establish relationships to hospitals and are occasionally involved in networking with funding agencies to initiate further clinical trials (group #D2.1).

In the clinical stage IIa, contacting and contract negotiations between BD managers differ in some aspects from the same phases in the late research stage. A fundamental difference refers to the institutional setting of the transactions. BD managers on both sides are less concerned with different organizational goals and missions that relate to the relevance of social benefit, freedom to publish and the provision of funding. It is not surprising that policies of most companies on warranties and indemnification were not mentioned as a severe stumbling block in the closure of a contract, though transactions do fail in the contacting phase due to different licensing policies (group #S1.1, #S2.1, D2.1). Furthermore, many criteria mentioned by TTO managers are also vital for companies as pure suppliers, notably the ability to develop, produce and marketize the product, a business plan for commercialization and collaboration with the scientific personnel (group #S2.1., #D1.1, #D2.2).

Other differences relate to the search of suitable licensors and licensees, the role of freedom-to-operate analyses and internal approval by key decision-makers in the companies:

For licensors and licensees, scientific articles in peer reviewed journals, scientific conferences and symposia do no longer serve as primary information source. Instead, patent databases in combination with company information databases on pharmaceutical projects gain more relevance in the clinical stage (group #D2.1., #D1.1, #S1.1). Using these sources, notably pure licensors are able to find out who is involved in clinical trials of a specific therapeutic area and may be interested in a

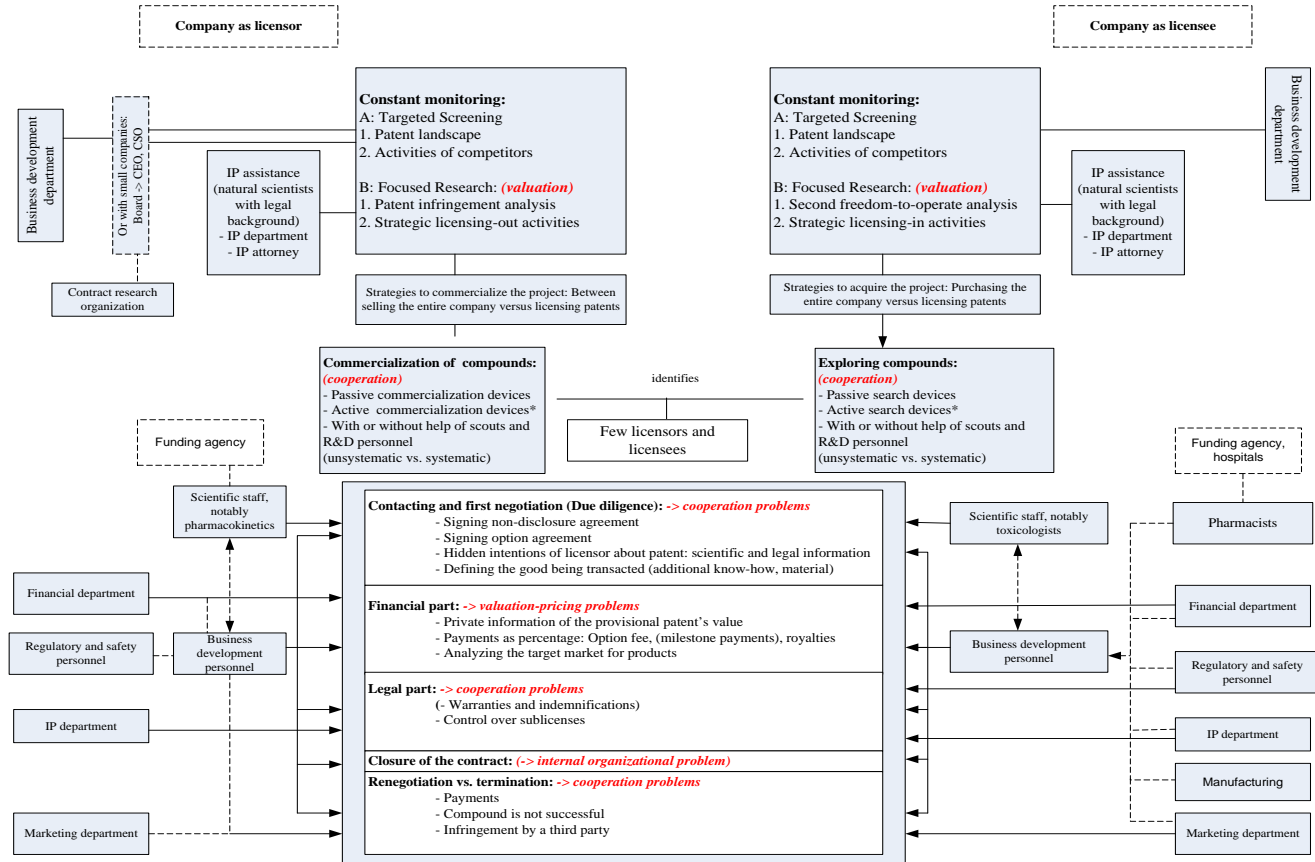


given project. They also assess if companies are not inclined to acquire a license (group #S1.1). However, scientific conferences and symposia are still an arena for informal contacting. Besides, partnering events offered by intermediary organizations remain important. In general, pure licensors approach licensees for the reasons that they intend to license-out or sell projects for profit. Non-pure licensors contact potential licensees for the same reason. In addition, they also offer a license if they find that a drug candidate has a therapeutic effect other than their commercial interest in the market for products. This is not a frequent case but it shows that patent licensing is a way to handle unexpected effects of drugs and at the same time making profit (group #S1.1, #S2.1).

While a first freedom-to-operate analysis in the late research or preclinical stage is often considered to be provisional, a second freedom-to-operate analysis in the beginning of the clinical stages is carried out with accuracy (group #D1.1, #D2.1). Basically, freedom-to-operate concerns become vital for potential licensors and licensees between the preclinical stage and clinical stage IIa. Since many drug candidates are withdrawn during the preclinical stage, the second analysis focuses on fewer qualified compounds. Companies are able to identify compounds that may become roadblocks to their products and they find out who is potentially infringing a patent because it is much clearer whether a distinct patent has a strategic value to the company or not. Consequently, the companies can best react between those stages to avoid roadblocks and to mitigate a loss due to patent infringement. If a roadblock is not detected before clinical stage IIa, the company risks a severe loss because the product will be blocked or a third party's right infringed. The patent holder can extort high payments from the infringer when he is able to prove a damage (group #D1.1).

Apart from these concerns, organizational factors come into play. BD managers reported that the internal approval of licensing deals is often protracted in the clinical stage IIa. Particularly if large companies negotiate, coordination between numerous departments is necessary to come to a final decision. The departments typically have different interests and express different concerns which may collide (group #S1.1, #D1.1, #D2.1). Thus, organizational decision-making processes are enduring. With an increase of the value of patents and higher licensing payments, the closure of a patent licensing contract is typically bound to the internal approval by many decision-makers (group #D2.1). On the part of the licensee, internal coordination results in another lag. The closure of the licensing contract is put to risk if the licensor suddenly decides to resign from his offer.

**Figure 9: Patent transaction process at the clinical stage IIa**



## 5.6 Valuation and cooperation problems at the clinical stage IIa

### 5.6.1 Valuation-pricing problems at the clinical stage IIa

In the clinical stage IIa, valuation-pricing problems occur when licensors and licensees refer to private information (1) and the parties agree on a price (2):

Ad 1.: Much more than in the late research stage, future-oriented valuation methods are used to negotiate the price, though they come along with different problems in the two transaction constellations. In constellation 1, licensees are aware about their advantage in valuing patents. They are closer to the market for products than pure licensors and they usually possess more relevant market data from which royalties are calculated. Consequently, they chiefly refer to their own data when valuing the patent and entering price negotiations. What is unknown to the licensor and strategically hidden to him, is often relevant for valuation and pricing the technology (group #D1.1, #D2.1). Pure licensors face similar problems as universities do in the late research stage, particularly if they lack personal resources to gather information about the product market. In constellation 2, this problem was obviously less emphasized by the BD managers (group #S1.1).

In general, industry-specific royalties are acknowledged and applied for pricing. BD managers reported that licensors and licensees usually agree on the most relevant parameters and recognize the benefits of option-based approaches to value projects and patents. Obviously, these approaches are widely known to the managers and shared among them. Finding a common benchmark or base for pricing and valuation for patents on drugs was described as problematic in special cases, for instance a second medical indication (group #S1.1, #D2.1).

Ad 2.: The calculation of the net price value is part of the daily activities of BD and IP managers. Similar to the late research stage, licensor and licensee often differ in their results. Yet, it appears that the difference is caused by different information which is used to arrive at specific assumptions in financial models. Valuation and pricing problems arise because of the confidentiality of private information and restricted access to it. A common ground for pricing refers to equivalent information and similar assumptions about current and future developments. So, how do licensor and licensee come to an agreement if they operate with private information that significantly differs?

Much more than in the late research stage, the systematic valuation of patents is a starting point for price negotiations. Financial negotiations revolve around numeric figures but at the same time, financial models are not fully revealed to the other party. Notably the licensee fears that if the licensor understands the architecture of

the models, she may infer parts of the confidential data from the models (group #S1.1, #D1.1, #D2.1). However, if both parties focus their negotiations on the outcomes of the models, they are not able to understand and reconstruct the valuation of the other party. Thus, both parties need to fill a gap. Two tactics of the parties could be identified:

- a) In financial negotiations, licensors and licensees seem to *beat around the bush* to finally find a common ground for pricing. This means that the parties approach each other by referring to general aspects of the financial model while ignoring confidential details. Licensor and licensee come to a common ground in financial negotiations by reasoning and hiding financial models at the same time.

*„They do not show the financial models to each other. They talk in general about how it looks like. What the results are, we have problems in this model here or there, how large are the difficulties. One gets a sense of what the other thinks, what is the basis for the model of the other. [...]. Well, but the basic assumptions, this is a new product that is a new version of an old product, such things are always clear.“ (#S2.1, translated by IT)*

*„Sure, some facts are exchanged: What kind of product, technology it is. What does the technology achieve, these are the tests that have been executed...and the results thereof. These are the hard facts you can always exchange for a particular deal. They [the parties, IT] never exchange everything. But the financial models usually remain hidden. Otherwise the other will recognize the true value of the technology and that his own valuation was too high. So, there would not be a negotiation. Then the parties never come together on a royalty percentage.“ (#D2.1, translated by IT)*

- b) The parties occasionally try to fill this gap by demonstrating their competence to value patents systematically to overcome a gap in the calculations. The *demonstration of competence* is a means to convince the other party of a systematic and diligent conduct in the valuation of the technology. Moreover, this tactic helps to prove that the value of a patent is objective and based on robust assumptions. A profound knowledge about comparable transactions is often a first step in the demonstration of competence.

*„Of course, we focus a bit on what the market expects. Because when you initiate conversations, you do not want to appear ludicrously. I do not want the reputation of our company [...] to be that I arrive with absolutely exorbitant figures that are totally unrealistic.“ (#S1.1, translated by IT).*

It appears that the first tactic (“beat around the bush”) is successful if both parties share a common stock of knowledge *and* information. The interviews showed that transactions in constellation 2 have a high chance to be solved by the first tactic. Managers reported that a competitive situation often facilitates financial negotia-

tions. Both parties are likely to share a common stock of knowledge and confidential information and thus, they are able to reconstruct differences in the findings but also to arrive at similar results. They come to an understanding without explicating details.

*„No, with rivals it is actually easier to negotiate. It is much easier in contrast to universities and start-ups and other companies. [...] Because the competitors are familiar with the market conditions, they show up with reasonable numbers and they are able to understand our assessment. With rivals you can best negotiate and talk. They do not suggest exorbitant values. And to press home an advantage has its limits too. You always meet twice.“ (#D2.1, translated by IT)*

Notably in constellation 2b, the negotiating parties do not need to disclose confidential information if they agree on basic assumptions. If both parties have a common stock of knowledge *and* information, it is not necessary to demonstrate competence in the financial process.

For pure licensors and licensees (constellation 1 and 2a), however, the second tactic (“demonstrating competence”) was described as an adequate tactic to start with financial negotiations. Since the parties act on different markets, they are likely to share dissimilar information and assumptions. So, they must find another solution. Pricing is ideally oriented to a systematic valuation of patents with room to haggle within an accepted range of royalties and concessions on both sides. Similar to the early stage transactions, comparable transactions are the starting and anchoring point in the negotiation process. This process leads over to the explication and reasoning of different results which are based on private information. If both or either of the parties is not knowledgeable about the product market or less able to assess future developments, conversation about general assumptions are not rewarding (group #S2.1, #D2.1). The final result of the pricing process is dependent on how well the parties are able to convince the other side of a systematic and objective conduct in the valuation. Thereby, exaggerations and a forceful demonstration of a high value are regarded as detrimental because this signals incompetence and ignorance about the real market conditions (group #S1.1, #D2.1). In this case, financial negotiations are prone to fail if either of the two parties neglects a systematic and comprehensible patent valuation in principal.

It appeared that the establishment of a common ground for valuing and pricing is important in the financial negotiations and patent transactions in general. If BD managers approach each other with this regard, they are typically more willing to make mutual concessions in financial and legal negotiations. The transaction is likely to be concluded despite long-lasting legal negotiations and extensive conversation about contractual details in the subsequent phase (group #S1.1).

### 5.6.2 Cooperation problems at the clinical stage IIa

In the clinical stage IIa, cooperation problems occur when companies offer or seek patents (1) and audit the technology in the due diligence phase (2).

Ad 1: Similar to the case of early stage patents, contacting is aggravated by a lack of transparency about the “right company” and the “right manager in the company”, and the demand for technologies. The right licensee widely fulfils many criteria mentioned in the first case except for the need to accept license terms and policy of the licensor. Furthermore, licensors often profit from a patent transaction if the licensee foremost intends to clear a roadblock away through a license or a purchase. The licensee is expected to assign a high reservation value to the patent if it is of strategic purpose to him. Thus, the licensor is able to exert high payments provided that freedom to operate in the product market is assured (group #S2.1).

If a company detects a roadblock in the clinical stage IIa, it usually reacts very promptly in order to avoid any further damage. Suddenly, contacting is not a matter of weeks but of a few days.

*“If it is really urgent, we rush through the whole process. Once I made a deal in four weeks. Then of course thousand things have to run in parallel. So if it is necessary you rush through. But if it is only about a very small amount of money, then you do not invest that much effort.” (#D1.1, translated by IT)*

The “wrong” company, however, is the one that offers “bad quality” (#D2.1) and is very hesitantly in carrying out the deal (group #S1.1). A pure or non-pure licensor may offer a non-valuable patent on an ineffective drug. The licensee may not be able to bring the technology to the product market or underestimates regulatory hurdles. Under these circumstances, companies are suspected to hide their intention and information.

For the same reasons as in the early stage, finding the right manager in large companies is likewise a problem for licensors but it also affects a licensee. Pure licensors and pure licensees obviously make themselves more visible to the public than many non-pure licensors and licensees intend to. However, the vast bulk of information provided by the companies revolves around general information about the characteristics of the technology portfolio (group #S2.2, #D1.1). As in the early stage, the potential licensors and licensees are widely known to companies active in a specific field. It is usually not expected that unacquainted firms express interest.

Ad 2.:

The due diligence phase is usually more extensive and complex than in the late research stage for the following reasons: First, as the amount of information and knowledge about the product and patent has accumulated during the last stages and more information is potentially available to be inspected and examined. Second, the

value of the patents has enormously increased and the license entails higher total payments. Hence, licensees have a vested interest in examining the entire range of information available and accessible.

The due diligence phase involves the scientific examination of data from preclinical testing which reveal toxicological, safety-related and pharmacokinetic characteristics of drugs. In any case a non-disclosure agreement is closed to prevent the leakage of information among other companies, and so these agreements are also a prerequisite for the due diligence process in this stage. However, the licensor is often suspected to influence the due diligence strategically. One reason is that the licensor has potentially more information about side-effects and efficacy of the drug to hide from the other party. Second, she is able to coordinate the stepwise disclosure of information strategically (group #D1.1). For instance, the licensor may conceal detrimental information while putting other aspects in the foreground. As in any due diligence process, a licensor does not reveal all relevant data but those requested by the licensee. Interestingly, hidden or concealed information on the part of the licensor is not the most problematic point in valuation and pricing mentioned by the BD managers (group #D1.1, #D2.1). With an increase of previously lacking information about the product and patent, licensees are able to audit and examine the data more thoroughly than before. The licensee typically takes the time necessary to review all relevant data and asks for access to know-how over a time span of a couple of weeks, and opts for an option agreement with the licensor.

Due to the multidisciplinary nature of clinical trials, numerous departments and personnel are involved in the due diligence process. With more input and departments, the number of scientific valuation criteria increases. The personnel focus on the further development of the patented technologies, regulatory approvals, sales and marketing concerns. Expertise and a profound knowledge are required to assess costs and needs for stage III studies and the regulatory situation (group #D1.1, #D2.1).

In light of different assessments and more information, licensees are confronted with procedural uncertainties. Gathering information in due diligence process often turns out to be a stumbling block. The following example of a manager acting on behalf of a licensee nicely shows that due diligence in this stage is laden with scientific evaluations:

*„Now we have agreed on a day for the due diligence, then I show up in the (other, IT) company with ten people and start to dig. For this purpose the company has a room prepared with two to three shelves full of folders that describe this product only. And my staff is digging in the folders for one to two days. And everybody, you can imagine, has its own focus. The researcher, the toxicologist, the patent attorney, the marketing staff and so on. So, we have different disciplines and each is auditing its issues. And the company will get a list of questions from us, I'd say, ten pages*

*organized by priority. And then the company passes this list further internally to its departments, the marketing department, the toxicologists etc., in the view to answer the questions.“ (#D2.1, translated by IT)*

The audit of the product is an essential part of the patent transaction because the licensee needs to assure that the product will be a candidate for stage III trials. The information available is thoroughly evaluated. The licensees, either pure or non-pure licensee, obviously do strive for observable and counterfactual information about the good. And notably companies in constellation 2 having enough personal resources seem to be very thoroughly searching.

### **5.6.3 Interaction of valuation and cooperation problems**

#### **Critical point 1 for winner's curse:**

The dilemma of the winner's curse has different implications for transaction constellation 1 and 2:

*Constellation 1:* BD managers representing pure licensors are very affected by this dilemma when the ultimate price significantly shrinks below the estimated reservation value of the patent. To leave the patent unexploited is not a realistic option to pure licensors because their commercial well-being depends on the commercialization of patented technologies. Licensors usually find the way to the market by contacting the biggest player in a given product market, which is potentially interested in the patents, first. Only if a deal is unpromising, the company will proceed to the second and then third biggest market player and so forth. The pure licensor ultimately profits from transactions with the biggest player for several reasons: The biggest market player and largest company respectively is deemed to be more likely to develop the technology further and to bring the product to the product market than (smaller) companies with a lower market stake. The latter are often in need of a strategic partnership with other companies which aggravates licensing negotiations. In many cases, the biggest player is easier to convince about the merits of the product. The following quotation reflects the viewpoint of the licensee.

*„If you want to convince your own bosses to buy a new technology, your company is usually the market leader. Then the company would pay for it, then immediately buy or license. Otherwise it is probably almost impossible to convince people that it is worth the money to bring in a new technology in the company.“ (#D1.1, translated by IT)*

The pure licensor will most likely reach the highest price in financial negotiations with the biggest player. This player is aware that the second and third biggest players will even profit more from the product and are willing to make a higher bid provided that the companies are able to gain a higher market share through this transaction. This usually means a potential threat to the big player who risks to lose a mar-



ket share. If he opts not to license or purchase the patent, other market players will do so and in the long run he will need a license as well.

*„Then after some time, the big is ultimately forced to buy a license. But at this stage, the price is already determined by the other market players. Then the big player has no reason and room to negotiate. The big player pays what the others are paying.“ (#S1.1, translated by IT)*

Consequently, the biggest market player is inclined to accept the reservation value of the pure licensor. The licensor will start to offer the technology to the second biggest market player not before he ensures that the first company bids significantly below this value. The disclosure of information among a number of licensees, however, is less an object of concern because the licensor typically discloses confidential stepwise with an increasing commitment on the part of the potential licensees.

*Constellation 2:* A winner’s curse may well be found in the opposite direction. Non-pure licensors can choose to exploit a patent internally or to grant a license. In the perception of licensees, notably non-pure licensors are inclined to offer non-valuable patents in the market for patents, for instance those with weak toxicological testing data, while valuable patents are exploited internally (group #D2.1). Such “lemons” cause subjectively perceived uncertainty for licensees in constellation 2. Obviously, it is recognized that non-pure licensors and non-pure licensees first and foremost seek to bring a drug to the product market. It is not considered to be rationale to license a drug out when a company bears high costs in clinical trials. In any case, a company would invest in blockbusters and attempt to withdraw drugs with lower quality. However, a licensor may have reasons to depart from this logic. For example, a change in a company’s market strategy or product portfolio prompts the licensor to sell the patent (group #S2.2, D1.1). A second medical indication of the drug, which is not in the therapeutic field of the company, may also induce a sale. If this happens, the licensor will probably need to conduct long conversations with BD managers in order to prove this circumstance. Only if the reason sounds plausible to the licensee a deal may be concluded (group #S2.1, #D2.1).

### **Critical point 2 for fear of unexpected inquiries: Detection of a roadblock and infringement**

A second freedom-to-operate analysis helps to identify roadblocks and at the same time it uncovers whether other companies, notably competitors, regard one’s own patent as a roadblock. Thus, the results of the analysis also indicate if competitors are likely to request a license. The dilemma of unexpected inquiries is essential to non-pure licensees and non-pure licensors who act in two markets and are rivals (constellation 2). BD managers reported that for obvious reason a non-pure licensee would ask for a license if freedom-to-operate concerns are vital to the company.

In the case of alleged patent infringement, companies rather act the other way. Alleged infringers are usually advised to disclaim patent infringement and wait until the patent holder is able to prove damage. Since no agency monitors patent infringement, it is the task of the patent holders or his licensee to take action. Typically, a patent holder or other licensee will write a letter to the infringer in order to notify legal measures. Such a letter, however, involves the option to effect negotiations on a patent license with the patent holder. In some instances, conversations are complicated when the patent holder is a university, while another licensee negotiates with the potential infringer. In general, the detection of a roadblock or patent infringement is advantageous to the licensor who can achieve a high price. Licensors do not fear unexpected inquiries but profit from them provided that infringement is provable. This is also the case with rivals (group #S1.1, #D2.1). The assertion that rivals are not willing to grant each other a license was not found under this circumstances.

If pure licensees ask for a license (constellation 1), patent infringement is far less suspected and strategic uncertainty is lower (group #S1.1). Not in any case pure licensees are confronted with a high-priced bid due to an unexpected inquiry. For this reason, the dilemma is apparently less crucial in constellation 1. Nonetheless this finding is subject to further qualification.

#### **5.6.4 Interpretation of the results**

The study resulted in the following answers to the research questions:

1. *How do BD managers price patents when relevant information, which was missing in the late research stage, is available in principle?*

In financial negotiations, BD managers are confronted with different results in the financial models that result from privately held information. As indicated, valuation-pricing problems arise because of the confidentiality of private information but also because of a restricted access to the financial models. A common ground for pricing refers to equivalent information and similar assumptions about current and future developments that are based on this information. In order to be able to understand and reconstruct the valuation of the other party, two tactics could be identified: The “beat around the bush” tactic alludes to conversations about general aspects and principals of the financial models whose construction is often hidden from the other party. Non-pure licensors and non-pure licensees acting on the market for technology and products (notably constellation 2b) successfully handle valuation-pricing problems with this tactic. One reason for this may be that both parties share similar knowledge and information. The “demonstration of competence” is the second tactic to overcome different results in financial models. It is successful if both parties are

obviously not likely to share similar knowledge and information. This is often the case in transaction constellation 1 when licensor and licensee operate in different markets.

2. *How do the managers price patents in light of a high variety of possible valuation criteria?*

With regard to valuation criteria, transactions in the clinical stage IIa do not significantly differ from those in the late research stage. Market data from comparable technologies are the starting point for financial negotiations which leave room for haggling and mutual concessions.

3. *How do the managers find the right technology offered or required by the most appropriate licensor and licensee?*

With regard to the commercialization of patents, a labor division along different development stages is not usual in small and mid-size companies. In many cases, these companies lack personnel. Scouts in the clinical stages also establish relationships to hospitals and are occasionally involved in networking with funding agencies to initiate further clinical trials. Contrary to the early stage, patent databases in combination with company information databases on pharmaceutical projects gain relevance. This is because the patent has been granted in the meantime. Furthermore, the second freedom-to-operate analysis is a device that helps to identify holders of patents that have a high strategic value to companies.

4. *Which information is suspected to be withheld or hidden by the other party? And how do the managers cope with hidden information in financial and legal negotiations?*

Licensors are suspected to hide toxicological testing data and data on the efficacy of a drug. Licensees often fear that non-pure licensors license and sell non-valuable patents. In the due diligence phase, the licensee still has the chance to ask for missing information and to discuss ambiguous data. More often than not, hidden intentions are clarified in this process (group #D2.1). What is hidden by the licensee, however, is confidential information about the product market.

*“For a new drug for example, you will watch carefully the initial toxicity tests to see if a drug does not kill any animal nor kill any man... this information can be exchanged without problems. But what for instance Pfizer thinks, the market leader, what is the next Viagra. This is what Pfizer does not tell the small startup licensor.” (#D1.1, translated by IT)*

5. *Which valuation and cooperation problems interact? (The role of the “fear of a winner’s curse dilemma” and the “fear of unexpected inquiry dilemma”)*

The study reasons that both patent licensing dilemmas are vital in constellation 2 when licensors and licensees are rivals in the market for products and for technolo-

gies (constellation 2b). The “fear of the winner’s curse dilemma” affects pure licensors because their well-being depends on a successful commercialization of patented technologies. They solve this dilemma by contacting the biggest player in the product market, which is potentially interested in the patents, first and then proceed to the second and third biggest player.

6. *Which parts of the licensing contracts are more thoroughly negotiated? And why?*

Similar to the early stage, financial and legal negotiations take time. In the clinical stage IIa, however, the licensee is much more inclined to audit scientific data thoroughly for the following reasons: First, more information is available to be examined, second the value of the technology has usually increased over the last clinical stages. Third, the licensee needs to assure that the high costs of the clinical stage IIb and III are worth for a given drug. Apart from that, the managers seem to spend much time on conversations about mutual concessions in the legal part.

7. *What are the most severe uncertainties that TTO and BD manager perceive in the transactions?*

The most severe uncertainty refers to commonly shared assumptions of prospective developments in the financial part of the transaction process and restricted access to the financial models. Consequently, licensors and licensee refer to their own data and models. A common ground for pricing, however, is important to approach each other in financial negotiations. Only if the parties manage to find this ground without disclosing too much confidential information, they are able to make further concessions. Moreover, procedural uncertainty is high when the parties audit the technology. For this reason, the due diligence phase is often long-lasting.

*Proposition 1: The calculation of the net price value (NPV) is no longer perceived as problematic by the managers. Informed guesses and internal budget restrictions lose their relevance. The managers aim at precise predictions on the net price value and strive for a bilateral contingent solution which is based on information available to them. The financial phase is less prone to fail than in the first case.*

BD managers are affected by the calculation of the net price value if licensor and licensee do not share confidential information from the outset of the negotiations. Financial negotiations are prone to fail if the parties do not find a tactic to approach each other or are not willing to understand the base for valuation used by the other side in principle. Thus, financial negotiations remain a critical stage in the transaction process. Furthermore, the managers appear to be much less pragmatic in the valuation process than in the late research stage. The application of future-oriented

valuation methods is widely acknowledged. The common ground for pricing rather refers to similar assumptions about current and future development used in the formula than to shared ideas and guesses about the long future. Another reason for a non-pragmatic attitude towards valuation of patents is that the increase of information is paralleled by an increase of the value of patents. This increase let BD managers on the licensee side act cautiously and systematically.

*Proposition 2: If BD managers negotiate financial terms, they have potentially more and enhanced information available that is used in financial models. To negotiate a price that is based on commonly shared or even objective valuation principles, they reveal a fraction of confidential information.*

The findings show that licensors and licensees are often not willing to uncover a fraction of confidential information in order to come to a price. Even the architecture of the financial models is not fully revealed to the other party. Instead, the parties shift to tactics that seem to differ in transaction constellation 1 and 2. Constellation 2b is characterized by competition between the companies in the market for technologies *and* the market for products. Under specific market conditions, competition aggravates patent transactions because market actors fear a loss in market shares on either of the two markets (Arora/Fosfuri 2003; Fosfuri 2006). However, with regard to financial negotiations, the study indicates the opposite. Managers reported that negotiations with rivals are deemed to be non-problematic and less prone to fail. One explanation is that rivals are likely to share similar ideas and results about the value of patents. Hence, the principles of rivalry and similarity allow to transform the subjective valuation of patents into a secretly shared valuation.

In constellation 1, the licensor and licensee are apparently less able to reconstruct differences in the findings but also to arrive at similar results. The demonstration of competence is a way to move towards each other despite dissimilar information and knowledge. Thus, licensor and licensee obviously divert from general information about the product market to a general attribute of the company and BD manager, namely competence. This diversion allows to circumvent the disclosure of confidential information.

*Proposition 3: In the search of technologies, social networks play a pivotal role for non-pure licensors and non-pure licensees (constellation 2b) and a complement in constellation 1 and 2a. For constellation 2b, initiating licensing agreements with companies known from prior transactions is essential.*

The study did not find evidence that social networks are more important to companies in constellation 2b. Pure licensors are more inclined to make their technology portfolio open to the public than non-pure licensors. Nonetheless, small and mid-

size companies do not commercialize patents on a regular base as large universities do, for instance. Many non-pure licensors commercialize patents hesitantly, though licensing-out is taken into consideration in principle. BD managers reported that active search of licensees is usually not successful given the low number of potential licensees. The essential point is not whether a potential licensor is willing to grant a license to rivals but that a licensor is inclined to lapse a patent if he does not expect to see companies which are seriously bidding for the technology (group #D2.1).

*Proposition 4: The development steps in the clinical stage IIa are clarified and thus a change in commitments is not at issue. Licensors and licensees have more information available to demonstrate and assess the capabilities of actors. For the managers, it is easier to infer from those information to the capabilities of the other party.*

The results do not entirely support proposition 4. With more robust information available to the licensor and licensee, both parties struggle with a huge load of complex data. Numerous departments are involved in the due diligence process and the personnel involved in the audit are likewise rising. Gathering information in due diligence process often turns out to be a stumbling block and notably the licensee is confronted with procedural uncertainty. The due diligence process requires coordination between departments but also numerous conversations between the companies.

## **5.7 Similarities and dissimilarities of transactions at early and late stages**

This sub-chapter summarizes the main similarities and dissimilarities of patent transactions at both stages, the late research stage (case 1) and the clinical stage IIa (case 2).

### **Similarities and dissimilarities in the patent transaction processes**

In both cases, the contacting phase poses the challenge of finding the right manager in (large) companies. Notably, TTO and BD managers on the supply side are confronted with this problem. Potential licensees hardly publish detailed information about the manager in charge as well as a concrete demand for a specific technology in a therapeutic field. These aspects are often considered to be confidential information. Moreover, non-pure licensee may not be inclined to accentuate their need if they do not license-in patents on a regular base. In the due diligence phase, strategic uncertainty about capability and willingness of the licensee to further develop the drug and bring it to the product market comes into play. This issue is important to both cases in principal. Uncertainties in legal negotiations are akin to one another,

though university policy on warranties and indemnifications is an additional stumbling block in the late research phase. Renegotiations and termination of the contractual relationship does not significantly differ according to the findings of the study.

Dissimilarities between the two cases apparently refer to the contacting phase and financial negotiations. In the late research stage, the intra-organizational process from invention disclosures to a commercialization strategy is a challenge to TTO managers. BD managers have difficulties in finding promising drug candidates when information is still limited and vague. Financial negotiations are prone to fail due to different assumptions which are based on different guesses and ideas about prospective R&D and market conditions. In order to approach each other, both parties need to clarify and trust the guesses and ideas of the other. A price agreement is reached when both share similar ideas of the patent. In the clinical stage IIa, contacting problems differ in the two constellations. First of all, non-pure licensors and non-pure licensees must identify ways to externally exploit and acquire patents. Potential licensees suspect a licensor to offer non-valuable patents provided that the latter has downstream capabilities. In constellation 2, it is far from clear whether a non-pure licensor is willing to license-out a technology that has a strategic value to him.

In the financial phase, a difference in the assumptions is based on the use of private information that significantly differs from each other. In order to understand the valuation of the other party, confidential information is needed which is not disclosed. Thus, BD managers must handle a gap due to different information. In doing so, they may apply two tactics to circumvent the disclosure of confidential information about the product market - either to *clarify general assumptions* or to *demonstrate competence in valuation*. For both tactics, *clarification and trust in calculations or calculative competence* of the other party appear to be essential elements. An agreement in pricing is best reached when the companies share a common stock of information *and* knowledge. Interestingly, this is the case when two rivals negotiate.

### **Similarities and dissimilarities in judgment devices**

At first glance, judgment devices hardly differ in the two constellations. In both stages, scientific conferences, scientific networks and partnering events are notable devices that channel licensors and licensees (“confluences”). Future-oriented valuation methods and forward-looking planning are guiding and seen as appropriate even though their application is considered to be unrewarding in the early stage.

When comparing the two cases, the following differences in judgment devices become apparent:

In order to find a valuable technology of interest, patent databases gain relevance soon after a patent application has been disclosed and a freedom-to-operate analysis reveals roadblocks and potentially interesting drugs when a drug candidate has suc-

cessfully entered preclinical and clinical I development. The role of freedom-to-operate analyses changes from the late research stage to the clinical stage IIa. A first freedom-to-operate analysis gives BD managers a tentative account of the patent landscape to spot roadblocks and to assess the risk of infringing a third party's patent before the company invests in clinical trials. A second analysis, however, brings forth more robust findings on roadblocks in a stage when a company is more and more exposed to legal actions taken by other firms. Monitoring the activities of competitors becomes more essential in the clinical stage IIa in order to achieve competitive advantages over other companies. Companies constantly seek to retain control over blockbuster drugs.

In the late research stage, future-oriented valuation methods are rather used as "in-house tools" or as a calculative attempt that is subject to further improvement. A systematic valuation is oriented to comparable transactions in the past. However, this retrospective approach is not regarded as appropriate to the licensee. In the clinical stage IIa, the application of these models is seen as realistic and a systematic valuation using product market information follows forward-looking principles. However, the models themselves are often hidden from the other party. In this case, the devices themselves become an object of strategic action and foremost insights into general clarifications and trust in the competence of the other party seem to mitigate this valuation-pricing problem.

In the late research stage, milestones and a business plan are still vague and subject to change. For this reason, they rather serve to assess the capability and commitment of the licensee to develop the technology further than they serve for a strict planning. In the clinical stage IIa, the informative value of a business plan is higher. However, a licensor fears that a licensee may cause a loss or damage to his business because the latter is now able to assess the strategic value of a technology. In return, the licensee attempts to audit the drug cautiously to reveal frictions in the testing data.

### **Inquiry and judgments versus decision-making**

Following Karpik (2010: 36-43), judgment-making consists of a choice between alternatives, though the choice is anchored in a reflexive process of discussion and persuasion. A judgment responds to uncertain conditions, it is individual and particular in nature. The transformation from an uncertain or troubled into a determinately unified situation requires the progressive act of inquiry on the part of the actors involved. If inquiry is successful it results in judgments and knowledge (Dewey 1938: 135). Decision-making, however, involves the choice between comparable elements, and by calculation decisions "arrive at objective or universal solutions" (Karpik 2010: 41)

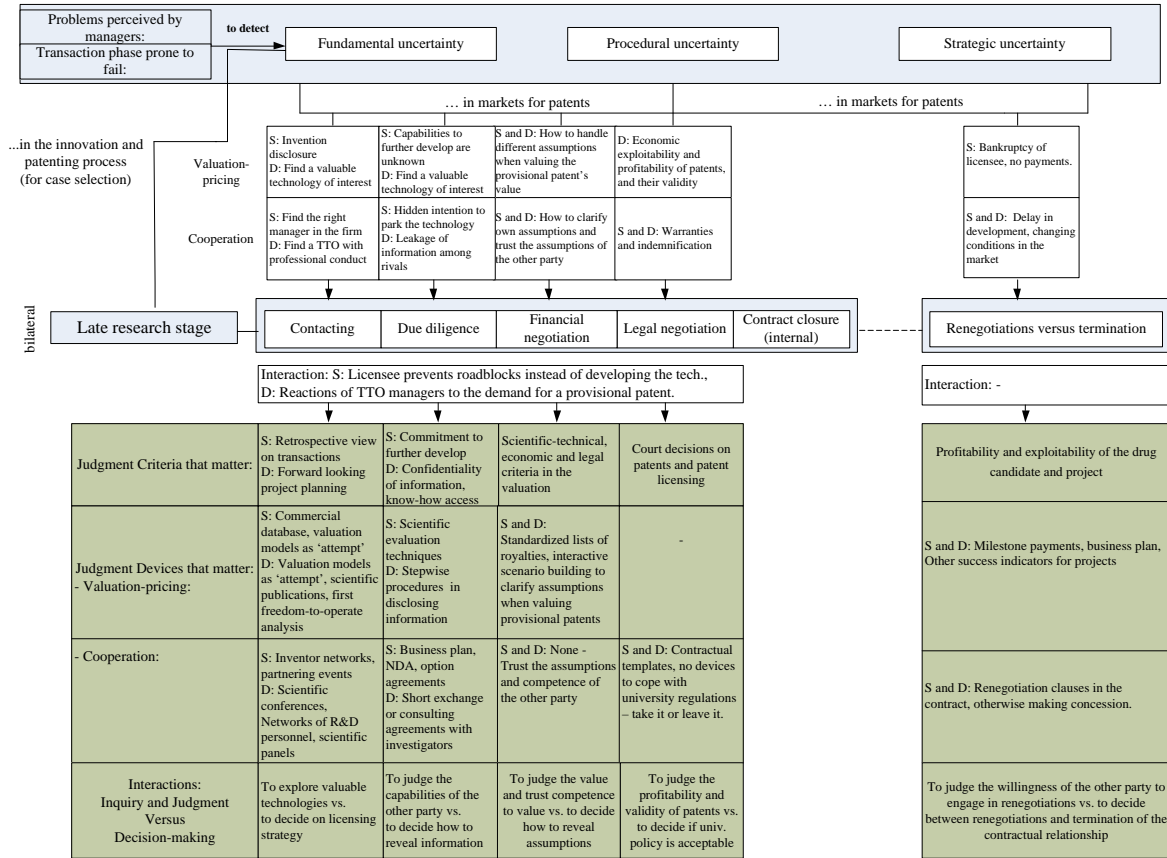


In general, both cases involve elements of inquiring acts and judgments that are oriented to norms and criteria and at the same time enough room is left for (strategic) decision-making:

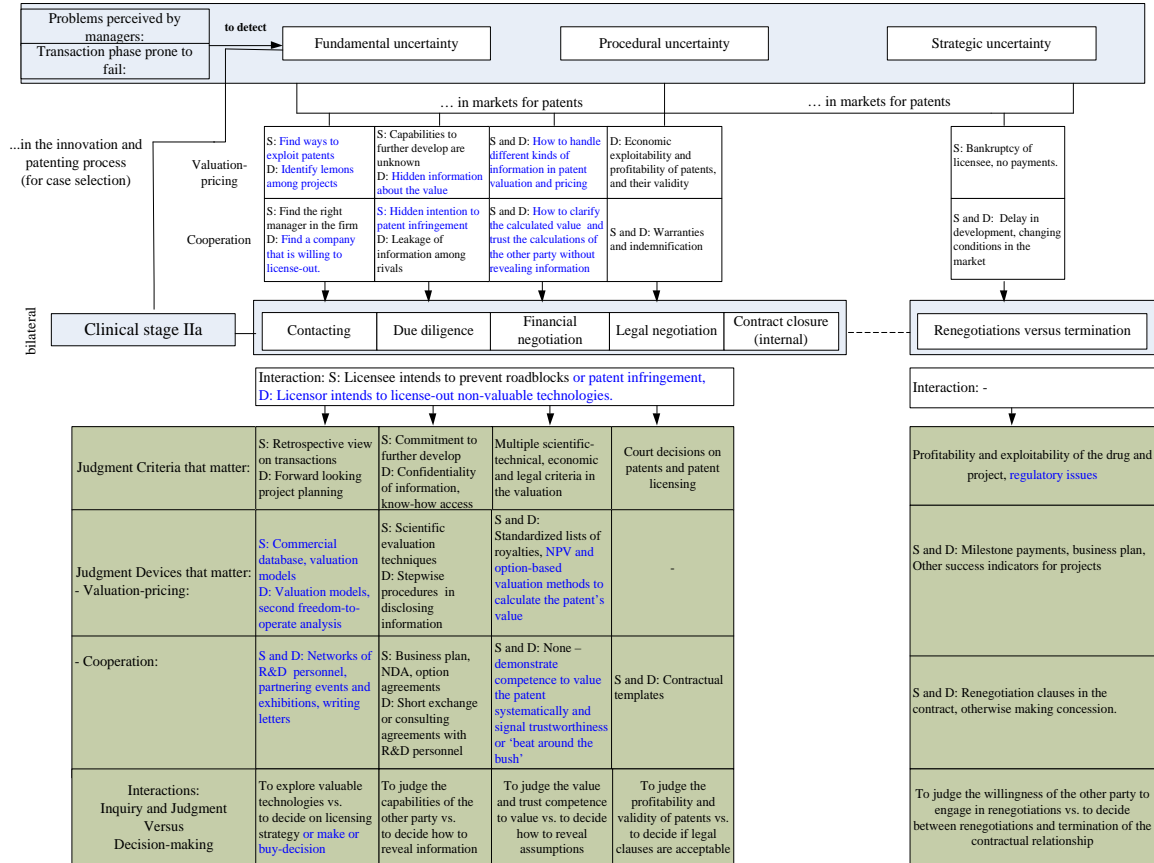
In the contacting phase, inquiring acts and judgments come into play when companies explore interesting technologies in the search of valuable drugs. While the licensor judges the capabilities of the potential licensee to further develop the drug, the licensee needs to figure out to what extent the university has a professional conduct. When both parties make informed guesses on the prospective value of a drug candidate, they strive to arrive at a mutually shared judgment about the value as well as the profitability and validity of the patents. In light of long-term contracts, both sides need to judge the willingness of the other to engage in renegotiations in the future. In all these instances, judgment-making is prevalent due to fundamental uncertainty about the product and the patent. However, TTO and BD managers are able to decide which commercialization and acquiring strategy fits best to the organizational goals and business. Decision-making also refers to the way due diligence is carried out and confidential information is revealed to the licensee. BD managers are confronted with university policies, which shield academic institutions against uncertainties, but at the same time, it is up to the company to decide if a deal makes sense or not. In the long run, the outcome of a contractual relationship depends on the final decision about renegotiations versus termination of a contract. In the clinical stage IIa, companies are confronted with make-or-buy-decisions and outweigh if legal clauses are acceptable or not.

The essential question that is still open to be answered is whether patent transactions characterized either by high or low fundamental uncertainty differ in the prevalence of inquiry and judgments on the one hand and decision-making on the other hand. This last question shall be tackled in the next sections by analyzing the shift from high to low fundamental uncertainty with the accession of relevant knowledge.

**Figure 10: Transaction process in the late research stage**



**Figure 11: Transaction process in the clinical stage IIa**



### **A shift from external to internal factors**

The last sections compared the two cases by identifying similarities and dissimilarities. Since information and knowledge is assumed to accumulate over the pre-clinical stage and clinical stage 1, how does the role of information and of the three facets of uncertainty change? The following analysis presupposes a shift in the origin of the most meaningful uncertainties: *From external (outside) to internal (inside) factors*. External factors relate to valuation-pricing and cooperation problems that are placed outside the sphere of influence of licensors and licensees and affect both more or less. Internal factors, however, have their origin in the information itself and the social relationship between the parties. They may leverage either the licensor or the licensee.

In the late research stage, external factors seem to exceed internal factors. A clash of ideas about a patent's value results from different assumptions in the financial models that both use. These assumptions are based on informed guesses about prospective developments but not on robust information that is privately withheld. The licensee is closer to the product market and thus may be more competent to judge market conditions and regulatory issues. However, as indicated, the fundamental lack of information about the future is only partly mitigated. While attempting to consider the most adequate and realistic assumptions for the financial models the managers jointly strive to identify as much information about the current external conditions as possible. Basically, licensor and licensee are both affected by high risks and uncertainties and thus struggle with lacking information.

The same refers to the most crucial cooperation problem. Warranties and indemnification usually refer to a change in external conditions, for instance the grant of the patent, actions of third parties and sublicenses. As indicated, warranties and indemnification are a means to control actions of outsiders as well as unknown changing conditions in principal. Even if both parties strive to demonstrate trustworthiness and competence, most signals are weak and vague in principle, e.g. the business plan. Contractual details are thoroughly discussed but in the end, BD managers seem to be aware that the full control about external conditions is impossible. The long duration of the contractual relationship and uncertainty about the value of the patented technology let licensor and licensee act pragmatically. Negotiations are successful and a deal closed when both parties are confident enough that the long-term commitment will hold a few years. It is recognized that renegotiations and terminations are inevitable in principle. It seems that *confidence and a portion of imagination* on both sides are necessary in the late research stage to cope with uncertainties that are originated outside the influential sphere of the market actors.

In the clinical stage IIa, the most meaningful uncertainties revolve around information that is not missing in principle but either withheld or difficult to gather and comprehend. Valuation-pricing problems are based on confidential information which is obviously not disclosed to the other party. Even though both parties are able to uncover information, they rather choose to discuss about general aspects or to demonstrate competence (the two tactics). Both parties are rather inclined to suspect the other side to hide information and intentions. This change can be attributed to an increase of information that can be potentially hidden. Additionally, other reasons are relevant: The value of the patent has increased and the entrance of the drug into a stage with high investments. Thus the licensee tends to audit any detailed information thoroughly. Strategic utilization of information, hidden intentions and procedural uncertainty seem to prevail in the clinical stage IIa for several reasons and they indicate that uncertainty is originated inside the influential sphere of the actors and the information they handle.

One may argue that the tactics actors use are a means to produce trustworthiness between the parties. Signaling similarities and competence are strategies to indicate trustworthiness (Beckert 2005). The “beat around the bush tactic” is based on the emphasis of similarities between licensor and licensee, for instance when rivals act on two markets. The “demonstration of competence tactic” allows to cope with strategic uncertainties on the level of credible knowledge and professional conduct. Negotiations are successful when both parties *signal their trustworthiness and competence* and confirm those issues on the other party. Nonetheless, it also may have additional roots, for instance membership of BD managers and inventors in networks. This circumstance alludes to judgment devices.

The last section featured some differences in judgment devices between the two cases which are associated with such a shift. With the accession of relevant information and knowledge, the role of judgment devices partly changes. While a business plan is regarded as vague in the beginning, it has a higher informative value in the clinical stage IIa provided that the plan includes all details. Financial models are guiding and thus stand for a successful conduct of valuation in both stages but it is acknowledged that it supplies the credible knowledge necessary to value patents systematically in the clinical stage IIa (cf. Karpik 2010: 49-51). Interestingly, licensor and licensee mainly use these models as “cognitive support” (ibid.) for themselves. Financial and legal negotiations are highly social because in order to ultimately reach an agreement a mutually accepted judgment has to be formed. The credible knowledge inherent in the financial models, however, seems to become a strategic cue ball and exposed to strategic interaction in the clinical stage IIa. Accordingly the two tactics described above serve as change maneuver. Apart from

that, the role of networks and partnering events in contacting and contractual clauses in legal negotiations remain the same over the stages.

## 5.8 Discussion

This chapter serves as a counter case to consider a variation of fundamental uncertainty about the patent and the innovative product and to confront the findings of the first case investigated in chapter 4 with a change in conditions. The basic insight of this study is that with the generation of information about the innovative product and the patent, valuation and cooperation problems do not diminish but change in nature. Strategic utilization of information, hidden intentions and procedural uncertainty are prevalent in the clinical stage IIa and are perceived as more severe by the managers. The interplay of valuation-pricing and cooperation problems appears to be complex and more essential in the two constellations than in the early stage of the compound. Procedural uncertainty is high.

Many obstacles in transactions, though not all, can be attributed to different facets of uncertainty. As indicated, a change in valuation-pricing and cooperation can also be attributed to factors that do not directly relate to the good: Regulatory procedures, the organizational hierarchy, the high value of the patent, high investments before product launch and competition in the market for products. Hence, the final discussion revolves around the following question: *What exactly is the effect of fundamental uncertainty about the product and the patent on patent transactions, notably how BD managers value and price patents and cooperate, as opposed to other factors?*

The findings indicate a tendency for inquiring acts and judgments to cope with valuation-pricing problems in the late research stage. Both, licensor and licensee seem to be captured by a fundamental lack of information. In the financial and legal negotiations, the parties are mainly concerned with a change in external factors that affect both. Hidden information and intentions and strategic issues play a role but in the light of the most critical uncertainties, they are rather in the background than in the foreground. One may infer from this finding that the late research stage is characterized by relatively non-strategic behavior in negotiations as opposed to the clinical stage IIa. This may explain why confidence in prospective developments on the part of both parties plays a crucial role in the late research stage, while trustworthiness is more pronounced in the clinical stage IIa. Consequently, high fundamental uncertainty facilitates joint action, imagination and social interaction about future outcomes in negotiations.

In the second case, a joint imagination of lacking parameters in financial models is not necessary. Warranties and indemnification are more flexibly handled by the companies. Licensor and licensee rely on the information they possess or are able to

gather and audit. In the negotiations, internal conditions referring to the information and the relation between the parties are a subject matter while external conditions lose their significance. The strategic room for decision-making in negotiations is found to be larger in this stage because both parties apply tactics to hide confidential information and also use judgment devices as cue balls in negotiations. Since both parties are rather inclined to suspect the other side to hide information, signaling of trustworthiness and competence becomes important. Accordingly, strategic behavior appears to be more dominant than in the first case and thus, low fundamental uncertainty seems to ease strategic behavior.

However, in both cases, inquiring acts, judgments and decision-making are in place. Thus, inquiries and judgments are not fully replaced by decision-making. The effect of fundamental uncertainty is that of a facilitator, while a clear causal relationship between fundamental uncertainty and strategic behavior is *not* proposed here. The assertion of such a causal relationship would certainly need further qualification. The results of both studies show that fundamental uncertainty could also be beneficial to financial and legal negotiations because it prompts social interaction, notably to convince the other side through arguments (cf. Stark 2009). This demonstrates that high and low fundamental uncertainties have a social dimension inherent.





## **6 Towards arm's length transactions and market constitution: Public IP auctions**

### **6.1 Introduction**

The current trend towards the commercialization of IP and growing markets for IP suggests that patent transactions are more and more carried out as typical market transactions. Bilateral licensing is characterized by long negotiation processes and complex agreements to transfer a complex good. Typical market transactions of patents involve standardized contracts and arm's-length exchanges to transfer patented technologies. Such transactions typically comprise sales or simple patent licensing transactions, which do not require multi-party agreements. Since market transactions entail standardized contractual arrangements, they are usually limited to stand-alone technologies (Jarosz, et al. 2010). Transfers of complex bundles of IP, know-how and services, which require long-term collaborations between market actors, are more likely to be carried out within networks of technology partners than as market transactions (Williamson 1979).

An upcoming transaction form oriented to arm's length transactions, is the IP auction. From a theoretical viewpoint, auctions are interesting because they provide an efficient allocation and pricing mechanism for singular goods (Marshall [1920] 1961; Krishna 2002). As opposed to established forms of licensing, IP auctions have the advantage that numerous patent holders offer their portfolio for sale and potential bidders compete for patents and thereby forming a market price. Auctions are designed to work efficiently. Multiple auction types provide solutions to valuation-pricing and cooperation problems (cf. Krishna 2002). And game theorists assist the auctioneer in finding the most appropriate auction design that matches up with the interest of all participants – to reach true market prices with the highest outcome. Auctions are considered as appropriate transaction mode when the seller is unsure about the values that bidders assign to the object being sold. The uncertainty about the value of the good facing both, sellers and buyers, is an inherent feature of auctions (Krishna 2002: 3). Thus they may well apply for singular goods characterized by uniqueness, incomparability, incommensurability and uncommonness (Karpik 2010), as for instance patents.

Compared to electronic and internet auctions, live multi-Lot IP auctions are advantageous when bidders wish personal contact with the auctioneer and direct exchange of information and previews of the patented technology at the place of sales. Since internet exchange of patents did not meet the expectancies of the marketplace so far (Lichtenthaler/Ernst 2008), live IP auctions seem to be a promising alternative to traditional licensing transactions. However, the success of many live IP auctions

was alternating over the years and mostly brought forth poor sales percentages (Clark 2006; Viscounty/Vries/Kennedy 2006). At present, auctions are obviously not a profitable business model, and they are unlikely to replace traditional bilateral negotiations anytime in the future (Jarosz, et al. 2010). So, even though markets for patents are flourishing (Arora/Fosfuri/Gambardella 2002: 2), typical market transactions are still a special case and they do not represent the majority of patent transactions.

This chapter investigates how Ocean Tomo LLC, a US patent market intermediary, copes with valuation and cooperation problems, notably matching, and the insufficient propertization and appropriation of knowledge prevalent in IP auctions. Furthermore, it tackles collective market making efforts by the auctioneer and the participants in the respective conference and IP auction. The Live IP auction events hosted by the intermediary Ocean Tomo LLC are an example of a recently established IP auction that is open to all companies, single inventors and universities. The explorative study analyzes, how typical market transactions are functioning and how the auction event contributes to market constitution.

This leads over to the overarching question of this chapter: *How are uncertainties tackled in patent auctions?* Thereby the study poses the following sub-questions:

1. *How are arm's-length transactions arranged by a third party?*
2. *How does Ocean Tomo cope with an insufficient propertization and appropriation of patents in patent auctions?*
3. *How does the auction event, notably the conference, contributes to market constitution?*

To answer research question 1 and 2, the study makes use of the theoretical framework developed in chapter 3. In doing so, it underpins the role of the auctioneer Ocean Tomo, LLC as third party assistance and his attempt to apply a systematic valuation of patents. Anecdotal evidence from my observation of the fall 2008 Live IP auction suggests that this event contributes to the conscious constitution of primary and secondary markets for patents. Hence, the event can be seen as an initiative for market making (Aspers 2009). This case challenges two theories on market constitutions: the *performativity theory* (Callon 1998; 2007) and the concept of *institutional entrepreneurship*. While answering the third question, I will examine the two approaches for the case of the fall 2008 Live IP auction.

A central proposition in this study is that Ocean Tomo's live IP auction is more than a floor for arm's-length transactions because it is communicated as a "forum of commerce" (Anonymous 2008) that unifies market exchanges and social interaction between market actors. The auction event including conferences, a Gala dinner, and

speeches, is not only a fancy by-product of the auction nor the result of a marketing strategy, as I argue, but a necessary step for the implementation of this transaction mode and for market constitution in general. The (primary) market for patents is characterized by non-transparency and highly guarded bilateral negotiation processes to avoid information leakage between firms (Jarosz, et al. 2010). The communication about the experiences and practices of BD and TTO managers in those events appears to be a constitutive element for the emergence of arm's length transactions in the primary market and in the market for intermediary businesses likewise. The event helps to establish new business models as best practice in IP management. Furthermore, it incorporates important elements of bilateral patent licensing that stem from outside the marketplace.

## 6.2 IP auctions as matching and pricing mechanism

In general, IP bidding procedures and IP auctions are no new phenomena. For a long time, bidding procedures have been common business practice, and in some cases they were arranged by an intermediary organization. However, due to the private, secret and confidential character of those procedures, they remain unknown. We can at best speculate how these auctions are initiated by patent market intermediaries (PMIs) and how PMIs cope with valuation and cooperation problems. Anecdotal evidence suggests that bidding wars take part in exclusive networks of patent professionals and innovators, often selected by a PMI (Viscounty/Vries/Kennedy 2006). The latter ideally has full control over the bidding procedure and the flow of information between the parties (cf. Jarosz, et al. 2010). Private auctions span a low array of technologies and are usually held for particular IPRs (McClure 2008-2009). So, what is new regarding the IP auction model and the respective marketplace? The recency of these IP auction models is surprising because patents have numerous attributes that allow for an efficient exchange over arm's length transactions in a public marketplace.

On the current secondary market for patents, a relatively small number of intermediary organizations is explicitly specialized in IP auctions. Apart from Ocean Tomo LLC, we find IpAuctions, the IP Auctions GmbH (IPA), FreePatentAuction. All companies were founded within the past ten years. IpAuctions, Inc. was founded by Joe Popolo in 2001. The company is an internet auction firm headquartered in the US. It is a sales venue for bankruptcy courts, IP law firms and other companies (IPAuctions 2009). The IP Auctions GmbH is a German IP auction house founded in 2006. The company is an independent member of an international network specialized in IP evaluation, licensing and marketing in various technologies (IP-Auction GmbH 2009). IPA hosted its first international Live IP auctions in Munich in 2007. The holding company IPB AG became bankrupt in 2010 (Amtsgericht Hamburg

2010). FreePatentAuction has launched its business in 2004. It is a non-commercial and not for profit initiative for inventors who can offer patents or pending patents costless. The firm is financed through donations (FreePatentAuction 2009).

This new generation of IP auctions seems to emulate the perfect market model and attempts to realize efficient arm's length transactions. As opposed to traditional bidding and bilateral negotiations, the auctions have an *open and public character*. They are publicly announced and the access to the marketplace is not restricted in principal (# O.T.1). While individual inventors and SMEs have often been excluded from secret bidding procedures, they are free to supply and bid on the marketplace. Second and consequently, the marketplace is basically *non-discriminatory* because the auctioneer as a neutral party does not discriminate between bidding competitors and non-competitors. Third, IP auctioneers aim to attract *numerous suppliers and bidders* instead of selecting exclusive groups of companies joining the auction (Ocean Tomo fall 2008 catalog). Therefore, they have the format of a mass auction with a broad array of technological areas (McClure 2008-2009; Viscounty/Vries/Kennedy 2006). Fourth, the auctioneer seeks to bring a sense of "*urgency*" (Ocean Tomo fall 2008 catalog) into the transaction process in order to overcome lagged internal approvals for transactions. The following quotation describing Ocean Tomo's aim underlines the main characteristics of the marketplace nicely: The IP auction offers "transparency and open price discovery while providing immediate monetization on behalf of intellectual property sellers" (ICAP Ocean Tomo 2011).

### 6.3 Theoretical framework

The point of origin of the theoretical framework is the distinction between a narrow perspective relating to the auction as mechanism of allocation and a broader perspective that regards the auction as arena of social interaction (Aspers/Beckert 2008; Beckert 2009). Accordingly, the IP auction is understood as mechanism of allocation and the auction floor including Ocean Tomo's conference and workshops as event that contributes to collective market-making efforts (Möllering 2010).

From a narrow standpoint, *any auction acts similar to a (market) device which solves valuation-pricing and cooperation problems* (Muniesa/Millo/Callon 2007; Beckert 2009). Following Karpik (2010), auctions promise a successful conduct of action and the auctioneer and the bidders rely on this device assuming it will not disappoint them. However, an appropriate auction design should fit to the characteristics of the good, the bidding behavior of potential buyers and fulfil the requirements of the sellers. In general, an auction is composed of a set of market devices, ranging from analytical techniques, pricing models and a purchase setting. It recon-

figures what bidding is and what bidders and sellers are and can do (Muniesa/Millo/Callon 2007). As the auction is oriented to a functioning market model, it consists of abstractors or “abstractive calculative devices” (Muniesa/Millo/Callon 2007: 4) that comprise metrics, monitoring instruments or systematic benchmarking procedures. These devices allow for clear decision making, calculability and systematically planned procedures. Auction designers use these tools to plan the most efficient auction for a given good and purpose.

However, the mechanical law of supply and demand rarely governs the auction process and the formation of prices. As Smith (1990) argues, in auctions, prices are not only formed through the bidding procedures but also through the value that the auction participants attach to a lot. This value is determined by a complex social process combining both, the beliefs and actions of the auction participants and the assumptions and practices on the auction floor (Smith 1990: X). The same holds for the matching mechanism. The gavel ultimately decides upon the matching of supply and demand for a given item, yet the preceding bidding procedure involves numerous kinds of strategic actions and social habits, ranging from the mumbling or cheering of the auctioneer, hesitant waving of paddles and hectic bidding by the phone. Bidding in live auctions spreads a sense of urgency and sensation out and thereby generates excitement and similar emotions among participants (Hassoun 2005; Bandelj 2009).

The role of the auctioneer is not restricted to a host of auctions. When he compiles the auction catalogue, he obtains expert advice and values the goods at assessed values, and he assembles lots. In the case of IP auctions, the auctioneer is confronted with the problem that non-valuable patents are less likely to be traded (Serrano 2006; Gambardella/Giuri/Mariani 2005), but at the same time, a considerable share of non-valuable patents may be offered by patent holders (Gambardella/Giuri/Mariani 2005; Gambardella/Giuri/Luzzi 2006).

From a broader perspective, *an auction can be understood as a social arena* (Beckert 2009) in which market actors come together to examine the items at formally scheduled previews before sale. Potential bidders try to identify the dealers, who are spotting the prospective buyers and the auctioneer “is keeping his eye on all of them” (Smith 1990: 13). Notably in auctions of valuable goods, the participants make extensive conversations with the auctioneer, consult experts or get in touch with other participants (ibid.). In many one-of-a-kind auctions, the bidders encounter the items of sellers from previous auctions and thereby meet actors with similar interests. This allows for conversations and exchange of knowledge. On the auction floor, the bidding parties are forced to instantly react to the bids of other actors under time pressure, either through waiting or bidding. The valuation of the good is a process that unfolds in different stages in which the value is formed by different

kinds of information, the encounter of different judgement criteria (Karpik 2010) and types of actors. This process has consequences for the items being auctioneered. "Auctions serve as rite of passage for objects shrouded in ambiguity and uncertainty" (Smith 1990: X). This rite of passage begins in different expert testimonies and previews by the potential buyers. As indicated, an item is described in auction catalogues, often exhibited in previews or is further examined on request of interested buyers. In each exposition, the item is subject to different valuation criteria used by the experts (ibid.). The passage ultimately finds its end in the actual bidding when the price for a given lot is set.

*Live IP auctions* feature many advantages of live auctions for singular goods, though they are connected to two types of obstacles:

First, insufficient propertization and appropriation of knowledge. This type of obstacle comprises, as spelled out on page 43-51, the indivisibility of the good (a), the information disclosure problem (b.) and the acquirement and apprehension of the invention (c.) by bidders. the functioning of open IP auctions is highly preconditional and in need of provisions made by the auctioneer. Consequently, the auction process acts as a device or allocation mechanism but it requires further arrangements by the auctioneer, who acts as third party in the transactions. For instance, the auction mechanism does not solve information disclosure problems, guarantee confidentiality nor ensure a fast completion of complex transactions. The auctioneer relies on a number of additional devices to outweigh insufficient propertization and appropriation of knowledge.

*Proposition 1: In order to overcome the insufficient propertization and appropriation of knowledge, the auction requires additional provisions and arrangements on the part of the auctioneer. It is also assumed that the auctioneer sets various arrangements to solve cooperation and valuation-pricing problems.*

In sum, the auction may unify different types of judgment devices. Depending on which devices are dominantly used by Ocean Tomo, we can observe on which principles (judgment criteria and trust) the auction operates.

The second type of obstacle refers to the insignificant role of public live IP auctions or other forms of arm's length market transactions in the primary market for patents as opposed to bi-monopolistic trading. This obstacle certainly alludes to the absence of a thick patent market in which many sellers or licensors face many licensees or buyers to form a real market price (Gans/Stern 2008). Other than Garcia-Parpet's (2007) study of the strawberry market suggests, the Live Multi-Lot IP auction is not a mere replacement of an established inefficient transaction mode by a more efficient one. This auction is far more concerned with the launch of an open marketplace and the creation of a secondary market for patents, as further argued.

Ocean Tomo must find ways to attract new bidders and suppliers but also to convince companies of the idea of an open marketplace. Interestingly, many managers seem to share this assumption in principle (Viscounty/Vries/Kennedy 2006). The auction event including conferences and workshops is a means to establish open arm's lengths transactions in the primary markets for patents and new IP management models in the secondary market. At the same time, the event aims at the constitution of thick primary and secondary markets for patents.

The Ocean Tomo's conferences are held on the occasion of the IP Live auction and provide an example of a market constitution event, as I will spell out in the next sub-chapter. Two theses contribute to the explanation of market constitution, Michel Callon's performativity thesis and the thesis of institutional entrepreneurship. In the study, I examine which ones of the theses are more likely to explain Ocean Tomo's IP auction.

The *performativity approach* emphasizes the shaping influence of economic theories but also techniques, e.g. formulas, data, economic models, and material equipment on economic action and the constitution of markets (Callon 1998: 21; Muniesa/Millo/Callon 2007).<sup>99</sup> As indicated, economists do not only provide knowledge but actively engage in deliberate and planned market creation. Thereby, they may dictate the design of more efficient forms of transactions, as for instance the auction (Garcia-Parpet 2007; Mirowski/Nik-Khan 2007). Auction theory provides the knowledge necessary to realize efficient market transactions. The same holds true for IP management models, which are the subject of Ocean Tomo's workshops. Conscious market creation is spurred by the belief of a group of market actors that a certain knowledge and set of techniques, in this case IP exploitation models, brings forth optimal outcomes for patent holders and sellers. And the mode of transactions and IP strategies directly result from the deployment of this knowledge in practice.

*Proposition 2a: Following Callon's performativity theory, it is expected that conscious market-making is driven by theoretical arguments. Conclusive arguments for the choice of a transaction form are provided by the participants who refer to knowledge and techniques from economic and managerial science. And the participants employ and recommend this knowledge in/for practice.*

In fact, Michel Callon's performativity thesis found much attention but also criticism in economic sociology (Aspers 2007; Kjellberg/Helgesson 2006). Santos and Rodrigues (2009), for instance, examine this approach by reviewing the case study

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<sup>99</sup> As Callon (1998: 51) argues, through the assistance of these devices, the market actor is constructed as homo economicus.

of the auction of the Federal Communications Commission (FCC auction) critically (Mirowski/Nik-Khan 2007; Nik-Khan 2008). They find weak support that economic theory can be made true by construction. Similar to the live IP auction, the FCC auction was established to build-up a market for selling licenses in the US telecommunication sector. The FCC hired academic game theorists to find a beneficial and optimal auction design. The authors conclude that the complexity of the good set significant barriers for auction designers who were not able to apply models and techniques provided by auction theory. The auction designers had to create a special design which allowed for auctioning licenses, which complement and substitute each other. The FCC auction likewise provides an example of the creation of devices and knowledge by market actors involved in practice. Furthermore, the interest of certain groups of market actors comes into play, as Garcia-Parpet (2007) and Lépinay (2007) could also show.

As indicated, the concept of *institutional entrepreneurship* emphasizes the role of agency, institutions and interest in the constitution of markets. Following DiMaggio (1988) and Maguire et al. (2004), "*institutional entrepreneurs*" are organized actors "who leverage resources to create new institutions or to transform existing ones" (Maguire/Hardy/Lawrence 2004: 657). They let new institutions arise when they "see in them an opportunity to realize interests that they value highly" (DiMaggio 1988: 14). They form a group of influential professionals who use different strategies to shape and form institutions (DiMaggio 1988). To champion new rules, entrepreneurial efforts have to gain legitimacy. However, if more social groups with heterogeneous interests are involved such efforts become difficult. Consequently, power relations between social groups and struggles come into play (Fligstein 1997; 2001). These struggles may revolve around the meaning of practices. New rules become institutionalized, as Garud et al. (2007: 11) point out, when "meanings become shared and taken for granted across the wider field". Institutional entrepreneurs are particularly influential if they use any cultural material and knowledge strategically as to persuade rival groups (Greenwood/Suddaby/Hinings 2002; Suddaby/Greenwood 2005).

In line with conceptual articles (DiMaggio 1988; DiMaggio/Powell 1991; Garud/Hardy/Maguire 2007), I arrived at the following proposition:<sup>100</sup>

*Propositions 2b: Following the concept of institutional entrepreneurship, it is expected that conscious market-making is driven by interests of a few actor groups. Certain protagonists or groups in the conference attempt to exert their influence on*

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<sup>100</sup> The concept of institutional entrepreneurship is still developed by scholars in organizational studies and economic sociology, and thus a fixed set of hypotheses is missing.



*other participants. By presenting IP business models, they try to champion new rules of how to trade and manage patents. Thereby, they try to convince other participants of their most preferred business model and aim to set new standards of IP management practice.*

I do not argue that the oppositeness of these two theses is clear cut. In both theories, interest and theories come into play, though with different emphasis. Consultants and assistances, who make use of knowledge and techniques in practice, profit from certain models. So, they may support those models which are best suited to their interests. At the same time, institutional change is often followed by “theoretization” when organizational practices and failings are conceptualized and linked to potential solutions (Greenwood/Suddaby/Hinings 2002). Interests and ideas of how to solve a problem<sup>101</sup> are interrelated (Scheler 1960: 21-22). In some instances, ideas bring about specific interests (cf. Münnich 2010), while in other instances it is vice versa (cf. Mannheim 1985 [1929]). In the same vein, rules and techniques are interrelated. In the pragmatist tradition, a difference between practical and theoretical reasoning does not exist. Both, rules and techniques are operational and have a cognitive content. According to pragmatism, knowledge and techniques are about what is believed to be functioning, while social norms and values are hypotheses about what is good in action (cf. James 2007 [1907]).

The relationship between the two theses surely requires further clarification which cannot be delivered in this chapter. The main difference between Callon's performativity thesis and the concept of institutional entrepreneurship tackled in this chapter is of *how collective market-making efforts are organized and justified*: First, it is interesting to know whether and how interests of actors come into play in the negotiation of meanings. Using a weak notion of interest, e.g. as ambitions and goals of participants, one may ask if championing new rules versus creating new techniques (devices) prevail in the conference. Second, it makes a difference if speakers act and present themselves as interest group versus as assistances to solve problems in the market. Third, the role of power struggles between actor groups is relevant. Conference participants may use cultural material and knowledge strategically to convince other participants on the one hand. On the other hand, they may strive to come up with shared solutions to a problem without aiming to persuade other participants.

To sum up, the crucial aspect addressed in proposition 2a and 2b is whether economic knowledge applied to practice (performativity thesis) or interest-driven institution-building efforts (institutional entrepreneurship) play a prominent role in the

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<sup>101</sup> In the sociology of knowledge, the term „knowledge“ is often used in a similar way as “ideas” (Berger/Luckmann 1967).

constitution of a patent marketplace. It will be examined which ones of the theses finds more support in the case of the IP auction event.

Table 3 summarizes three lines of arguments derived from the two approaches for the IP auction event. While Callon's performativity thesis emphasizes the significance of techniques and knowledge that strongly relates to the term "device", the concept of institutional entrepreneurship points to institutional rules and power struggles when explaining market making efforts.

**Table 3: Three lines of arguments**

<b>Lines</b>	<b>Derived from Callon's performativity thesis</b>	<b>Derived from the concept of institutional entrepreneurship</b>
1	In the conference, participants discuss or create new techniques because established techniques do no longer help to solve a given problem on the market. Rules are treated as techniques.	In the conference, participants champion new rules that are valued highly by them. Techniques are treated as rules.
2	Participants act and represent themselves as consultants that stand for a technique to solve problems.	Participants act and represent themselves as organized groups that stand for certain interests.
3	Power struggles between groups do not play a role. Participants strive to come up with shared solutions to a problem without aiming to convince other participants.	Power struggles between groups play a role. Conference participants use cultural material and knowledge strategically to convince other participants

## 6.4 Methods

This chapter uses a qualitative research design to examine how the auctioneer Ocean Tomo, acting as a third-party assistance, copes with valuation-pricing and cooperation problems on the one hand, and with insufficient propertization and appropriation of patents on the other hand. The first part of the study examines the Live IP auction as mechanism of allocation and market device and the provisions made by Ocean Tomo preceding and following the actual auction. The second part is a case study about market constitution.

### Case Selection

The number of IP auctioneers is small. Ocean Tomo's auction qualifies for a case study on arm's-length transactions and market constitutions for the following reasons: First, the auction is designed to realize efficient arm's length and on-the-spot transactions. The auction proceeds as a standardized transaction process. Second, the company's vision is strongly characterized by an open and public IP marketplace. The auctioneer does not discriminate between certain types of sellers and purchasers. Instead, Ocean Tomo seeks for transparency and standardized processes in mar-

ket transactions and aims to create liquidity in the market (#O.T.4). Third, the conference hosted on the occasion of IP Live auctions provides an example of a market constitution event, as I found. The conference is not only a merchandizing instrument for Ocean Tomo but aims at introducing “the marketplace to a forum for facilitating the open and public exchange of Intellectual Property” (Ocean Tomo fall 2008 catalog). The company cooperates with various non-profit, governmental and non-governmental organizations to encourage initiatives for market-building and systematic valuation of patents. Ocean Tomo’s managers are eagerly presenting at international congresses.<sup>102</sup>

Between 2006 and 2010, Ocean Tomo and ICAP Ocean Tomo hosted eleven Live IP auctions across the US and Europe. In fact, the first auction held in San Francisco in 2006 has attracted a lot of attention in the media. In 2006 and 2007, the auctions have been featured on CNBC, Bloomberg TV, The Wall Street Journal, Barron's, Red Herring, BusinessWeek and Reuters (Businesswire.com 2008). Through the high media coverage, Ocean Tomo, LLC has perceptibly gained global recognition as the leader in live auctioning of IP for many large and most established global companies.

The Ocean Tomo’s auction conferences are open to C-level managers from private companies and public universities, inventor communities, governmental agencies, IP consultants and intermediary organizations. The events are held for “approximately 500 IP and business professionals in attendance, including Fortune 500 IP and licensing professionals, C-level executives from small and mid-size companies, investors, individual inventors, attorneys and press.” (Ocean Tomo fall 2008 catalog). The target audience consists of different professionals ranging from IP attorneys, IP managers, business development and university technology transfer managers. The objective of the event is to bring together those professionals, to provide networking opportunities and the build-up of relationships with the “Who’s Who’ of the global IP marketplace” (ibid.). It offers a round-table for discussions and a market-forum likewise. The conferences revolve around issues as IP transactions, IP investments and corporate IP strategies with a strong focus on patents. The intermediary invites influential speakers to the conference and workshops who act as panelists and moderators. The conferences are hosted in collaboration with other companies, non-governmental organizations and inventor networks that support the auction event as sponsors. The Live Multi-Lot IP auctions are the final of the event.

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<sup>102</sup> Jim Malackowski formed the Center for Applied Innovation Inc., a non-profit organization, in July 2004. According to newspaper articles, the state of Illinois was considering contributing money (Anonymous 2004a).

I chose the fall 2008 auction and conference in Chicago because I assumed that, after a series of conferences held at the beginning of the auction's launch, this event features a settled and proven program. In this event, it turned out that about 70% of the conference participants were trained in IP law. Most of them were managers from US companies and individual inventors, attorneys and consultants, while the minority came from larger European and Japanese firms, notably in the electronic and telecommunication sector. Few and far between, university technology managers participated in the event. 20 sponsors, most of them PMIs, advertised on their stands in the hall.

The event shares many characteristics of so-called "field-configuring events" (Lampel/Meyer 2008; Möllering 2010). The event including conference, workshops and network opportunities are not only open to sellers and bidders but to anybody interested in IP management and transactions (Ocean Tomo fall 2008 catalog). Different professionals with different organizational and geographical background were invited to the event. In the event, the actors came together in one location to exchange information, to discuss issues in workshops and round-tables and also to learn about (new) IP management tools and models. Collective-sense making and learning were both at the core of the event. Furthermore, the event included ceremonial and dramaturgical activities, as for instance a gala dinner and speeches at first-class venues (cf. Goffman 1969).

I do not claim nor do I prove that Ocean Tomo's auctions and conferences are most influential in the IP field. The IP field is scattered over different markets for technologies and patents. And the conference and auction attracted most interest among US firms in the electronic and telecommunication industry so far. Other patent market intermediaries host similar events and exert their influence in the IP community, for instance Yet2Com. Thanks to Ocean Tomo's public relation efforts and intensive networking with non-governmental organizations and inventor communities, the event certainly created a buzz in the IP world. Its impact on IP management practices and market making, however, is difficult to assess. However, I take this example to illustrate how the auctioneer solves valuation-pricing and cooperation problems and give account on the relevance of devices on market constitution.

### **Data collection**

For the purpose of both parts of the study, I conducted different kinds of data. In the data collection, I mainly relied on secondary data including Ocean Tomo's and ICAP Ocean Tomo's press releases, corporate reports and newspaper articles about the auctions. These data provided key information about the PMI and its initiatives, the auction process and the success of previous auctions. I used the newspaper arti-

cles primarily as a source of information about the public opinion on IP auctions, the IP marketplace and Ocean Tomo. Parallel, I conducted semi-structured interviews with four Ocean Tomo managers in October and November 2008 (see appendix 3.1). The interviews should give additional insights into the auction process and problems that Ocean Tomo faces in auction processes and the way how the company tackles them (sub-question 1 and 2). In the interviews, I focused on the daily practices of the managers but also their expert knowledge about the development of the secondary patent market. Furthermore, the interviews helped to validate the findings of the observation and to arrive at a conclusive interpretation. For confidential reasons, I was not allowed to record the interviews.

To explore the IP auction event, I conducted a semi-structured participant observation of the Live IP Auction event in October 2008 in Chicago hosted by Ocean Tomo. The observation should give an account of how a Live Multi-lot IP auction event, notably the conference, contributes to market constitution (sub-question 3). In the field observation, I acted as participant observer with a low degree of involvement in the social setting. I observed the happening as participant but did not intervene in the discussions. However, I interacted with participants of the auctions. My presence and identity as researcher was known to Ocean Tomo but not to the participants of the auction. My role was that of an “observer as participant” (Gold 1958). This role is suitable for identifying with the field without being entirely involved in the setting (Burgess 1984: 81-85). As a researcher I did not belong to the target group of the event and thus, my role was that of an outsider. In the observation, I did not use a camera but recorded all observations manually. To structure the recorded observations and to focus my attention to relevant aspects, I compiled an observation checklist in preparation to the event (see appendix 3.2).

In the course of the observation, I focused on the following categories that ultimately guided the check-list:

**Table 4: Categories and indicators**

#	Derived from	Category	Indicators	Examples of evidence in the observation
1	Proposition 2a	“Techniques and theoretical arguments in the foreground”	1a: Discussions on techniques prevail	The program mainly includes presentations about business models and techniques.
			1b: Theoretical arguments used by presenters	The presenters refer to knowledge and techniques from economic and managerial science.
2	Proposition 2a	“Techniques employed in practice”	Presenting business models employed for a company	Business-models in corporate practice are presented and discussed.

3	Proposition 2a	"Rules as techniques"	Corporate IP management practice is presented as solution to a problem	"and we believe that this a proper solution to the problem because it works"
4	Proposition 2a	"Presenters act as advisors or experts"	In the presentations, corporate representatives and PMIs screen and recognize developments or options that other firms may not be aware of (Seaton/Cordey-Hayes 1993).	The presentations include case studies, expert opinions and conclusive arguments that are instructive and informative for many other firms and universities.
5	Proposition 2a	"Arrive at a reasonable solution to a problem"	The panelists and speakers aim at the best and most reasonable solution to a problem.	The discussion between panelists and speakers is akin to an expert discussion. The audience pinpoints to shortcomings of a solution.
6	Proposition 2b	"Rules in the foreground"	Discussions on corporate practice prevail.	The program mainly includes presentations about taken-for-granted practice in organizations.
7	Proposition 2b	"Techniques as rules"	Business models and techniques are presented as part of (corporate) IP management practice.	"the way we usually do it at our company is to look at key metrics first and then proceed to details"
8	Proposition 2b	"Presenters act as interest group"	The presenters are organized in groups that stand for certain interests.	Specific slots in the conference are reserved for certain actor groups.
9	Proposition 2b	"Champion new rules"	The presenters aim to persuade the audience of their corporate IP management practice and services.	The speakers emphasize that their in-house model and services are best practice.
10	Proposition 2b	"Power Struggle exists"	10a: Balance of time is unevenly spread over issues and presentation slots.	The actual presentation time exceeds the program planning or the program agenda sets more time for specific issues.
			10b: Allocation of issues in the programme uneven	The program agenda covers only a few broad topics.
			10c: Status of participants differs	Some presenters and action groups have more time to talk and present their issues of concern.

In table 4, a *discussion between experts* is defined as a conversation about a central topic characterized by task-related elements of interactions. In line with Bales (1976), interaction process analyses comprise the following task-related elements: The discussants ask for and give information, orientation and confirmation (“orientation”). They ask for and express their opinions and wishes, and give assessments (“opinion”). They ask for and give suggestions, instructions and solutions to a problem (“suggestion”). *Taken-for-granted rules* cover corporate procedures and practices that are generated and reproduced in an organizational setting. In contrast to devices, they are specific and thus not necessarily applicable for other companies.

At the same time, I attempted to be open to unexpected incidents in the observation. I made open records of the *framing of the event*. The framing of the auction event is relevant, as I found, because it delivers further insights into the way the event contributes to market constitution. By orienting to Goffman’s (1969; 1986) frame analysis, I focused my attention on dramaturgical and ceremonial elements, e.g. regrounds (role-exchange) and technical redoings (e.g. demonstrations of activities), and strategic actions and interactions of participants. Dramaturgical and ceremonial elements do not have any practical implication for the setting. It is a playful engagement on the part of the auctioneer and the presenters. In a role-exchange, the event breaks with ordinary activities and thinking and changes the functional contexts of practices. Strategic actions and interactions are directly opposed to dramaturgical elements because they involve strategic goals and means on the part of the actors. The purpose of the open recording was not to arrive at a sound framing analysis but to use key categories from this approach to direct my attention to specific details of the event.

### **Data analysis**

In the data analysis, I applied two methods. In the first part of the study (sub-question 1 and 2), I used the same qualitative content analysis described in the previous chapters for documents and the interview transcripts (Mayring 2007). In the second part of the study, I attempted to find support for one of the two theses on market constitution. Thereby, I reviewed all recorded observations, relevant passages in documents and interviews in order to detect and collect examples of evidence for the categories presented in table 4. To organize the material, I contrasted all records and passages that would fit to proposition 2a with the ones that match up with proposition 2b. Thereby, I used a deductive and counterfactual procedure to analyze each session of the conference. First, I attempted to find out which assumptions of the two propositions are not supported in a given session. This should help me to filter out those passages of the material that confront the theses. Then I focused on the other passages to learn which assumptions are more or less confirmed by the material.

Finally, I used a coding procedure oriented to Strauss and Corbin (1991) to gain a comprehensive picture of market constitution and to ultimately answer the last sub-question.<sup>103</sup> The aim of the coding procedure was to arrive at a low number of core categories that characterize the way how the IP live auction event hosted by Ocean Tomo LLC contributes to market-making. The carving out of core categories is a means to identify the most crucial conditions, interactions, strategies of actors and consequences of the event (“Paradigm Model”) (Strauss/Corbin 1991: 99-108). In the analysis, I primarily made use of the open and axial coding procedure. In the open coding procedure, I conceptualized the data by “breaking down” (ibid: 63) the meaning of relevant passages, by making comparisons and asking questions to the texts. The aim of axial coding is to make connections between the categories and sub-categories in order to end up with a few core-codes. The technique applied for this procedure is the paradigm model (Strauss/Corbin 1991: 97-99).

## **6.5 Public IP auction events as special case**

### **6.5.1 Ocean Tomo LLC as PMI and host of public IP auctions**

Ocean Tomo, LLC was founded in 2003 by James Malackowski and Andrew Carter, and is referred to as Capital Merchant Banc<sup>TM</sup>. The company is headquartered in Chicago with five US offices and one office in Paris at present ([www.ocean-tomo.com](http://www.ocean-tomo.com)). The company currently provides a wide range of IP related products and financial services, including expert testimony, IP valuation, research, IP ratings, investments, risk management and transactions. Ocean Tomo assists corporations, law firms, governments and institutional investors “in realizing Intellectual Capital Equity<sup>TM</sup> value broadly defined” (ibid.).

The company was initially active as strategic advisor and approved by US bankruptcy courts in a number of auctions held in bankruptcy proceedings, e.g. Commerce One (eWeek.com 2004; cf. Viscounty/Vries/Kennedy 2006). However, investment banking, IP valuation and risk management became the core businesses, and the company soon began to broaden its business and to pioneer IP related financial products. With the creation of the first Live IP auction in 2006<sup>104</sup>, and the distribution of advanced IP software solutions (PatentRatings<sup>TM</sup>), services and financial

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<sup>103</sup> However, the analysis did not aim to come up with a grounded theory, a model or integrative description of the event. Much more the interpretation was guided by theoretical concepts found in economic sociology.

<sup>104</sup> Ocean Tomo claims to have held the first public IP auction worldwide. Yet, a predecessor of this kind of auction was the Shanghai Patent Auction held in Shanghai Intellectual Property Park on December 29, 2004 (Anonymous 2004b).



products, Ocean Tomo embarked on new strategies to commercialize patents. In recent years, Ocean Tomo, LLC, heavily pursued its long-term goal and extended its business towards stock exchange trading. The company introduced two public IP indexes and co-founded the Intellectual Property Exchange International (IPXI) in 2006 ([www.ipxi.com](http://www.ipxi.com)).<sup>105</sup> Ocean Tomo also responded to the current downturn and financial crisis. The company launched a Corporate Recovery and Restructuring (CRR) Advisory Services in 2009. In the course of a restructuring process, the PMI assisted corporations in valuing and managing IP. Furthermore, Ocean Tomo introduced a fixed fee structure for expert services in patent infringement cases observing that more and more companies avoid high and unpredictable costs of disputes (Meyer 2009). The valuation of IP, however, remains the IP-related domain of Ocean Tomo, LLC.

### **The Live Multi-Lot IP auction**

The *Live Multi-Lot IP* auctions are part of a broader transaction division of Ocean Tomo that comprises three other services: Private IP Brokerage, Dean's List<sup>TM</sup> and the Patent/Bid-Ask<sup>TM</sup> platform. The services differ with the degree of anonymity of clients, the speed and urgency of transactions and access to listings: The *ICAP IP Brokering* is an IP transaction advisory service and it certainly stands out from other services because brokers are active in primary and secondary IP markets. *Dean's list* is an online IP exchange service similar to Yet2.com, TAEUS, Tynax, eBay and wikipatents.com. IP sellers submit IP to be listed either for sale or for licensing. IP buyers may remain anonymous during initial diligence by using general e-mail (Ocean Tomo fall 2008 catalog: 26). The *Patent/Bid-Ask* platform is "the first web- and voice-enabled marketplace that allows buyers and sellers to submit offers to buy ('Bids') and sell ('Asks') any of the 33 million plus patent assets, or any combination thereof, across 81 countries and patent-issuing authorities in a completely transparent fashion" ([www.icap-ocean-tomo.com](http://www.icap-ocean-tomo.com)). Bidders are able to anonymously post unsolicited bids to initiate a sale or exclusive license but all other activities including the identity of the sellers are made public "as a benefit to the IP community" (ibid.). According to the intermediary, this makes the platform as "the first and only global patent price discovery platform" (ibid.). In online IP exchange and listings, IP sellers

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<sup>105</sup> In December 2006, Ocean Tomo launched the Ocean Tomo 300 Patent Growth Index, an equity index consists of about 60 stocks from an universe of US-listed 300 companies whose evaluation is largely based on patent valuations (BuySellSignals 2010). Besides, the company introduced the Ocean Tomo 300® Patent Value Index. The company is also the co-founder and majority owner of the Intellectual Property Exchange International (IPXI) ([www.ocean-tomo.com](http://www.ocean-tomo.com)). Buyers can purchase an Unit License Right® (ULR) and thereby obtain the right to use a pre-established unit of IP. The shares vary in value based on supply and demand on the marketplace, which will determine the true value of a patented invention.

and buyers can constantly observe bidding activities over a longer time period. The urgency in bidding, however, is typical for live IP auctions, as indicated.

Ocean Tomo hosts two to three Live Multi-lot auctions per year in the English auction style. Besides, the intermediary still holds private IP auctions, e.g. for the Green Road Project to auction licenses (Businesswire.com 2009b). On June 16, 2009, Ocean Tomo announced that its IP auction and private brokerage division was purchased for 10 million USD by ICAP, PLC, an interdealer broker and provider of post trade services which matches buyers and sellers in various branches through voice and electronic networks ([www.icap-ocean-tomo.com](http://www.icap-ocean-tomo.com)).<sup>106</sup> The newly created firm now operates under the name of ICAP Ocean Tomo. Through this deal, the auctioneer unifies ICAP's brokering expertise and Ocean Tomo's know-how in IP valuation and financial services.

In sum, over 90% of the lots offered on the ten auctions are patents (Jarosz, et al. 2010), and thus the Live IP auction *is* a patent auction. About 70 % of the lots include US patents only, while about 30 % (individual and portfolio lots) additionally have non-US patents in the portfolio (author's calculation based on ten catalogues and seven supplements). It is interesting to note that the IP offered in the initial auctions had been foremost US Intellectual Property. The subsequent nine auctions between 2006 and 2009 offered IP portfolios of US and non-US patents. 43 % of IP lots comprised bundles of patents whereas 57% consisted of individual patents (see for a detailed listing in: Jarosz, et al. 2010).

In the first auction, the average price per lot paid by the bidders, 272,455 USD, was lower compared to the IP offered in the following nine auctions, 406,529 USD. The main reason according to Ocean Tomo was that the first auction offered IP by secondary sellers, also known as IP aggregators (Chicago Tribune 2006 quoting James Malackowski). In the following auctions, the PMI attracted primary sellers, amongst large companies and notably small companies and individual inventors that do not have sufficient resources to monetize their patents. Since 2008, Ocean Tomo has increasingly approached governmental corporations and established collaborations with universities to license technologies, as for instance the University of Southern California and NASA. Throughout the years, telecommunications, electronics, consumer products, computer, software and web services accounted for the vast bulk of lots being auctioned (Jarosz, et al. 2010). However, most recent ICAP

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<sup>106</sup> ICAP is also a provider of global market information and research for professionals in the international financial markets ([www.ipac.com](http://www.ipac.com)). In the course of the deal, ICAP closed a 10-year contract with the Merchant Banc® to promote the development of IP finance through a long term working partnership for both, live intellectual property auctions and private sale transactions (Anonymous 2009; Shane 2009). IP finance is estimated to be a potential 10 trillion USD market (Shane 2009).

Ocean Tomo auctions follow a growing bio and life sciences practice (Medical Device Daily 2010).<sup>107</sup> The company obviously realized an industry need for a Live IP auctions for drugs and drug candidates at all stages of development (Newswire 2010). The PMI now accepts patent submissions for pharmaceutical small molecules beside consumer electronics, e-commerce and communication technologies (ICAP Ocean Tomo 2010b). The Pharma Small Molecule Live auction planned for March 2011 shall be a public one-stop-shop designed to match sellers “with the right buyers, no matter the size of the company, in a risk free, flexible environment” (ICAP Ocean Tomo 2010c). The growing range of patented technologies offered on the auction suggests that the auction remains open for any industry needs.

The series of Live IP auctions have rather been a trial and error process than designed in order to reach a fixed target in sales and revenues in the short run. The initial live IP auctions have been a new experience for the intermediary as well as for companies (# O.T.1). For Ocean Tomo, they served to learn about what is possible in the marketplace and to make experiments at the same time. While the auction style remained unchanged, Ocean Tomo found out that bidders prefer to have the reserve price disclosed. This is not typical for auctions at all. Through this disclosure, transparency about the value should increase and bidding companies are better enabled to understand the value of a given technology (# O.T.2). Despite the high interest of patent holders to sell or license IP, the PMI realized that bidders are apparently overstrained with too many lots, and instead numerous IP auctions may be more effective for the start despite higher costs (# O.T.2, O.T.3). Ocean Tomo was confronted with C-level managers that have never experienced auctions. This was also a reason why the intermediary offered workshops about auctioning in the first conference, to familiarize managers with this method of pricing and the legal implications of sale transactions, and changing adjudication. In the long run, IP auctions might establish but still remain an alternating business.

### **Success of the IP auctions**

By now, the Live IP auction is a story of alternations. In 2006, Ocean Tomo soon became leader in the live auctioning of IP with over 30 Million USD in transactions (Businesswire.com 2007). The first auction in spring 2006 generated 3.0 million USD in sales<sup>108</sup>, while sales amounted to 23.9 million USD in fall 2006 for 25 sold lots; this was the best result from any auction. In the following years, sales and the number of lots offered and sold alternated. Finally, the spring and summer auctions

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<sup>107</sup> Already in 2009, Ocean Tomo detected increasing private transactions in the area of life science and expected “the auction floor to see the high tech sector moving up market to fewer, but larger, deals” (Lab Business Week 2009 quoting James Malackowski).

<sup>108</sup> Post-auction sales are excluded.

in 2009 have been disappointing for the PMI regarding sales and the number of lots sold.<sup>109</sup> The PMI had to take stick about the heavy decline in transactions and the high buzz that was brought to the auction event (Jarosz, et al. 2010). In the last spring auction 2010, however, the ICAP Ocean Tomo reported its second highest sales proceeds, 14.3 million USD (ICAP Ocean Tomo 2010a).

There are certainly many reasons why some IP auctions were successful while others were not, and the open-cry auction as specific exchange mechanism of patents is only one aspect. First, Ocean Tomo apparently makes a high volume of sales in post-auctioning transactions, e.g. sales of patents subsequent to the live auction. In the first IP auction, post auctioning sales surmounted the actual auction sales about 180% for five lots only.<sup>110</sup> Second, particular lots are heavily promoted as highlights in advance, e.g. the Jimi Hendrix music library in spring 2006 or the NASA patent portfolio in fall 2008. Most IP auctions have been successful because a few matches reached a high price. Third, Ocean Tomo offers efficient and discreet due diligence of IP which is still important in arm's length transactions.

As we will see in the next sub-chapter, the auction per se solves only a fraction of cooperation and valuation problems that may occur in the transaction process, and without the provisions and arrangements made by Ocean Tomo, IP auctions would not succeed. Ocean Tomo also actively tackles issues raised by sellers and buyers.

## 6.5.2 Coping with uncertainties in the IP auction process

### The auction process

Sellers and bidders face a straight and shortened transaction process between three days and a few weeks. The process for the Live IP Auction has only a few steps for both: The seller submits patents for the auctions that go through Ocean Tomo's IP qualification process. After the acceptance of the IP into the auction, the seller signs a consignment agreement and a listing fee based on portfolio and reserve price. The reserve price, which is set by the seller, must at least amount to 10,000 USD. The listing fees range between 1,000 to 6,000 USD per lot for patents. Furthermore, the seller must fill out various forms in which he gives representations about ownership, inventorship, list of licenses and encumbrances. Ocean Tomo is flexible enough to

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<sup>109</sup> Prior to the spring auction, Malackowski still sounded optimistic and announced plans to expand the company's business to Hong Kong. "Having a good US patent portfolio still remains to be the most promising ticket to win in the global markets, and the recession is making more buyers and sellers focus on US patents" (Lab Business Week 2009 citing James Malackowski).

<sup>110</sup> For the subsequent auctions Ocean Tomo did not release sales figures on post-auction activities.

accept IP two weeks before the event. The bidders must register prior to the auctions which is even possible curly before the event. The bidder must fill out a bidder agreement and registration forms and submit a bank letter guarantee to become qualified as a bidder. Once she is qualified, the bidder may opt to be anonymous, either to the auction participants, to the intermediary or to the marketplace. In the first case, the bidder makes an absentee bid, a telephone bid or by proxy bidding through a staff member of Ocean Tomo. In the second case, the bidder will retain an agent to bid on the auction in order to be anonymous towards Ocean Tomo. In the third case, the bidder decides to bid in the private post-auction.

As noted in chapter 6.5.1, the intermediary must select those patents that are most suitable to be auctioned. In the IP selection process, the intermediary tackles issues related to the proprietization of IP. As the grant of a patent does not guarantee full ownership of an invention and third parties may have rights to the IP, Ocean Tomo examines the entire patent history including all encumbrances to the IP, for instance re-examination or invalidation, oppositions or granted non-exclusive licenses. Ocean Tomo does not assess whether other companies infringe the patent. This is part of a freedom-to-operate analysis of the seller.

To ensure a smooth appropriation of the technology, the intermediary must consider the *indivisibility of inventions* (1.), the *information disclosure problem* (2.) and the *acquisition and apprehension of the invention* (3.) by bidders (see chapter 2.3):

Ad 1.) The *indivisibility of inventions*: Some inventions are not conveyable as isolated or a well identifiable lot. Patents often complement and substitute each other. The intermediary addresses this issue in the formation of lots. Other than the FCC auctions, the lots are assembled by Ocean Tomo prior to the auction. Single lots encompass one patent for a stand-alone technology which is transferred isolated. Bundled lots can cover a portfolio of patents. The PMI assesses which collection of patents forms a technology that is valued higher as a unit than as a sum of lots comprising individual patents. An informed decision about the grouping of patents into lots, often assisted by the seller, is a precondition for bidding activities. Bidders cannot bid on subsets of bundled lots or a combination of lots at the same time (Jarosz, et al. 2010).

Ad 2.) The *information disclosure problem*: For every lot, the auction catalogue lists non-confidential information: The name of the seller, the inventors, the patent number, issue date, earliest filing date, a summary of the lot, patent citations and the representative independent claim of the patent. The lot summary entails a short and general description of the invention. The catalogue basically reproduces key information already published in patent databases. However, knowledgeable bidders are well informed about the prospect market and application and thus, the description in

the catalogue is not sufficient to them. They require more information to assess the patent. To spur efficient due diligence and at the same time secure the confidentiality provided by non-disclosure agreements, Ocean Tomo established a so-called "online data room". This device is a software program with restricted access to confidential information. Registered bidders can log-on in the software to conduct due diligence about the lots. Additionally, the intermediary offers one-to-one meetings with the sellers.

Ad 3.) The *acquisition and apprehension of the invention*. The intermediary selects technologies that are not too specific but related to a broader industry need and market application (# O.T.3). In the catalogue, Ocean Tomo addresses several potential licensees that could be interested in a particular lot. A broad range of potential licensees increases the likelihood that non-competitors act as bidders. However, sellers must be aware before the IP submission that in no case, competitors are excluded by the open IP auction (# O.T.1). The utilization and appropriation of novel knowledge often requires subsequent exchanges of know-how and services including intensive collaboration between the R&D personnel. The same holds for early stage technologies. Ocean Tomo does not exclude such lots in general but attempts to discuss solutions to this issue with the seller. Basically, such technologies "are pretty hard to deal with" (#O.T.4). In this case, the intermediary must assess whether a deviation from the standardized procedure and the resulting increase in transaction costs is profitable for him. The same refers to IP in which a high amount of valuable know-how is involved. This is a severe problem for the intermediary and the seller (#O.T.2). The seller may wish to sell the know-how as a supplement to the transactions but this service may not be part of the auction process. The bidding companies often require information about the know-how directly by the seller. In this case, one-to-one meetings are offered by Ocean Tomo in which the intermediary controls the amount of information flow between the parties.

In most patent transactions decided by the gavel, the patent is sold and not licensed. The bidding price is treated like a lump sum without partial payments. Due to the Bayh Dole Act (1980), however, US governmental corporations are not allowed to sell their IP. Instead, they may grant non-exclusive, exclusive or co-exclusive licenses. For example, this was the case with the NASA technology auctioned in fall 2008. Since such licensing transactions are more complex than sales transactions, the intermediary had to make provisions to assure that the transaction is nonetheless standardized and expeditious. The amount of contractual clauses was shortened and streamlined (#O.T.3, #O.T.4). In the IP submission process, the intermediary often assists sellers in identifying patents that are most likely to be auc-

tioned. Ocean Tomo managers reported that the company finds quite a high supply of patents from patent holders willing to offer their IP on one of Ocean Tomo's trading platforms (#O.T.3, #O.T.4). To detect the most qualified patents, the staff selects those patents that are valued high by potential sellers and sort patents out which are invalid and thus do not qualify for the auction.

In return, it is more difficult for the company to find seriously interested purchasers. Bidders often direct to Ocean Tomo for exploring technologies of interest. Bidders identify patents for sale when reviewing Ocean Tomo's database and catalogues. Besides, the PMI realized that bidders are apparently overstrained with too many lots on the auction floor. Despite higher costs, the company decided to offer fewer lots on a higher number of IP auctions for the start (# O.T.1, #O.T.4). Consequently, the selection of valuable IP and the compilation of the auction catalogue are important elements in the preparation process for the PMI.

A key part of the IP qualification and selection process is the *valuation of patents*. Key screening factors are the area of the technology, the claim language, encumbrances, market information and the time remaining in the IP (Ocean Tomo 2007). More precisely, Ocean Tomo claims to evaluate the quality of patents by using specific metrics. For this purpose, the intermediary developed an intellectual property quotient ("IPQ"). For each submitted IP, a score is calculated. For this purpose, the examiners first identify the maintenance status, litigation issue, chain of title and ownership and re-examination requests of the IP. The IPQ measures IP quality that reflects the strength of the patent. To compute the score, the intermediary uses a variety of metrics that are based on the number of dependent and independent claims, number of US patents and related international patents, forward citations (Ocean Tomo 2007). The result of this assessment is a due diligence report provided by the intermediary. Ocean Tomo also offers clients its in-house IP software solution PatentRatings<sup>TM</sup> which is used for other monetization strategies. In general, a holistic patent quality assessment is not required for the auction screening process. However, often sellers have unrealistic expectations regarding the value of their patents (# O.T.4). In this case, the claimed objective approach of patent rating is a powerful device to convince sellers of the "objective" value and to set the reserve price. Since 2008, the intermediary even publishes the expected value of a given lot in the auction catalogue to "let the people know how much they would have to spend for a particular lot" (#O.T.2).

Furthermore, Ocean Tomo addresses numerous issues raised by sellers and buyers. First, sellers fear that purchasers will acquire portfolios to file an infringement suit against them. This lack of information about the intention of the other party is aggravated by the anonymity of the bidder. Ocean Tomo assesses the pre-registration form to identify key motivations of bidders. However, the intermediary does not

prevent subsequent disputes nor does he exclude qualified bidders because they may sue the IP seller, as for example the so-called “patent troll” does (#O.T.1, O.T.4). Second, the purchaser aims to ensure that the auction yields the expected value. This is another reason why Ocean Tomo publishes the expected value of the lot in the auction catalogue. Since fall 2008, the reserve bid has been disclosed. As indicated, this should improve the price discovery process on the part of the bidders. The intermediary inhibits the submission of less valuable patents by accepting IP whose reserve price is well above 10,000 USD. Third, many bidders prefer to remain anonymous (Jarosz, et al. 2010). They do not wish to reveal a need for IP because this signals a technological weakness to potential competitors or the simple fact that the bidder is an infringer of the IP (cf. Arrow 1962; Lopez/Vanhaverbeke 2009). Ocean Tomo's auction design permits double blind bidding to secure anonymity.

### **The broader context of the auction**

Ever since the PMI hosted the first auction, it was part of a larger event that included a conference, workshops, several bars of sponsoring firms, a gala dinner and networking opportunities. The Live IP auctions are announced two months before the event takes place. Ocean Tomo and ICAP Ocean Tomo respectively strongly merchandise the upcoming auctions to pile up IP but much more to attract companies to bid and to raise awareness of the auction in the public (# O.T.1).<sup>111</sup> Ocean Tomo coordinates the auction event that precedes the actual auction. Ocean Tomo is known to hold “first-class events [...] at five-star properties and historical dinner venues with approximately 500 IP and business professionals in attendance” (Ocean Tomo fall 2008 catalog). For this purpose, the firm is constantly hiring sponsors. Companies can become silver, gold or platinum sponsors. Alternatively, they may host an event against a premium. Sponsorship is a financial source for Ocean Tomo Live IP auction event and it is a means for companies to raise visibility of the own firm. Sponsoring, the set-up of bars in which companies market the technology and the network opportunities throughout the event are designed to offer “an opportunity to build relations with key clients and partners and network with the ‘Who's Who’ of the global IP marketplace” (Ocean Tomo fall 2008 catalog). This and targeted mailings and confidential strategic partnership meetings “[...] allows your company to gain exposure to over 100,000 intellectual property and business professionals” (ibid.).

The Live IP auction is embedded in a one-and a half-day conference. For this occasion, Ocean Tomo invites numerous guest speakers who debate about novel busi-

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<sup>111</sup> Ocean Tomo receives many IP submissions from sellers, the bidding side is much more the focus of marketing.



ness models and exchange information about their experiences and practices. The PMI gathers information about the most preferred topics from the participants through questionnaires handed out prior to the IP auctions. The program schedules numerous workshops, many of them organized in tracks designed for the needs of specific professions, for example Buying and Selling IP, managing IP risks or Maximizing IP Value for Business Professionals. The IP marketplace and open innovation are also important issues in these workshops. The conference is finished by a gala dinner hosted in impressive venues. In several speeches, the participants get the opportunity to learn more about Ocean Tomo's future plans and the development of the patent marketplace. Subsequently, the Live IP auction begins.

### **6.5.3 The Live Multi-Lot IP auction in fall 2008 in Chicago: The marketplace in a forum**

This sub-chapter describes the happening of the fall 2008 IP Live Auction (October 29 and 30, 2008) and thereby presents the formal set-up of the event, its framing and the aims of actors and actor groups.

The conference was hosted in the 16<sup>th</sup> and 17<sup>th</sup> floor of Chicago's new Trump International Hotel and Tower, one of the largest buildings in the US. Ocean Tomo reserved the largest salons in the tower - the Grand Ballroom, Grand Salon and Skyline room - for the conference including different workshops and networking opportunities. The conference started on October 29 early in the morning, registration and breakfast at 7.00 am. The conference was organized in three separate tracks, each covering a topical field. Track A addressed presentations and discussions on "Buying & Selling IP" in the large Grand Ballroom. Track B presentations treated topics revolving around "Managing IP risks" and took place in the smaller Grand Salon. In Track C, presentations about "Maximizing IP Value for Business Professionals" were held in the Skyline room. The venue of the plenary sessions, however, was the Grand Ballroom, which was the actual room of my observation. Each presentation was scheduled for approximately 20 minutes.

The program agenda was dense and strictly organized. The plenary sessions first included a panel of attorneys on major developments in Patent Law 2008, followed by a panel of IP aggregators on evolving business models and market perceptions. In both sessions, current developments in the IP field were subject to discussions. In the course of session 1, the panelists provided an analysis of the impact of changes in the IP environment on patent protection and IP management activities. In the beginning, the implication of crucial court decisions, notably KSR versus Telefax, and new USPTO guidelines on patent infringement and IP licensing and sales transactions were critically analyzed and discussed. This part included essential elements of an expert discussion, foremost judgments of lawyers (opinions) and the audience

asking for orientation. The panelists arrived at the conclusion that the discretion on the part of patent examiners at the USPTO has increased and that infringers are now emboldened. Furthermore, new directions in patent litigations were discussed. The long docket in the high-tech and telecommunication industry was subject to further discussion between the panelists. Session 2 tackled a highly debatable topic in the IP world: IP aggregators acting as patent trolls. This session was particularly interesting because the participants, coming from different backgrounds, obviously have had different opinions on this kind of business model (see chapter 7.2, page 225-228).

It was remarkable that almost all panelists represented the IP aggregator side and that the program included key phrases signaling a positive attitude towards the patent trolls, as “dispelling the myths – public perception vs. clarifying and understanding the character of existing business models” and “understanding the evolution of these models”. The speakers spelled out that after a period of defensive blockade by large patent holders (defensive strategy), small companies and single inventors may profit from offensively attacking “patent lords” and thereby find new sources of monetization. The IP aggregators also showed how they amass patents in portfolios to raise the value of IP for clients. They found that given the low value of most patents reported in empirical studies, this business model is due. The panelists gave orientation to the audience and at the same time, they drew attention to newspaper articles that focus on the positive side of IP aggregation. Session 3 was devoted to the reevaluation of IP strategies in a changing economy. Similar to session 1, the impact of the legal environment on IP strategies was assessed. The panelists were patent attorneys and IP experts. They discussed the harmonization of patent institutions and the role of the US international trade commission (USICT) for the valuation of IP and patent trading. The panelists concluded that patent harmonization, though still far from political feasibility, provides accelerated patent examinations and thereby has a positive effect on corporate IP strategies. The presenters gave advice on what changes companies should be instituted in the changing economy.

In the afternoon, the participants could choose between the three tracks. All tracks had business models and management strategies as central subjects. The panels included numerous speakers with different backgrounds. In session 4 (track A), sale and monetization options for IP owners were assessed. Very much in the foreground was the issue of how Microsoft Corp. encourages inventors to offer their patents to the company. David Lubitz, Director of Licensing, did not only report from corporate practice but also gave clear hints to inventors about how to best commercialize their inventions to companies in general. The other panelists discussed hurdles for IP owners in due diligence and licensing in general and listed key expectations of IP purchasers to IP holders. In session 5, the tracks dealt with IP owners' concerns, in

the sales process (track A), in IP risk management (track B) and the valuation of IP (track C). In the focus of these presentations and discussions were techniques of utilizing data, patent metrics and documentation, while knowledge about best practice and strategies was less pronounced. In-house models of how to evaluate IP were introduced, though with a reference to the validity and reliability of those metrics. Session 6 touched hurdles and problems of IP purchasers in using IP information (track A), insuring innovation against litigation (track B) and structuring deals (track C). In track A, the advantages of systematic patent analyses and benchmarking techniques in the investigation of the competitive landscape of companies were highlighted.

The finale of the first conference day included a gala dinner at the Historic Stock Exchange. This dinner combined a series of ceremonial and dramaturgical elements with plenty of networking opportunities. In the inspiring atmosphere of the assembly hall of Chicago's Art Institute, the participants had sufficient time for socializing and to exchange their opinions on the conference and their expectations of the forthcoming auction. Given the dense conference program, this part was certainly enjoyable for most of the participants. The gala dinner, however, was characterized by a purposeful orchestration of ceremonial and dramaturgical elements. While the participants could continue their conversations and enjoy the dinner at a round table, the main happening was focused on the podium speakers, who inaugurated the dinner. This ceremonial moment was reserved for Ocean Tomo and its managers, who used to act in the background during the conference. The most impressive speech on the floor was given by the co-founder of the company, Jim Malackowski. Using a metaphorical language combined with a theatrical performance, he introduced the fundamental idea of his work and inducted the audience into his visions of a free market for patents. He talked about how he arrived at the idea of a public IP marketplace and why many companies, that are now selling patents on the auction, reacted so negatively in the beginning. The emotional part of the speech was highlighted by expressions that evoked the spirit of the liberal market economy - price discovery, transparency, liquidity and realizing the value of unexploited patents through the marketplace.

During the first day, I was able to make a few conversations with other participants of the conference. It was interesting to note that the participants were not given tags that would reveal their identity. In the Grand Ballroom, people were allocated to a large number of round tables that provided place for about eight people. So, except for the lunch and coffee breaks, the spatial arrangements allowed participants to get intensively in touch with a low number of other participants and to start long discussions. The participants rarely signified their identity as potential bidders. With the sellers of lots and representatives of intermediary organizations, it was vice ver-

sa. They used the conference to distribute their business cards and to spot potential clients. I observed that throughout the sessions, the majority of participants showed great interest in learning about the background of other participants and their thoughts about the current development in the US IP market. It was an intensive exchange of experience and ideas followed by discussions about problems managers face in their practice. They expressed interest in the conference program and the key speakers, and they were curious about the auction. This curiosity was much talked of. The managers were well informed about negative press releases from the previous live IP auctions and most of them were quite skeptical towards the success of this business model. It seemed that especially managers from large companies were wondering at Ocean Tomo's ambition and intention to spur a public patent marketplace.

The second day comprised three sessions. In session 7, track A and B explored the success and challenges of open innovation and thereby referred to the functions of the patent marketplace for open innovation. By showing different case study examples, the panelists pointed to the risk of engaging in open innovation when being sued for patent infringement by a third party. However, they did not come up with a clear solution to this problem. Presentations at the end of this session dealt with the business models of open innovation companies, such as Venture2 and InnoCentive. Session 8 was spread over different topics. In the focus of track A was a case study of the first federal agency to auction licenses on Ocean Tomo's auction floor. The panelists were managers from US governmental agencies. NASA's chief patent counsel introduced legal stipulations for governmental agencies that have crucial implication for spot-market transactions. Ocean Tomo's staff reported on their experience in partnerships with governmental agencies. This session was particularly informative to universities and federal laboratories who wished to learn about how to handle legal barriers in the commercialization of federally funded patents. However, the session was likewise a public relation initiative for both, NASA and Ocean Tomo. Session 10 was finally reserved for special issues, as structuring IP deals (track A), Ocean Tomo's recently launched IPXI (track B) and sales of IP in bankruptcies (track C). Many participants already left the conference before this session and only a few participants interested in details stayed in the Grand Ballroom.

The venue of the Live IP auction was the Cultural Center in Chicago. The two bars at the back of the room and the amusing comments given by the auctioneer Charles Ross from Gooding & Company contributed to a conspicuously relaxed atmosphere. It soon became apparent that the majority of the participants in the auction just came to observe the auction. At least fifteen persons were busy making notes about the bids, while the other hundred participants eagerly watched the happening. Throughout the auction, the auctioneer spent about 90 minutes for offering

87 lots which is on average one minute per lot. In fact, this is exceptionally slow for business auctions. Lot number 61 even took 8 minutes and 30 seconds to reach the final bid. In other words, the bidding having a time span of approximately 20 seconds between two bids was very hesitant. This kind of hesitation was even stronger in previous auctions, as another participant told me. Charles Ross spent a good time in cheerfully entertaining the audience and to instill enthusiasm on the auction floor. He was visibly zealous to bring speed and urgency in the bidding process. So, it occurred that the participants clapped their hands ten times when the bidding price of a lot all of a sudden climbed up. The most serious bidders made bids by phone to the Ocean Tomo staff and thereby remained anonymous. The paddle was raised only a few times. The most discernible impact on the auction floor came from NASA's lot number 56. Charles Ross announced this lot intensively and directed the attention of the press to the relationship between the governmental agency and Ocean Tomo. It seemed that the audience was eagerly waiting for NASA's patents and that the success of the auction was measured accordingly. In sum, the auction shared more attributes of a typical charity auction than a business auction.<sup>112</sup>

#### **6.5.4 Market constitution in the Live Multi-Lot IP auction event**

Ocean Tomo's Live IP auction supports the conscious constitution of primary *and* secondary markets for patents, as I found. In the analysis, I identified three dimensions that characterize the auction event and indicate how the auction event, notably the conference, contributes to market constitution:

1. **Joint effort:** This category refers to a precondition of the constitution of a functioning primary and secondary market for patents. Ocean Tomo is the host of the auction event but the IP auction is a joint effort in which many other market actors are involved, notably the sponsors. The key speakers are C-level managers of large companies, PMIs and single inventors. Their comments and discussions shape the event enormously. The audience is also part of the event because the workshops allow participants to take part in the debates. Numerous arrangements in the auction are built to emphasize a buzz character of the event. Ocean Tomo acts as transformational leader on the marketplace and strives to put its vision of a perfect market into practice. In the public, Ocean Tomo enjoys a good reputation as a pioneer and stands for expertise in valuing and transacting patents. However, the firm regularly co-acts with many other PMIs, for instance Intellectual Ventures, Altitude Capital Partners,

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<sup>112</sup> This impression may also result from the fact that Gooding and Company is known for hosting charity auctions.

RPX corporation and 3Com. Numerous efforts in the event are focused on forming a community feeling.

This type of market-making involves cooperation between different market actors that share similar visions about the marketplace. Even though some interest groups exerted influence on discussions and debates, the majority of panelists and participants seemed to agree on common goals. Throughout the sessions, the participants widely acknowledged that defensive IP strategies have shortcomings, sleeping patents need to be exploited, aggressive licensing is not desired and that litigations at US courts are a profitable but risky source of profit. Undoubtedly, patents were regarded as an asset class and tradable good. As a matter of fact, the sessions revolved around the liquid status of the asset and the market as a solution for transactions and open innovation.

**2. Establishing best practice and performance in the MFI:** The second category describes a function of the auction event regarding the constitution of the secondary market. Throughout the conference and workshops, I observed customer education on the part of PMIs and managers from incumbent firms. Numerous participants in the audience raised issues and concerns about their current corporate practice and the speakers responded with suggestions from their experience. However, the range of debates and discussions went beyond such efforts. Guest speakers presented their business models and ideas of how to create profit from patents. At the same time, they were open to arguments and suggestions from the audience. A key part of these discussions touched the IP environment, notably the dynamics of the market economy and legal system. In many debates, the speakers expressed their opinions and called for a feedback from other panelists about current changes. The conference aimed to establish best practice and performance in such an environment, as I found. In the conversations, it became obvious that BD, IP and TTO managers have had a high demand to inform others about their concerns and experiences and to listen to the experiences of others. In many sessions, the panelists strived to arrive at a set of conclusive and commonly shared arguments or solutions to an identified problem. This exchange of ideas is obviously important to establish practices as best practices and to legitimize business models in the secondary market.

**3. The public marketplace as mission:** The third category characterizes the contribution of Ocean Tomo to the constitution of a functioning primary market for patents which allows for more arm's length transaction activities. Ocean Tomo pursues the idea of an open marketplace for IP. This goal was strongly communicated to the participants of the event. The speeches given by James Malackowski envisioned the transition from a "feudal system" of bilateral licensing to a free market

for patents (cf. Malackowski 2006). This transition is a vision for actors in the primary markets for patents but much more it is a mission for Ocean Tomo as PMI in the secondary market for patents. Ocean Tomo and other PMIs shape the secondary market for patents (cf. Chesbrough 2006). And they form services around and according to his vision. At this point, interest-driven activities of PMIs play a crucial role. Ocean Tomo has a vested interest in altering the conditions of the primary market and diminishing the second obstacle – the insignificant role of public live IP auctions or other forms of arm's length market transactions in the primary market for patents.

The following example shows quite nicely how Ocean Tomo defines and redefines its mission of market-making: In a newspaper interview, the CEOs of ICAP Ocean Tomo and Ocean Tomo, attributed a temporary decline in IP auction transactions to a drop of the stock market and market caution on the part of bidding companies due to the financial crises. Andrew Carter, managing director of Ocean Tomo reported that despite this decline, “clients are looking to protect and exploit every proprietary advantage they have [...] our Damages Expert Testimony practice has never been busier” (Businesswire.com 2009a). While the managers identified the decline in transactions in the exogenous environment of IP markets, they seemed to characterize this temporary crisis as one of the clients but not of Ocean Tomo's business. Instead, they redefined their mission to support their clients in crossing the crisis - the valuation of IP.

### 6.5.5 Interpretation of the results

*Proposition 1: In order to overcome the insufficient propertization and appropriation of knowledge, the auction requires additional provisions and arrangements on the part of the auctioneer. It is also assumed that the auctioneer sets various arrangements to solve cooperation and valuation-pricing problems.*

The findings of the study show that Ocean Tomo deals with cooperation and valuation-pricing problems as well as the insufficient propertization and appropriation of patents. To reach a high degree of efficiency in transactions, the lots are assembled by Ocean Tomo prior to the auction. Beside the independent claims and the opening bids, the intermediary even publishes the expected value of a given lot. However, it is quite uncommon to disclose the expected value of a lot in auction catalogues because this approach thwarts the idea of bidding. The auction shows a simple design – the ordinary English auction model. In general, Ocean Tomo strives for keeping “the auction simple and straight for patent holders and bidders” (#O.T.3). To my knowledge, Ocean Tomo did not hire auction designers to make the auction more efficient. The rationale for this simple approach is, as Ocean Tomo's

managers suggested, that potential bidders obviously do not wish to be confronted with technical details of sophisticated auction designs. Instead, they prefer to conduct extensive due diligence and learn as much as possible about the value of the IP. To sum up, the auction - understood as allocation mechanism and market device - plays a minor role for the solution of coordination problems.

Most devices in the auction process are designed to assure typical market transactions. Instead of long negotiation processes with lagging internal approval, the auction mechanism prompts bidders to react immediately. The due diligence is shortened and replaced by an online data room that centralizes due diligence (Ocean Tomo 2007). Instead of non-disclosure and option agreements, sellers and bidders sign various standardized agreements submitted to the intermediary that controls the entire process and prevents the disclosure of confidential information. Since the lots are grouped by the intermediary, sellers and bidders simply exchange a bundle of IP instead of additional know-how and services. However, many devices in the broader context do not follow this streamline. The expeditious and standardized auction process goes along with many networking and partnering opportunities in the conference that allow for non-standardized and long-lasting negotiations. Ocean Tomo's events are designed to offer a "tremendous business development opportunity" that gives sponsors the opportunity to raise "[...] the visibility of your firm through both pre-event and on-site promotions" (Ocean Tomo fall 2008 catalog). The anonymous arm's length transaction in the auction is thus paralleled by the buildup of relationships.

Ocean Tomo obviously uses a high variety of judgment devices to spur the marketplace. The data room is an impersonal judgment device but not necessarily because of the virtuality of the room or the absence of direct communication. This device ensures that all registered bidders receive the same amount of confidential information stored for any bidder that logs onto the computer. If a potential buyer wishes to spend a few weeks on his due diligence, Ocean Tomo does accept this request. One-to-one meetings are streamlined but they are also personal devices. The control of information flow is not generated by the software but through Ocean Tomo staff which is involved in all conversations between sellers and registered bidders (# O.T.1). The same holds for the valuation of IP: PatentRatings is a software tool that guarantees an objective evaluation of patent quality. The results of the analysis give the seller an idea about the expected value of the patents. However, the bidding price is engendered by the auction. Ocean Tomo staff notifies the sellers that this price can highly deviate from the expected value, as this was the case in most auctions (Jarosz, et al. 2010). And the intermediary consults the sellers when setting the reserve bid and exploring the genuine value of the IP.



It is obvious that Ocean Tomo's intention to streamline and standardize the auction process conflicts with the desire of potential buyers for extensive due diligence of the IPRs. A failure of the live IP auction model was often attributed to a lack of adequate time for the purchaser to conduct due diligence: "It is imperative that potential bidders work with trained patent professionals sufficiently in advance of the auction to conduct adequate due diligence on patents of interest to evaluate their validity" (Viscounty/Vries/Kennedy 2006). And even if a third party provides and organizes all pertinent information about a patent, the reviewing process itself is complex and usually takes weeks on the part of the potential purchasers (McClure 2008-2009; Huebner 2005). Obviously, in a commoditized IP market spot-on transactions are unsuccessful in principle and transactions are less likely to be fully standardized.

### **Proposition 2a and 2b**

*Proposition 2a: Following Callon's performativity theory, it is expected that conscious market-making is driven by theoretical arguments. Conclusive arguments for the choice of a transaction form are provided by the participants who refer to knowledge and techniques from economic and managerial science. And the participants employ and recommend this knowledge in/for practice.*

*Propositions 2b: Following the concept of institutional entrepreneurship, it is expected that conscious market-making is driven by interests of some actor groups. Certain protagonists or groups in the conference attempt to exert their influence on other participants. By presenting IP business models, they try to champion new rules of how to trade and manage patents. Thereby, they try to convince other participants of their most preferred business model and aim to set new standards of IP management practice.*

The program agenda featured various issues, and numerous speakers with different backgrounds could contribute as panelists in the nine sessions. The agenda had, however, a slight focus on US companies as IP holders, new business models of PMIs and the impact of the legal environment on IP transactions and strategies. Table 5 shows that assumptions derived from the concept of institutional entrepreneurship found a tad more support in the conference sessions (S) than those from Callon's performativity approach.

**Table 5: Assumptions derived from two theoretical approaches to test for conference session S1-S9**

<b>Performativity approach</b>	<b>S1</b>	<b>S2</b>	<b>S3</b>	<b>S4A</b>	<b>S5B</b>	<b>S6A</b>	<b>S7</b>	<b>S8A</b>	<b>S9</b>
1: "Techniques and theoretical arguments in the foreground"	a: - - b: -	- +	- -	+ +	+ +	+ +	- -	- -	- -
2: "Techniques employed in practice"	-	+	-	+	+	+	-	-	-
3: "Rules as techniques"	-	-	-	-	+	+	-	-	-
4: "Presenters act as advisors or experts"	+	-	+	+	+	+	+	+	-
5: "Arrive at a reasonable solution to a problem"	+	-	+	+	+	-	-	-	-
<b>Institut. entrepreneurship</b>	<b>S1</b>	<b>S2</b>	<b>S3</b>	<b>S4A</b>	<b>S5B</b>	<b>S6A</b>	<b>S7</b>	<b>S8A</b>	<b>S9</b>
6: "Rules in the foreground"	-	+	-	+	-	-	-	-	+
7: "Techniques as rules"	-	+	-	-	-	-	+	+	+
8: "Presenters act as interest group"	+	+	+	-	-	+	+	+	+
9: "Champion new rules"	-	+	-	-	-	+	+	+	+
10: "Power Struggle exists"	a: - - b: - - c: -	- + + -	- - - -	- + - -	- - - -	- - - -	- + - -	+ + - -	- + + -
<b>Supports proposition number:</b>	-	<b>2B</b>	-	<b>2A</b>	<b>2A</b>	<b>2A</b>	<b>2B</b>	<b>2B</b>	<b>2B</b>

Notably session 2 and 9 were interest-driven. In session 2, the group of IP aggregators found a key opportunity to introduce themselves to a skeptic audience. Jim Malackowski, as a key figure in the event, presented IP aggregation as a promising business model that still needs to be legitimized in the IP world. The audience obviously did not confront the panelists with critical remarks about IP aggregation, notably because small inventors contributed to the subsequent discussion. The last session also served to certain groups of PMIs and Ocean Tomo in order to familiarize the audience with new business models and to signalize their expertise for potential clients. One reason for the interest-driven motivation is that, as opposed to other business models, IP aggregation is not fully legitimized and the IP index is still in its infancy.

Session 6A, 7 and 8 were rather interest than knowledge-driven. The panelists partly promoted their in-house IP intelligence databases and techniques, though they also referred to different applications for competitive intelligence research that

should deliver a solution to IP managers. Open innovation companies and initiative also found a platform for showing their in-house models and practices. In session 8, NASA signaled its willingness to actively look for new ways to the patent market, while Ocean Tomo profited from the reputation as a partner of a prominent innovative governmental agency.

Sessions dealing with patent analytic software and IP evaluation methods happened to be knowledge-driven. Even though the sessions gave different providers of analytic software the opportunity to promote their software tools, the role of key metrics as solution to information gathering and valuation problems was emphasized. This emphasis surely resulted from the fact that devices *were* the focal point of the presentations and discussions.

In sum, assumptions derived from the performativity thesis did hold when the presenters tackled the concerns of IP holders and IP purchasers in the primary market for patents. In these cases, they strived for solutions to problems by using IP strategies in management studies. The audience rather asked for orientation and suggestions than gave their opinion on debatable issues. At the same time, the presenters were open to critical discussions on the impact of tools and business models on corporate practice and the market. However, these cases do not support the mere construction of the IP market by economic theory. The discussions among the panelists also served to explore and assess roadblocks and pitfalls in the primary market. The panelists did not give clear advices but just showed options and possible ways for firms to handle problems.

When secondary market actors (PMIs) introduced new business-models to the audience, they tended to act interest-driven. As indicated, the conference is an opportunity for PMIs to promote their business services and to signal expertise to inexperienced IP managers. The same held true for incumbent companies with established in-house IP licensing strategies. However, power struggles obviously did not play a key role. The reason was that the sessions have been organized in tracks by Ocean Tomo and the panelists consisted of homogenous actor groups. It seemed that Ocean Tomo avoided confrontations between different interest groups in the panel discussion.

As indicated, the relationship between the performativity thesis and the concept of institutional entrepreneurship requires further clarification and the case of Ocean Tomo's IP auction gives only a few suggestions about how this relationship should look like. What can be learnt from this case is that the three dimensions - joint effort of participants, the attempt to establish best practice and performance in the market for intermediary businesses and the public marketplace as mission – characterize and contribute to the making of markets. Using dramaturgical and ceremonial elements in the auction, Ocean Tomo drew attention to its own visions of a marketplace

and highlighted its role as prominent market player as well as the key role of other sponsors, notably PMIs, in market-making. Joint actions in the event are driven by a small number of active firms and managers. *Market-making is not only a vision but it is a mission of PMIs*, as I found.

Obviously, the auction shows similar patterns described and explained as *market driving* in the marketing literature (Kotler 1986). Market-driving is an orientation that a company has towards the marketplace. The marketing concept of those firms points to how the rules of industry or market games could be changed in principle. The firms coalesce around "visionaries who saw opportunity where others did not - an opportunity to fill latent, unmet needs or to offer an unprecedented level of customer value" (Kumar/Scheer/Kotler 2000: 132).<sup>113</sup> Kumar, Scheer and Kotler (2000) characterize this ideal-type of firm as "forward sensing" which means that the company spots how the marketplace evolves. The market driver is involved in customer education, channel reconfiguration and aims to exploit "buzz networks". This approach combines elements of the performativity and institutional entrepreneurship theses, though it tends to undermine joint action and collective market-making effort and power struggles between interest groups.

## 6.6 Conclusion

Open and public IP auctions are a theoretically interesting phenomenon in the IP marketplace, though by now, IP auctions have not fully been established as a successful market transaction form. The Ocean Tomo Live IP auction has a standardized structure and it is non-discriminatory and prompt. As opposed to bilateral licensing negotiations, this auction is designed to assure a high frequency and regularity of arm's length transactions, and thus to contribute to efficiency ([www.ocean-tomo.com](http://www.ocean-tomo.com)). The auction brings numerous sellers and bidders together and the auction mechanism ensures that market prices resulting from non-discriminatory bidding activities are fair. For a given lot, price discovery is transparent. In a transparent market, prices for IPRs will become public information and the estimated market-value will strongly correlate with the actual market prices paid for a given class of IPRs. This should help to standardize intellectual property valuation. Through frequent market transactions, a market price is created and comparability between IPRs is effectuated. Consequently, the price is no longer influenced by extensive price negotiations but by the market mechanism. This reduces the reliance on bargaining power and IPR valuation services. The idea of the market is that transparen-

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<sup>113</sup> The business of market driving firms is based on radical innovation on two dimensions: a discontinuous leap in the value proposition and the implementation of a unique business system (Kotler 1986).

cy and publicity “will assist in comparative analysis, and competitive market forces will help stabilize otherwise arbitrary prices for IPRs.” (McClure 2008-2009: 28). This, however, is only plausible for patented technologies which do not require further development and for established technologies with a stable product market.

This market-focused view falls short from the actual happening on the auction floor and the social interactions of market actors prior and after auction events. In general, auctions are not necessarily designed to produce arm's-length and spot-on transactions (cf. Smith 1990). Much more, the auctioneer must establish the auction process in a style akin to typical market transactions. This is what Ocean Tomo actually does. In this study, the auction mechanism was understood as market device, while the auction event was treated as a social arena of interaction. The auctioneer is confronted with two types of obstacles. To solve the first obstacle, Ocean Tomo assists companies in identifying valuable patents of interest, assigning values to patents, contacting, and in the exchange of confidential information. Thus, the PMI also responds to strategic and procedural uncertainties. Additionally, the findings have shown that the intermediary himself is challenged by numerous problems which arise during the auction process and beyond. The most important success factors of IP auctions are the provision of complete information about the technology coupled with buyer and seller anonymity, enough time for due diligence, and standardized IP valuation (McClure 2008-2009). “Without adequate time [about three months, IT], buyers will be hesitant to make risky investments, and the market will not develop.” (McClure 2008-2009: 26). Extensive due diligence, however, stands in conflict with the idea of spot-market transactions. Recommended retail prices by Ocean Tomo thwart the idea of forming of a real market price on the auction floor. Apart from that, the auctioneer is confronted with the problem that patent supply is higher than demand.

To mitigate the second obstacle, the auctioneer must convince corporations from different industries, universities as well as individual inventors of the advantages of live multi-lot IP auctions. The auction event is a marketing event for Ocean Tomo and their sponsors but it also serves to channel sellers and buyers of IP and to facilitate contacting. The conference gathers a high number of C-level managers that would otherwise not meet each other. It is obvious that managers initiate deals and approach each other for future transactions in the event. The workshops allow the participants to learn about new IP business models. Furthermore, strategic partnering meetings give the opportunity to exchange confidential information and initiate deals in a private atmosphere. To sum up, the auction event shares many characteristics of the BIO Pharma conference mentioned in the previous chapters. It incorporates important elements of bilateral licensing that stem from outside the marketplace.

To conclude, the anchoring of the auction in a process and event results in diverse devices built on different judgments. The auction solves only a fraction of matching and pricing problems. The communication about the experiences and practices of BD and TTO managers in the events appears to be a constitutive element for the emergence of arm's length transactions in the primary markets and of the market for intermediary businesses likewise. The event helps to establish new business models as best practice in IP management. Thereby, Ocean Tomo does not act solely but in cooperation with other firms that share similar visions of a free marketplace. Joint actions in the event are characteristic for collective market-making efforts (Möllering 2009).

The results also showed that the replacement of an old by a new transaction mode needs time and educational efforts. Despite the high interest of patent holders to sell or license IP, the PMI realized that bidders are apparently overstrained with too many lots. IP auctions are trusted and credible in principle because it is recognized that auctions ensure an efficient allocation of singular goods. However, potential buyers hesitated to bid and ask for patents and in the fall 2008 auction, Ocean Tomo was confronted with C-level managers that have never experienced auctions. It seems that the demand-side of the market still attempts to hold elements of traditional bilateral licensing and is sceptical about typical market features, as transparency, urgency, a lack of communication with patent holders, and price formation on a public forum. Hence, the IP auction involves moderate trust on the part of the buyers.

The fear of information disclosure and of prosecution of infringement is inherent in the market and let companies and universities act cautiously in transactions. Under this condition a need for information and communication about the practices and experiences of other companies is obviously high. In sum, the auction event appears to be a necessary step for the implementation of arm's length market transactions and for the constitution of a public marketplace in general because companies are familiarized with the IP auction process.

Moreover, the auction event operates under contradictory judgment devices. Despite the anonymous atmosphere of the auction, managers are given room for communication and exchange of experiences and ideas. The business auction is streamlined and designed to be transaction-efficient but at the same time it is anchored in a gala dinner with impressive speeches at a first-class venue. *The principles governing the auctions are efficiency and glamour as well as anonymity and familiarity.* This suggests that Ocean Tomo does not refrain from non-market or cultural material elements in order to be efficient. In fact, the company uses these elements strategically to communicate its vision of a public IP marketplace to the IP world.

## 7 Patent market intermediaries and the market for intermediary businesses

### 7.1 Introduction

Intermediary firms appear to play a key role in emerging markets for patents. The last chapter has shown how intermediary firms, Ocean Tomo LLC and their sponsors, actively contribute to market making processes. Patent market intermediaries (PMIs) compose a group of companies that assists and consults patent holders, licensors and licensees in various IP management activities. Following Howell's (2006) and Bessant and Rush's (1995) definition of intermediary organizations and bodies, PMIs consult, match, assist, build networks and thereby facilitate transactions. The primary object of the services of PMIs, however, are patents to be managed and transacted either as single entities or as important part of IP, technologies or knowledge-based companies. PMIs are specialized in the internal and external exploitation of patents to raise clients' profits and to reduce their costs (Lichtenthaler 2005; Lichtenthaler/Ernst 2008). Hence, the activities of PMIs exceed the service of traditional patent law firms. Using their particular technical, legal, and commercial expertise and their knowledge of supply and demand, they consult universities and companies in a variety of fields, as for example asset management, technology transfer and IP enforcement (cf. Saxenian 1994).

This type of intermediary has recently received attention from scholars in technology management. Thereby the literature has come up with similar terms, e.g. "technology market intermediaries" (Tietze/Herstatt 2010), "innovation intermediaries" (Chesbrough 2006a), "knowledge intermediaries" (Reiffenstein 2009) or "IP specialist firms" (Yanagisawa/Guellec 2009). The introduction of "patent market intermediaries (PMIs)" in this chapter should emphasize the relevance of patents for technologies, innovations and knowledge-based companies. As we will see, patent market intermediaries share most characteristics of intermediaries described in the respective literature. This circumstance results from the fact that patents are an integral part of technologies, innovations and knowledge-based companies. Consequently, for many intermediaries active in innovation management and technology markets, the term PMI is likewise applicable. Historical studies show that PMIs are not a new phenomenon (Lamoreaux/Sokoloff 1999; 2001; 2007). The present upsurge of patent filings and the increasing awareness of patent licensing as sources of revenues in small and midsize companies indicate the importance of intermediaries in contemporary primary markets for patents.

*The market for intermediary businesses (MfI)* is introduced as a secondary market for patents that responds to the need for consultancy and assistance of companies

and universities active in managing and transferring IP and technologies. The term secondary market for patents is occasionally used to summarize and characterize those patent transactions in which patent market intermediaries are involved beside sellers and buyers (Chesbrough 2006a), while a primary market for patents implies the absence of PMIs. However, the good being transferred in the MfI primarily comprises consultancy and assisting services of PMIs and not patents. The MfI, more specifically, encompasses business opportunities that result from the imperfections of the (primary) market for patents and of the hierarchical governance of IP management in companies - notably from *uncertainty*. PMIs cope with uncertainty to the extent that their services tackle uncertainties stemming from the sphere of primary markets for patents, and PMIs claim to provide solutions to uncertainty. Consequently, the services and products offered in the MfI respond to obstacles or coordination problems for companies and universities which sell, buy or manage and exploit patents (or IP). Additionally, they may fulfill a need or desire of patent sellers and buyers for assistance in transactions. The companies are explicitly addressed as *clients* by PMIs. In line with the economic sociological approach described in 7.3., the MfI is understood as a *social network of PMIs and their services*, which respond to uncertainties in the primary market for patents (cf. White 1981b). In this market, PMIs act as *suppliers of problem-related services*.

The literature on PMIs sheds various lights on PMIs. Historical studies investigate the role of intermediary firms, as law firms and patent agents, in the provision of market transparency and specialization in markets for patents (Lamoreaux/Sokoloff 1999; 2001; 2007). Geographical studies focus on the regional clustering of PMIs (Reiffenstein 2009; Monk 2009). Technology management studies, representing the majority of investigations, brought forward different typologies of business models (Millien/Laurie 2008; Yanagisawa/Guellec 2009; Lopez/Vanhaverbeke 2009; Tietze 2010). Some studies aim to explain the function of PMIs from a specific theoretical angle (Tietze/Herstatt 2010), while others attempt to compare regional markets (Chesbrough 2006a) and assess their impact on the (primary) market for patents (Lichtenthaler/Ernst 2008). From typologies of business models, however, we cannot easily infer how PMIs address the needs of clients and position themselves according to the businesses of other PMIs. This question is important to understand how PMIs demonstrate the value of their service to patent holders, sellers, buyers, licensors and licensees. Furthermore, from the structure of the markets for intermediary businesses we gain additional insights into the creation of thick markets in which a lot of buyers face a lot of sellers. To my knowledge, no attempt exists to reconstruct the market structure from information released by these companies about their businesses.



As opposed to the previous chapters, this chapter focuses on the enabling side of uncertainty for suppliers in a secondary market. While uncertainties may be detrimental for the (primary) markets for patents, secondary markets for patents are based on uncertainty because it is the origin of entrepreneurial profit (Knight 2002 [1921]: 311). In a market for intermediary businesses, uncertainties bring about market niches in which firms can position themselves.

The research questions to be answered are:

1. *Do PMIs address valuation-pricing and cooperation problems in their services?*
2. *How do PMIs respond to these uncertainties?*
3. *Which market segments of the MfI can be identified that ultimately characterize this market?*

This chapter highlights the role of PMIs as assistance in the primary market for patents and suppliers in the MfI likewise. It attempts to convey insights into the services of U.S. patent market intermediaries (PMIs) and the market for intermediary businesses (MfI) in the USA. Thereby, the definition of intermediaries provided by management science is used (Bessant/Rush 1995; Howells 2006). To answer the research questions, the theoretical framework developed in chapter 3 is extended by a structural approach from economic sociology (cf. White 1981b). This approach allows to reconstruct the relations between PMIs as suppliers in the MfI and the services for their clients (“business-related services”).

For the investigation, I mainly refer to U.S. intermediary firms active for clients in the electronic and semiconductor industry. In this field, a new generation of PMIs has been growing recently as a response to the concentration of high-tech companies and the developed venture capital industry (Monk 2009). The first part of the chapter (7.2) briefly presents findings from studies on essential characteristics of PMIs in the contemporary U.S., German and Japanese markets. It shortly discusses the functions of PMIs and reviews typologies of business models of PMIs in order to find overlaps and communalities. In chapter 7.5.1 and 7.5.2, the results of the reconstructive research are highlighted.

## 7.2 Characteristics of patent market intermediaries and typologies of their business models

### Characteristics of PMIs

With emerging (primary) markets for patents and technologies respectively, PMIs gain importance for innovating firms, and their number increases. Several pilot studies provide evidence that the number of U.S. intermediary firms have been growing since the 1980ies with an annual growth rate of 8% (Tietze 2010). A significant growth is reported for years between 2000 and 2006. Troy and Werle (2011) detect a similar trend in a sample of 94 German PMIs with the main activity being patent exploitation. The vast bulk of the companies were founded after the year 2000. Monk (2009) comes to the conclusion that a new generation of PMIs specialized in semiconductor technology and electronics is currently growing. These findings do not only show that the number of PMIs is growing in the USA and Germany but that a new generation of PMIs is emerging that has not existed ten years ago.

PMIs are usually located in regions with high-tech clusters and patent institutions. Reiffenstein (2009) detects regional concentrations of PMIs in the USA and Japan.<sup>114</sup> Clustering reflects a need for proximity to key actors in the patent system, ranging from technology clusters of firms and national patent offices or the courts. For the U.S., he identifies two large clusters of intermediaries that correspond fairly well to the regional distribution of patents: California with its Silicon Valley and the north-east coast (Bos-Wash states). Small aggregations could be found in Illinois<sup>115</sup> and Texas. In Japan, PMIs are mainly concentrated in the region of Tokyo which is the location for prominent Japanese companies and the JPO. According to Reiffenstein (2009), the administration of innovation in Japan is far more centralized and specialized than in the USA. By compiling a sample of 66 PMIs mainly specialized in computer and semiconductor technologies Monk (2009) finds that many U.S. intermediaries (33 %) are located in California, mostly in Silicon Valley. The concentration of high-tech companies and the developed venture capital industry attract specialized service providers and consultants which become a vital part of a market for patents (cf. Porter 1998). U.S. high-tech regions provide an excellent place for PMIs to emerge and expand their services nationally and internationally. Their dominant fields of expertise are complex technologies. High-tech companies require a highly specialized knowledge base for technical and legal expertise to manage patents successfully.

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<sup>114</sup> Reiffenstein (2009) mainly refers to patent agents and attorneys.

<sup>115</sup> This may be explained by the location of the American Bar Association which is headquartered in Chicago.

The pilot study of Troy and Werle (Forthcoming) shows that most German PMIs in the sample (N= 94) are scattered over various branches, with a focus on asset management, legal and engineering activities. One third of the sample is active in investment counseling, while 14 % offer legal advice and tax counseling and 10 % engineering activities. About 20 % of the sample could not be assigned to a specific branch. The majority of those PMIs have less than three employees. These findings on attributes of PMIs are subject to numerous caveats and qualification. The growing number of intermediaries indicates that IP management and patent exploitation becomes an attractive business area but it does not involve thick primary markets for patents and emerging arm’s length transactions of patents (Troy/Werle Forthcoming).

**Typologies of business models**

The range of business models of PMIs is very broad. Recent popular and scientific literature came up with various typologies of business models<sup>116</sup> of intermediaries. All these attempts resulted in the creation of numerous types, ranging between five and twelve types of business models. Table 6 summarizes a number of business models quoted in the literature by forming types and subtypes (see also Yanagisawa/Guellec 2009). This typology should help to preliminarily assess the impact of PMIs on the (primary) markets for patents and the IP management activities of the clients. It will also be used to specify the services of PMIs in the market for intermediary businesses and to interpret the findings in the subsequent chapters.

**Table 6: Typology of business models**

	Types and subtypes of business models	Description
1	IP trading models  A: Licensing agent model  B: IP broker model	A: Intermediaries assist IP owners in finding licensees. This is the traditional middleman model (Millien/Laurie 2008; Tietze 2010)  They act as licensing agents but they focus on finding buyers for patents rather than licensees. They operate for the buyer and the seller of IP (Millien/Laurie 2008; Tietze 2010).

<sup>116</sup> Following Teece (2010) and Chesbrough/Rosenbloom (2002), a business model forms the organizational and financial ‘architecture’ of a business. A business model comprises the way a company creates and captures value. An intermediary company creates value by offering specific services to the client and thereby “crystallizes customer needs and ability to pay, defines the manner by which the business enterprise responds to and delivers value to customer [...]” (Teece 2010, p. 191). For value capturing, the intermediary firm needs to convert payments received to profit.

	<p>C: IP auction model</p> <p>D: Online IP market exchange model</p> <p>E: University technology transfer model</p>	<p>They hold multi-lot (live) auctions for patents “with the attempt to providing a marketplace for facilitating the exchange of such historically illiquid assets.” (Millien/Laurie 2008: 55; Tietze 2010)</p> <p>Intermediaries offer e-bay-like web platforms for business-to-business transactions of IP. - The websites are either publicly accessible or have limited access to registered users (Tietze 2010). - Some websites offer blogs, forums and idea exchange (Millien/Laurie 2008).</p> <p>Intermediaries offer specialized intermediation for universities. They act as consultants, licensing agents and IP brokers and IP acquisition funds (Millien/Laurie 2008; Chesbrough 2006a).</p>
2	<p>IP financing models</p> <p>A: IP acquisition funds model</p> <p>B: IP-backed lending</p> <p>C: Royalty stream securitization model</p>	<p>Intermediaries provide financing for patent owners</p> <p>- and act as partners of knowledge-based companies. They raise money either from large technology companies or from the capital market and thereby expect above ROI from patent purchases (Millien/Laurie 2008).</p> <p>- by giving loans for IP assets as security. They act as intermediaries between patent holders and banks. Unlike the latter they take into account the company’s potential and actual value of IP assets (Tietze 2010).</p> <p>- through a sale-and-lease back model. The patent owner sells his patent (portfolio) to a bankruptcy-remote firm that licenses the patents back to the original owner. The patent holder thereby aims to raise funds more cheaply (Millien/Laurie 2008).</p>
3	<p>IP portfolio building model</p> <p>A: IP development model</p> <p>B: Patent pool administration</p>	<p>Intermediaries build up portfolios of patents.</p> <p>A: Similar to other companies, they engage in R&amp;D activities and produce patents and know-how but do not manufacture products. The technology including patents is strategically licensed out to one or more firms. “They form a link between the creator of the patented technology and those who commercially deploy it” (Millien/Laurie 2008: 54). They are involved in integrating the technology into the licensee’s manufacturing (cf. Chesbrough 2006a).</p> <p>B: The intermediary is involved in the administration of patent pools of companies, e.g. to issue non-exclusive licenses to other companies on behalf of the patent holder (Yanagisawa/Guellec 2009).</p>

	C: Defensive patent aggregation	The intermediary aggregates patents and patents portfolios through acquisition “to assert them against alleged infringers” (Yanagisawa/Guellec 2009: 26). Thereby the firm attempts to assert problematic patents before PLECs acquire them (Monk 2009).
4	Litigation model  A: Litigation finance model  B: Patent licensing and enforcement model (PLECs), (also known as “patent trolls”)	Intermediaries are involved in letter writing campaigns to demand payments.  A: They act as partners of knowledge-based companies or sponsors of costly litigations. They are involved in stick-licensing and infringement suits to get a ROI. This type may combine the business of PLECs and IP acquisition funds (Millien/Laurie 2008).  B: They purchase patents or portfolios of patents or co-found a knowledge-based firms in order to license patents out to other companies through “targeted letter-writing campaigns and then file patent infringement suits against those letter recipients who refuse to enter into non-exclusive licences” (Millien/Laurie 2008: 54; Diessel 2007). This is a form of stick-licensing.
5	IP-based M&A advisory model	They offer similar services as traditional M&A advisory but they are specialized in IP assets. Such services comprise IP due diligence, IP deal structuring, consultation on the integration of IP related assets and other general consultations (Millien/Laurie 2008).
6	IP consulting and management support model  A: Patent analytic software  B: IP outsourcing model	The intermediary provides specific support and solutions to IP analysis, management and commercialization, e.g. IP strategy advices, patent evaluation, portfolio analysis, licensing strategic advice, infringement analysis (Yanagisawa/Guellec 2009).  A: The intermediaries provide advanced patent search and analytic software tools. The clients can use these tools to assess validity probabilities of patents, and for infringement-related metrics and advanced prior art analysis, e.g. in the due diligence phase and the financial phase of transactions (Millien/Laurie 2008).  B: Instead of using tools, the client company outsources IP management activities to the intermediary firm. This includes e.g. patent and portfolio valuation, patent filing and portfolio mining (Tietze 2010).

Business models of PMIs support firms and universities in various managing activities and thereby facilitate technology and IP transactions in the primary market as well as other IP managing activities. In doing so, their businesses can support the

emergence of primary markets (Tietze 2010). The IP broker model, for instance, helps companies to acquire innovation outside their laboratory. This has also positive consequences for open innovation systems. PMIs become crucial for the smooth circulation of patents, notably IP, which is an important precondition for open innovation (Yanagisawa/Guellec 2009; Chesbrough 2006b).

The business models of PMIs expand the ways a new technology can be used and contributes to specialization among companies in the primary market (Chesbrough 2006a). PMIs advise patent holders in a number of different modes of internal and external exploitation of patents and consult them in various IP management activities. In doing so, they raise the awareness of a patents' values to the patent owner and to institutional investors (e.g. banks, investors and shareholders). In IP financial models, PMIs assist companies and banks in deal structuring and evaluation of patent portfolios. It is plausible that if portfolios of patents are systematically evaluated by experts, patent holders would gain access to capital more easily (Wurzer/Fonrobert 2004). In the case of IP lending and IP sale-and-lease-back models, PMIs provide direct access to capital and thus they appear to have a positive impact on R&D activities.

However, the facilitating role of PMIs does not apply for all business models. Following the literature on strategic patent management (Parr/Sullivan 1996; Sullivan 2000), the IP portfolio building model and litigation model follow the strategic game of offensive and defensive blocking. Strategic litigating and stick-licensing are legitimate and profitable ways to exploit patents financially (Lichtenthaler/Ernst 2009). These models cause coercive pressure on companies that either refuse to license-in an allegedly infringed patent or do not intend to license-out problematic patents. They promise benefits only to some patent holders and PMIs. Patent trolls (PLECs) are a debatable business model in the IP world. Even though PLECs still remain on the fringes (Malackowski/Floberg 2006) and only a small percentage of patent litigation can be attributed to them (Bessen/Meurer 2008: 3), companies and universities aim at identifying PLECs and thus pay attention to the intentions of in-licensing companies. Hence, these business models may eventually hinder transactions of patents. Furthermore, they can be regarded as a form of abuse of the patent system.<sup>117</sup>

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<sup>117</sup> Patent trolls generate a hold-up problem for patent holders and inventors and bring about socially costly injunctions because they also harm the consumer on the product market. The result of holdup by patent trolls is the "transfer of wealth from the practicing entity that is actually engaged in innovation to the troll that receives a windfall out of proportion with the benefit it has provided consumers" (Diessel 2007: 334).

### 7.3 Theoretical framework

We have seen that numerous business models of PMIs exist. Accordingly, intermediaries have various roles. Intermediaries are agents, brokers or mediators, they provide information, and assist firms in seeking funding for innovative outcomes (Howells 2006: 720; Bessant/Rush 1995).

Following Howells (1995), innovation intermediation is a process, relationship and function. Intermediary organizations are often regarded as service organizations providing service activities and service innovation to firms and universities. The intermediation process involves interaction with clients to improve a firm's innovation process. Innovation intermediaries offer knowledge intensive business services, so-called KIBS (Lente, et al. 2003; Howells 2006), and thereby rely "heavily on professional knowledge, i.e. knowledge or expertise related to a specific (technical) discipline or (technical) functional domain; and, supplying intermediate products and services that are knowledge based" (Den Hertog 2000: 505). Since they cover a wide range of services, they provide additional non-technological services in different service sectors (*ibid.*).

Intermediary firms respond to the needs of their clients but they also help them to define and articulate their needs in relation to innovation (Bessant/Rush 1995; Chesbrough 2006a) as well as to transactions, funding and access to capital. They do not only interact with their clients but also screen and recognize options that the firm may not be aware of (Seaton/Cordey-Hayes 1993). The services of intermediaries may aim at solving given problems as well as to open up new avenues in process management for their clients. Consequently, the relationship between the client and the intermediary is supportive to both in various ways. The clients realize new opportunities while the intermediary gains interesting insights into the practices of different firms that help him to assess the value of his services and to align his business (*cf.* Hargadon/Sutton 1997; Galunic/Rodan 21998).

To sum up, innovation intermediation has numerous functions which are represented by the business services of intermediary firms. Business services or activities are part of the business model of the intermediary firm. They range from foresight and diagnostics, scanning and information processing, combination and recombination, brokering, testing and validation, accreditation, validation, protecting results, commercialization and evaluation of outcomes (Howells 2006). Other features of the business model are the technological focus of the firm and its missions and goals. To offer a knowledge-based service, the intermediary must be knowledgeable in the technological field of the client (Den Hertog 2000). Furthermore, the business models signal market-related missions and goals of the intermediary firm.

These essential attributes prompt the question of different roles and functions of PMIs in the primary and secondary market. To understand how the market for in-

termediary businesses works, I strongly suggest that *on either of the two markets, PMIs have at least two functions*:

In the market for intermediary businesses, PMIs act as suppliers of intermediary business services. First, they must respond to the needs of their clients who form the demand-side of the MfI. The business models of PMIs reflect the “management’s hypothesis about what customers want, how they want it and what they will pay, and how an enterprise can organize to best to meet customer needs, and get paid well for doing so” (Teece 2010: 191). In order to exist in the MfI, the service of PMIs must address various problems of clients, e.g. a process to be optimized, a (re-) combination of factors be found or innovation projects and patents to be valued. Thereby the service may result in new or unknown opportunities for the client. Second, PMIs do not only address the needs of clients but may also observe the happening in the market, for example the rise or fall of prices and most notably the activities of other PMIs.

In studying where markets come from, economic sociologists, notably the *socio-structural* approach, have pointed to the role of monitoring activities of suppliers. Harrison White (1981b; 1992) argues that suppliers in a market orient themselves to the reactions of other suppliers through “the schedule of terms of trade” (White 1981b: 517).<sup>118</sup> The basic assumption of White’s *network approach* is that a market is defined as a structure of roles with a differentiated niche for each firm (White 1981b; 1981a). Particularly if market competition is high, suppliers position themselves in the monitored market structure distinctively from others. By finding a niche, they are able to secure profits on a long-term basis. Furthermore, White suggests that suppliers are a “fully connected clique transacting with buyers as a separate but aggregated clique” (White 1981b: 517). Markets are foremost characterized by the supply side. Suppliers are far less concerned in speculating “on an amorphous demand” (ibid: 518) nor in guessing what a concrete set of clients wishes to be offered in the market. Instead they monitor their competitors and thereby reproduce their own set of actions.<sup>119</sup>

This situation applies for PMIs too. PMIs are aware of other PMIs active in the MfI and their behavior is meaningful to them, as chapter 6 suggested. They are able to monitor the strategies of competitors and align their business accordingly. Hence, the analysis of the network structure of the MfI promises to reveal interesting insights.

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<sup>118</sup> Harrison White’s thesis refers to suppliers in product markets.

<sup>119</sup> This somehow implies but not necessarily brings about similarity and homogeneity among suppliers and their products (White 1981b).



In the primary market for patents, PMIs are assisting parties and support various managing activities of firms and universities. Some services or business models appear to have a supporting and stimulating effect on the growing markets for patents because they facilitate open innovation in firms (Tietze/Herstatt 2010; Yanagisawa/Guellec 2009) and open up access to capital. So, the services offered in the MfI should ideally add value to innovating firms (Tran/Hsuan/Mahnke 2010). At the same time, PMIs profit from imperfections in the market for patents due to uncertainties. Uncertainties are inherent in innovation and transaction processes but also court decisions and access to capital. As PMIs offer solutions to clients they are knowledgeable and have superior managerial capabilities in handling IP. In line with Knight (2002 [1921]), PMIs provide “business judgments” (Knight 2002 [1921]: 295) necessary to make profits in an uncertain environment. Therefore their function is to be specialized in “uncertainty-bearing” (Knight 2002 [1921]: 255, 270).

Figure 12 summarizes the four suggested functions of PMIs. Other factors being equal, PMIs must constantly adapt to the changing conditions of the MfI. These conditions comprise the changing needs of their clients and the entrance of new PMIs and business models but also the dynamics of the market environment in general, i.e. national patent system, court decisions, antitrust law and patent valuation standards. While some IP business models have a direct facilitating and shaping effect on the primary market, other models may have an indirect positive repercussion on the primary market for patents. As indicated, intermediaries profit from imperfections in the primary markets for patents because they provide business opportunities. Their existence and commercial well-being is directly dependent on uncertainty. Conversely, the more PMIs exclusively specialize in patent trading, the more they are confronted themselves with the uncertainty that weighs on this business. Without uncertainty intermediaries would not be needed but with too much uncertainty they would not survive (Troy/Werle 2008). As we will see, PMIs face uncertainty and make efforts in reducing it.

On a structural level, the market for intermediary businesses can be presented, as I suggest in line with White (1981b; 1992), as a network of ties between PMIs who monitor other PMIs *and* their business services. Therefore, the MfI is understood as a *network of supplying PMIs and their services*. These services offered by patent market intermediaries address the perceived needs of clients - or in other words, they represent the demand side in the eyes of the supplying PMIs because the services or business activities respond to the need for assistance on the part of the clients. As I will spell out in the next sub-chapter, they relate to the PMIs’ missions and goals that reflect client and market-oriented objectives of PMIs. The technological knowledge and primary object of intermediation are further important business-related attributes.

The market for intermediary businesses is usually considered to be a *new or emerging market* (Chesbrough 2006a; Lichtenthaler/Ernst 2008). In such markets, many business models that make up an essential part of the structure and its “cognitive framework”<sup>120</sup> are in a probing stage. PMIs often act on the basis of trial and error (Lichtenthaler/Ernst 2008). The demand for services on the part of the clients and the way PMIs should best respond to a need for assistance are far from clear. “Pioneers, in particular, are often forced to make only educated guesses as to what customers want, what they will pay for, and the cost structures associated with various ways to organize.” (Teece 2010: 191). Thus, the business models are provisional (ibid: 189). In new markets, competition is usually low and the market structure still unsettled. Many PMIs may not be aware of a business opportunity that makes up a potential market niche. Instead of positioning in a given market structure, PMIs may generally orient themselves towards the businesses of other PMIs (White 1981b). For instance, they spot who supplies, and they are curious about how other PMIs perform their businesses, address the needs of their clients and make profit. Social action appears to be important for surviving in an unsettled environment.

In new markets, monitoring and probing activities of market actors help to reduce and at the same time exploit uncertainty. In line with White (1981b), PMIs probably need to figure out what is successful and what works by observing what other PMIs are doing. Monitoring may result in unconscious mimicking or conscious copying of successful business models of others. A push towards homogeneity among organizations in the formation and structuration of fields is well documented and explained by organization theorists (DiMaggio/Powell 1991; Dacin 1997). The intermediary organizations may act under a “constraining process that forces one unit in a population to resemble other units that face the same set of environmental conditions” (DiMaggio/Powell 1991).<sup>121</sup> Parallel, the unsettled market structure leaves enough room for experimentation and the probing of new business models. Some models may emulate neighboring markets and similar transaction forms (Fligstein 1996: 665; Troy/Werle 2008). The example of the auction format and the financial market as a model for Ocean Tomo’s Intellectual Property Index provide examples for emulation and imitation.

However, other PMIs shape the market, the terms of trade and specific elements of the market’s cognitive framework more significantly. These suppliers may also

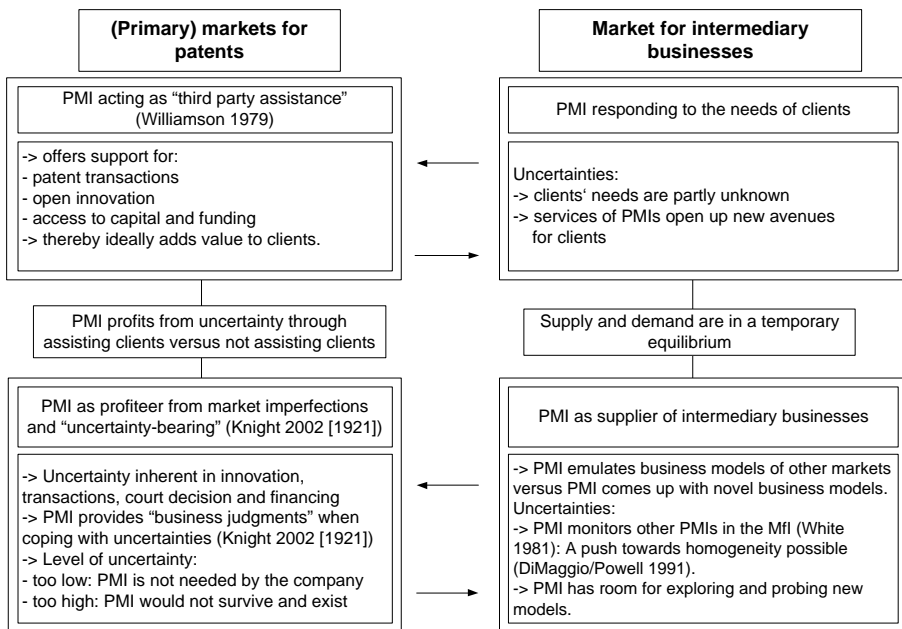
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<sup>120</sup> The “cognitive framework” of a market includes knowledge provided by industrial and managerial economics (cf. MacKenzie 2007), creates awareness of trade and profit opportunities and guides the (potential) market actors’ strategies. This framework helps the actors to define the product to be traded and the terms of transaction (Troy/Werle 2008).

<sup>121</sup> This process is also known as “isomorphism”.

bring forth novel or unprecedented business models that are only functioning on the secondary patent market. As the last sub-chapter indicated, some business models do not explicitly address the demand of clients and thus are not part of the Mfi by definition. Instead the models may even have negative repercussions on the primary market for patents. Consequently, the exploitation of uncertainty by intermediary firms is not in any case associated with the commercial well-being of market actors on the primary market for patents.

**Figure 12: Four functions of a PMI**



## 7.4 Methods

### Operationalization

The *business models of PMIs*, as I suggest, can best be captured through a variety of business-related attributes. The variables A, G, T and O in table 7 derive from the literature about roles of intermediaries and intermediation processes (Howells 2006; Bessant/Rush 1995). Additionally, I realized that many PMIs seem to be obliged to their missions and list a number of initiatives in which they took part in the past. Based on this finding a variable on "shaping macrostructures" (SM) was formed. Table 7 lists the five business-related variables:

**Table 7: Business-related variables:**

	Business-related Variables	Definition
A	“Activities” of PMIs	The activities comprise services that a PMI is offering to the clients.
G	“Mission and goals” of PMIs	Missions and/or goals are statements about the market-related purpose of the PMI firm.
T	“Technology”	Technology involves the technological knowledge of PMIs necessary to provide intermediation and notably to protect intellectual property of the client firm. The technology matches up with the industrial affiliation of the client companies
O	“Primary object”	Primary object of the PMI’s service that is the subject of intermediation.
SM	“Shaping macrostructures”	A PMI aims to shape the environment by taking part in initiatives that spur the secondary market for patents directly or indirectly.

These business-related variables should help to answer sub-question 2 and 3. The variables “Activities” and “Missions and goals” are important in giving evidence for whether PMIs address valuation and cooperation problems. Furthermore, they all together form the basic attributes for the reconstruction of the market for intermediary businesses in a mode-two-network analysis that will be explained in the next sections. The categories for the five business-related variables were gained through a content analysis, as indicated below. The operationalization of the categories is listed in appendix 4.1.

#### **Data collection**

Missing standard classification of the consultancy and assisting services in IP and a lack of data about the number of PMIs posed a challenge in the data collection process. It was far from clear which companies are intermediary organizations and how we can detect them. Thus, the search for PMIs was guided by a snowball sampling strategy. To identify PMIs, I started with three articles in the literature (Millien/Laurie 2008; Reiffenstein 2009; Monk 2009), and then searched for links on IP-related websites that forward to further intermediaries. Most PMIs do not publish corporate reports that could be used as information source. Besides, similar studies were confronted with a low response rate in surveys (Tietze 2010). This fact has prompted me to use websites of PMIs as main data sources. While simultaneously analyzing the websites, I finished the sample with a critical mass of 96 U.S. PMIs. I do not argue that the sample is complete but it does comprise most of the biggest players in the MfI mentioned in the three articles. The size of the sample is sufficiently large for the explorative and descriptive analysis of the MfI.

Websites are regarded as a valuable source of information for analyzing the businesses of PMIs and to reconstruct the MfI. First, websites show how PMIs present

themselves towards their clients and demonstrate their missions and goals because they often feature a heading about the company's visions, goals and missions. Second, headings on websites essentially demonstrate which services or problem solutions PMIs claim to provide. I understand that this assertion is relevant in answering the question of whether PMIs *address* uncertainties. However, one should keep in mind that websites foremost include advertising or promotion material. The information communicated to the public signals expertise to the clients (cf. Mann/Stewart 2000). From this source, we cannot learn about the actual performance of PMIs and to what extent PMIs add value to firms and universities and how client companies value the services of PMIs. As a consequence, I used information about *what PMIs claim to offer their clients instead of how they do so*.

### Data analysis

In the descriptive part of the study, information about the size of the PMI firm, the type of clients and the business focus (legal, technical and economic) was analyzed. Then a quantitative content analysis of websites was applied. In the first step, the five business-related variables were categorized in a smaller sample consisting of 12 PMIs. In this procedure, the literature on roles of intermediaries and intermediation processes (Howells 2006; Bessant/Rush 1995) served as starting point and guide. In sum, 26 categories could be gained for these variables. In the second step, the categories were applied to the whole sample of 96 PMIs. A category was assigned only if the website explicitly or primarily refers to a given activity, mission and goal and technology.<sup>122</sup> Subsequently, a selected number of categories were analyzed pairwise in a contingency analysis using SPSS 14.

In the reconstructive-explorative part, a mode-two network analysis was carried out to visualize relations. A reconstructive bimodal visualization is often effective "for transmitting a holistic understanding of the whole dataset" (Borgatti 2009) and thus it is helpful for reconstructing the MfI. The visualization of the graph should also help to interpret the findings from the crosstab and contingency analysis. For the analysis, UCI-Net 6.232 was used as software tool. In this study, the mode-two network analysis computes the ties between PMIs *and* the relations between businesses-related attributes. The network is a *PMI-by-business sociometric*; the rows represent the intermediaries and the columns refer to the businesses of PMIs as defined above. In the graph, two nodes are more or less close to each other to the extent that the geodesic distance between them is short (Borgatti 2009; Bor-

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<sup>122</sup> This procedure is distinct from assigning codes to text passages implicitly. For instance, "matching" between companies, "identifying" technologies and "evaluation" are part of licensing activities, whereas "create assets" comprises licensing, funding and enforcing activities. However, a code was assigned to a text only if the word "matching" was explicitly mentioned.

gatti/Everett 1997). Thus, business-related attributes are near each other if they are featured by the same PMIs (distance 2), and PMIs are close to one another if they have similar business-related attributes in common (distance 1).

In the analysis, I used a qualitative block modelling approach that does *not* involve distributional assumptions. Block modelling works directly on a binary incidence matrix and principally it allows to fitting any sort of block model to actor-by-event incidence data (Hanneman/Riddle 2005). Patterns of linkages between PMIs and their businesses are calculated with a two-mode core-periphery analysis and faction analysis. The core-periphery model seeks to identify a set of businesses and PMIs who have dense ties among themselves and therefore form the core of the network. The core is made up by a cluster of frequently co-occurring PMIs *and* business-related variables that are meaningful or important to the structure. The periphery consequently consists of a partition of PMIs who are not co-incident to the same business as well as businesses that only have a few PMIs in common. This model identifies important nodes in the structure that tend to be located in the center of the graph.

The two-mode faction model yields factions or groupings that have high density within the group and low density of ties between groups. Similar to a cluster analysis, the procedure locates joint groupings of PMIs and businesses that are as mutually exclusive as possible. This analysis attempts to identify clusters of nodes closely tied to one another. So in the graph, the nodes tend to be close to each other. For both models, measures of goodness-of-fit were checked, first the final fitness and second the density matrix.

## **7.5 Reconstructing the market for intermediary businesses**

### **7.5.1 PMIs in the U.S.: Addressing valuation and cooperation problems**

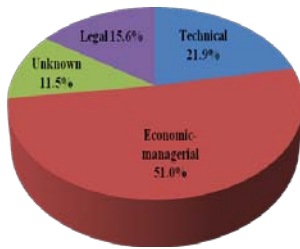
The sample of PMIs comprises 96 companies that are mainly located in the U.S.<sup>123</sup> Many of these PMIs are small and mid-size companies (SME) between ten to 40 employees (87 %). About 12 % are affiliated to a larger company. This makes it difficult to identify the business focus and origin of some PMIs. 15.6 % of the sample have a strong *legal background* and were quite easily to make out because they confine their consulting services to prosecution and freedom-to-operate analyses and offer typical services of attorneys. The vast bulk in the PMI sample, however, consists of companies with a strong *economic-managerial focus* (51%) which are

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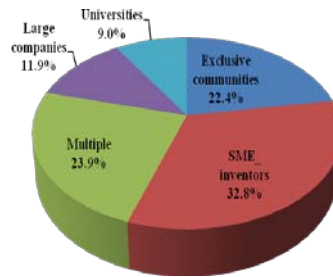
<sup>123</sup> Five of them are of non-U.S. American origin.

backed by internal or external legal agencies. Those PMIs are typically IP management and commercialization companies with a mission to expand or exploit under-utilized IP assets. About 21.9% of the PMIs have a *technical background*. They often aggregate patents in order to develop the technologies further. Furthermore, they are found to be active in electronics and semiconductor technology. It is interesting to note that legal companies appear to run their legal business without necessarily providing managerial or technology-related services. The PMIs with an economic-managerial focus, however, rarely do their business without additional legal services. PMIs with a technical background do not only offer technologically-driven services but are active in sound financial investments. 11.5% of the PMIs in the sample could not be assigned to a specific background.

**Figure 13: Focus of PMIs**



**Figure 14: Clients of PMIs**



**N= 96.**

**N= 67.**

Many websites refer to single inventors and SMEs as the primary clients of PMIs (32.8%, N=67).<sup>124</sup> About 23.9 % of this sample, however, is open to governmental agencies, universities, large companies, SMEs, single inventors and other consulting companies. Only few PMIs are specialized consultancies for universities (9%) and large companies (11.9%). Furthermore, 22.4% of those PMIs seem to direct their services to exclusive groups of companies active in a specific technological field, e.g. members of innovation networks or programs and patent pools, notably in electronics and semiconductor technologies. These PMIs are mostly IP development and patent pool administration companies (business model 3A and 3B). They are themselves part of these industries.

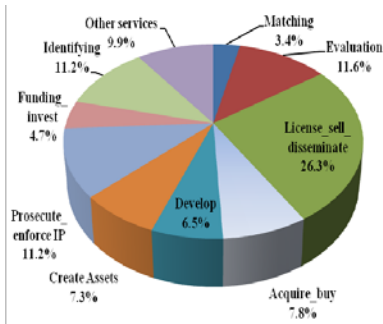
The services are relatively evenly spread over the categories except for the category *licensing\_sell*. About 22.9 % of the PMIs provide services in one activity field while 56.3 % are active in two to three fields (see appendix 4.2.1). Only about 17.7 % of the PMIs offer more than three different services.<sup>125</sup> This suggests that PMIs in

<sup>124</sup> 27 websites did not announce that the PMI would address a certain group of clients.

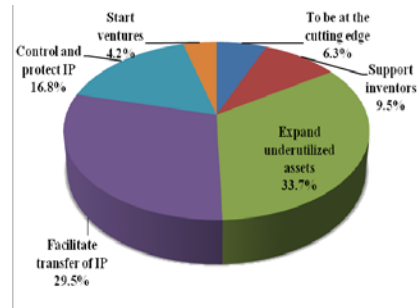
<sup>125</sup> Three websites did not record business activities.

the sample can be assigned to few activities. Most of the PMI's websites mention licensing, selling and disseminating activities as part of their business (26%), followed by evaluating of technologies and IP (11.6%), prosecution of infringement and identifying-monitoring activities (each 11.2%). Developing is the dominant activity of PMIs with a technical focus and remains underrepresented. Furthermore, PMI's websites report about other activities which do not fall under a distinct category (9.9%). Such services are for example training, advisory, clearing and mentoring.

**Figure 15: Activities of PMIs**



**Figure 16: Missions and goals of PMIs**



**N=232 service records on the websites.**

**N=95.**

In the initial sample, six categories of missions could be identified. In the quantitative content analysis, each PMI was assigned to a category to sum up the absolute number and percentages of missions (appendix 4.2.3). As figure 16 shows, most PMI's websites (63.2%) mention that the company aims to expand underutilized assets and facilitate licensing activities. These PMIs have a strong economic-managerial focus. The business models represented are notably IP trading (1.) and IP consulting and management support (6.) models, followed by IP financing models (2.). Obviously not all PMIs with a mission to control and protect IP have a strong legal background. This mission is found to be strong among PMIs with a litigation model (4A and B). In this model, PMIs also have a strong technical and economic-managerial focus. It is interesting to note that PMIs with the mission to support inventors mostly do have small and mid-size companies and inventors as their clients. They equip them with financial and legal resources and thus, they represent IP financing models (2.).

In the analysis, it turned out that about 43.5% of the websites explicitly or implicitly state that they support initiatives to strengthen the market for IP or support the market and innovation environment; e.g. being a member of a NGO or informal network and inventor community. Some PMIs apparently engage in the establishment of an efficient marketplace for patents. Others support or are members of an



open innovation initiative. About 14.1 % take part actively or even organize such initiatives (category SM\_yes) whereas 29.3% demonstrate a high willingness to support such initiatives (SM\_implicit). 56.5% of the websites do not mention a support. It appears that PMIs with a strong technical focus actively take part in initiatives.

Coming back to the research questions, do PMIs address valuation and cooperation problems in their services? In the last chapters, following valuation problems have been identified: *reviewing invention disclosures (1.), identifying valuable technologies of interest (2.), assigning values to patents (3.), warranties and indemnifications (4.), when companies contact each other (5.) and the exchange of confidential information (6.)*. In fact, some activities and missions allude to cooperation and valuation problems (e.g. identifying and matching). To find out whether and to what extent PMIs address uncertainty, it is helpful to study the relationship between dominant missions and services first.

The results of the contingency analysis show that the relationship between dominant missions and activities is slightly significant. I chose the three main missions (“Expand underutilized assets”, “Facilitate transfer of IP” and “Control and protect IP”)<sup>126</sup> and the four main services (“Evaluation”, “License\_sell\_disseminate”, “Prosecute\_enforce” and “Identifying”)<sup>127</sup>. The case processing summary of the cross-table computed 124 valid cases (N) for (dominant) missions\*activities. Inferential statistics shows a slightly significant Pearson’s chi-square test (ChiQ = 15.661, df 6, p<0.5). The Phi Coefficient indicates a non-trivial dependency between the categories (Phi = 0.355). Since categorical data are analyzed, I considered the Contingency Coefficient, which modifies Phi (CC = 0.334)<sup>128</sup>(see appendix 4.3).

The cross-table shows that the activities “Evaluation”, “License\_sell\_disseminate” are stronger than expected in the mission “Facilitate transfer of IP”. This mission is effected through licensing activities, and thus a relationship is intuitive. Nonetheless, as opposed to other services “License\_sell\_disseminate” seems to be strong in all three missions. It is also interesting to note that many companies with the mission “Control and protect IP” are active in “License\_sell\_disseminate” and “Prosecute\_enforce” but not explicitly designated for evaluating IP (“Evaluation”). PMIs with the mission to “Expand underutilized assets” appear to be less active in prose-

<sup>126</sup> These categories were coded as Mexpass, MfacIPtr, Mcontrprot.

<sup>127</sup> These categories were coded as Aevaluation, Alicenseldiss, Aprosecenf, Aidentif.

<sup>128</sup> Strictly speaking, the contingency coefficient should be applied for tables in which the number of rows and columns is equal. This, however, is not the case in the cross table of (dominant) missions\*activities.

cuting infringement (“Prosecute\_enforce”). Instead, they have higher values for “Evaluation” and “Identifying” than expected.

For a closer inspection of valuation-pricing and cooperation problems, I investigated the services of a smaller sample of 55 PMIs more thoroughly. These PMIs are active in licensing and assigned to the dominant missions:

1. *Reviewing invention disclosures and IP* is an essential service provided by those PMIs who address the needs of inventing small and mid-size companies and universities. The latter often require support in establishing a patent and licensing program but cannot justify a full time registered patent attorney or patent agent. For inventors, PMIs determine if legal protection is available in principle and how the idea can best be protected. Furthermore, they assist in determining a market potential of the idea and to identify potential licensees. For patent holders, PMIs assess the IP portfolio and provide a divestment service. PMIs “identify how, where and with whom these assets can be divested, in a way that ensures a clear set of objectives are met. [To find a, IT] preferable route to monetize non-core and core IP assets.” (#64).
2. For companies seeking valuable technologies, PMIs assist in the search process. They help to *find patents of interest* actively and passively. Some PMIs act passively because they have set up IP transaction and exchange platforms, for example an online marketplace, in which companies and universities can register to use the service. Those platforms help to “enabling clients quickly and efficiently to enhance their own resources and to address gaps in their IP portfolios” (#92). In the role as patent brokers (business model 1.B), PMIs are proactively matching supply with demand. For this purpose, they identify credible IP holders and buyers or licensees. They claim to rapidly identify, negotiate and transact IP assets on behalf of key stakeholders, “in a manner that is focused and discreet” (#64). Other PMIs, notably having an IP development model (3.), offer to buy or license the patents themselves. These PMIs make out valuable technologies which are aggregated for development. In this case, they conduct their own research, development and limited manufacturing (#45) (business model 3.A and 3B). In other cases, they put forward a claim against other IP holders (model 3.C).
3. The *valuation and evaluation of IP* is either the core business of specialized PMIs or integral component of a broader service. Specialized PMIs are developers and providers of patent analytic tools (business model 6B). These tools comprise software that organizes and analyzes large sets of patent data to identify the key information required to evaluate IP objectively. Furthermore, the data sets themselves and the provision of patent quality metrics “to add clarity

and an essential objective perspective to your deals” (#87) are part of the valuation service (#42, 81, 85).

PMIs continuously work on statistically proven and predictive software-driven tools for patent valuation. However, it is acknowledged that standardized solutions are unlikely to produce useful results and thus, documented valuation of patents consists of technology-based and industry-based analyses which assess the competitive landscape (#85, 83). For example, Next Step Research claims to have an advanced software tool that includes “sophisticated language vector algorithm, based on latent semantic indexing or LSI, which provides unprecedented insight into the value, opportunities and vulnerabilities of a specific patent, innovation or family of patents” (# 84). This tool can also be used for litigation discovery. Patent Analytics, for instance, offers a pricing model that values IP “as an equity derivative, an embedded patent validity insurance product” (#88) that is obviously underwritten by a leading global re-insurer. An additional element is the assessment of the patent quality for which PMIs develop indicators (#85). Such assessments are not only interesting for patent holders but also serve PMIs to specify benchmarks and to improve their analytic tools. Individual assessments are usually more comprehensive and comprise project and start-up valuations that uncover “complex management team dynamics” (#84) in the life-cycle of an enterprise “while highlighting potential conflicts and critical gaps” (#84). The valuation of patent portfolios is also an important requisite to build up an effective patent and licensing strategy. Hence, PMIs mostly value patents with the prospect to license, finance projects or to create assets in general.

4. Usually public U.S. universities do not take over *indemnification and warranties* about the validity of the patent and they do not guarantee a lack of failures in the technologies to be further developed. PMIs tackle patentability-related and development-related problems. For this purpose, they offer a professional search to guarantee detailed and up-to-date search results about prior art. They assist or entirely manage the preparation and processing of national and international patent applications (business model 6.C). Some PMIs have registered attorneys in each jurisdiction on staff to consult their clients in global best practices of the respective jurisdiction. Others are member of international attorney networks and cede foreign patent applications to attorneys abroad. PMIs manage the status of patents to “ensure that a client does not lose intellectual property rights for failure to meet deadlines [and the firm, IT] will protect your intellectual property through litigation should it become necessary” (#9).
5. *When companies contact each other*, they are often confronted with an inefficient processing within organizations or a lack of transparency about the right

contact person. PMIs having an IP trading or outsourcing model (1. and 6.B) do not only assist but manage the entire contacting process to overcome such inefficiencies, especially with multi-company entities. PMIs claim to ease administration process by tackling the time-intensive process of routing licenses between companies to reach the final signatures (#2). So the companies can focus on their core business. Beside enhancing efficiency in administrative processes, PMIs also operate in a way that potential licensors and licensees are approached in a discreet and “stealth-mode manner” (#78). While considering the competitive situation in a given market, PMIs do thoughtfully establish contacts and thereby figure out a strategic order of which company is to reach first and lastly. In bidding processes, anonymity is preserved and confidential information about the technology is fully controlled (#42).

6. The control of information flow is also vital for the *exchange of information* between organizations. PMIs claim to act as trusted advisor and transaction facilitator. If PMIs execute the entire licensing process on behalf of the patent holder or licensee, they provide the “control and reporting that large global corporations require” (#56). For example, Tynax has developed “a unique set of tools and methodologies that enable the company to market listings extensively, while at the same time maintaining the anonymity of the client. Where appropriate, confidential information is exchanged under NDA [=non-disclosure agreement, IT] and tightly controlled circumstances.” (#78). In a position as relatively neutral third parties, they also provide decisive information to the potential transaction partners regarding the use options, the most suitable transaction models to make open innovation happen and regarding the exchange value of patents (Troy/Werle 2008; Tietze/Herstatt 2010). First of all, they strive to lower the workload of all parties. Moreover, they maintain confidence of all to the patent transaction. They secure a discreet and non-discriminatory due diligence process in which they control the flow of information between the parties. To shorten the transaction time, they refer the clients to their own network of patent attorneys in various jurisdictions.

### **7.5.2 The structure of the market for intermediary businesses**

While previous studies mainly used a top-down approach to identify business models or typologies of PMIs, this study follows an empirical approach to detect structural patterns in the MfI. From the full sample, 78 websites<sup>129</sup> were chosen to *reconstruct the structure of the market for intermediary businesses*. As indicated, it

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<sup>129</sup> These websites contained sufficient information to be selected for the social network analysis.

is assumed that the business-related attributes of PMIs and the positioning of PMIs in the MFI are related to each other. The sets of business categories and sets of PMIs are analyzed to detect factions and core nodes that characterize the MFI. For the analysis, 26 categories referring to five variables were used to characterize the businesses of PMIs, including “missions and goals” (M), “activities (service)” (A), “technology” (T), “related object of the service” (O) and whether PMIs attempt to “shape the macrostructure” of markets (SM). In the two-mode-network graph (figure 17), business-related attributes are marked in green while PMIs are represented by yellow nodes.

### **1. Identifying important PMIs and businesses in the structure (Core-periphery model)**

The final fitness of the core-periphery model shows a weak fit of 0.383. The density matrix of the block model entails a density of 0.564 in the (1, 1) matrix section and a density of 0.181 in the 2, 2 section. Compared to a perfect density matrix with a density of one in the 1, 1 section, the density is relatively low here. However, as both values are either the highest or lowest in the matrix, this result is accepted (see appendix 4.4).

The analysis identifies five business-related categories as relevant core nodes of the network: “Patented technologies” and “Other IP” as primary objects, “Other comprised” as technology, “License\_sell\_disseminate” as activity and “No” for shaping macrostructures. These categories are marked with a cross in figure 17. Their nodes have a notably larger size than other nodes and tend to be located in the center of the graph. Core suppliers could not be clearly identified because the business-related codes are performed by a considerable number of PMIs (49 of 78 PMIs). More than the half of the PMIs in the core have an IP trading model (1.), followed by IP portfolio building (3.) and IP consulting and management support models (6.). Obviously, these PMIs and businesses are central nodes and features in the market for intermediary businesses.

PMIs in the periphery mostly stand for IP financing (2.) and litigation (4.) models. However, PMIs having other business models are also localized in the periphery, though they are underrepresented. Business-related codes in the periphery of the graph are “M\_to be cutting edge”, “A\_develop”, “M\_control”, and “O\_companies” at the bottom and “M\_support inventors”, “M\_start ventures” and “A\_funding” at the right, and “A\_matching”, “SM\_yes”, “O\_ideas” at the top. It also appears that most of the missions of PMIs are less relevant in explaining the relationships between PMIs except for “M\_underutilized assets” and “M\_facilitating transfer of IP”. The latter are central because they are more related to core activities, as e.g. licensing, evaluating IP and identifying assets, than other missions, as to be cutting edge,

start ventures, support inventors and control. Since PMIs are IP specialists, ideas and companies are secondary objects of services.

## 2. Identifying factions of the market through a reconstruction

### (Faction model)

The final fitness of the two-mode faction model features the correlation between the observed scores (0 or 1) and expected scores in each block. This value is only 0.269. The density matrix shows relatively dense ties in the 2, 2 section (0.389 within group density) but only few ties in the 1, 1 section of the matrix (0.186 within group density). Much more the ties between PMIs and businesses in the 1, 2 block seem to be strong (0.316 between group density). Basically, the fitness measures are too low and the density matrix is non-distinct to be taken seriously. Obviously, the mode-two network is not separable in disjoint business-supplier spaces but entails one dense group. So, the faction 2, 2 is analyzed only. This faction comprises a high number of PMIs (67). These PMIs spread over various business models. This may result from the fact that numerous business-related attributes ranging from evaluation, licensing, prosecuting and enforcing are included in this faction. Since the faction is quite heterogeneous, I decided to take a closer look into this faction in order to detect a number of sub-factions.

The two-mode visualization shows three distinctive sub-factions which are located in the area of the faction described above. The sub-factions are characterized as *exchange-related (a)*, *asset-related (b)* and *extensive (c)*.

#### a.) “Exchange-related sub-faction”

In the left-bottom area (marked in blue), there is a business-set composed of the codes “O\_patented technologies”, “A\_license\_dissem“, “A\_acquire”, and “SM\_implicit”. This faction indicates that licensing or selling activities are associated with acquiring activities, and both services relate to patents as opposed to non-protected ideas, companies or other forms of IP as primary object of the service. The services of PMIs obviously refer to patents to be transferred and traded between electronic and semiconductor firms.<sup>130</sup> This market faction, so to speak, is also characteristic for the PMIs in this area of the graph. In fact, these PMIs are active in licensing and acquiring patented technologies. They do not follow a specific mission. They create value for established communities and thereby appear to tackle “closed innovation problems through innovation networks for matching innovation needs from innovation seekers [...] and capabilities embedded in innovation solv-

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<sup>130</sup> Only five firms explicitly offer their service to the software sector.

ers” (Lopez/Vanhaverbeke 2009: 11). Other PMIs are open to multiple companies and assist them in the licensing process. In general, this sub-faction alludes to the flow of knowledge between corporations, either through transactions, know-how transfer or innovation networks. The business model represented in this sub-faction is the IP trading (1.) and IP portfolio building model (3.).

**b.) “Asset-related sub-faction“**

In the middle-right area (marked in green), four categories seem to cluster: “A\_prosec enforce”, “A\_create asset”, “A\_identify” and “SM\_no”. This sub-faction obviously unifies several forms of gaining profit from patent exploitation. All activities share a focus on exploiting the full value of IP and companies, either through defending the IP in order to control the product market or utilizing patents or the whole company as security. The business models represented here are the litigation (4.) and partly IP-based M&A advisory (5.) and IP financing model (2.). It is interesting to note that the activities are most distant from evaluation. Some PMIs near the cluster do offer evaluation consultancy but in connection with enforcing IP, prosecuting infringement and financing R&D ventures. The websites do not claim to offer broad-ranging evaluations of IP. Instead, PMIs tend to create assets because they recognize and strengthen IP as asset class. They are specialized in understanding and leveraging IP as asset class.

**c.) “Extensive sub-faction“**

The top-left area (marked in red) encompasses a sub-faction of five codes: “O\_other IP”, “T\_other comprise”, “M\_underutilized asset”, “A\_other service”, and “Evaluation”. This faction comprises non-specified services, technologies and objects of trade that cover various forms of IPRs and services, e.g. training, mentoring and clearing. Obviously, PMIs in the middle of the graph are less specialized, and they are consulting in a broad array of technologies and services. Some PMIs are large companies having resources to retain multiple expertise in various legal, economic-managerial and technical fields. It is interesting to note that PMIs in this area explicitly respond to valuation-pricing problems and at the same time claim to be active in shaping the macrostructure of markets. They represent the IP consulting and management support (6.) but also the IP trading model (1.)





### 7.5.3 Interpretation of the results

The analysis provided evidence that PMIs do address valuation-pricing and cooperation problems in their services. As indicated, some PMIs manage parts or the entire licensing process actively to ensure that companies and universities match up with each other and deals are closed quickly. Other PMIs follow a hands-off approach. They establish market facilities, for example online market platform, to enable but not to guarantee efficient IP management and licensing. PMIs provide access to legal, technical and market resources: Professional networks, IP-specific valuation tools and databases, discreet matching techniques. PMIs make arrangements to secure anonymous contacting and fair due diligence in order to lower uncertainties and finally reduce transaction costs. Moreover, if PMIs refer clients to external databases and international networks, they use those devices themselves. Since PMIs claim to constantly work on the improvement of valuation tools, techniques and arrangements, they also create those devices. The findings can be coupled to the four functions of PMIs described in the theoretical framework (figure 12).

#### **The Mfi: Emulated business models versus unprecedented business models**

PMIs pursue extensive approaches to enhance the value of IP for companies and universities. IP portfolio building and IP financing models deliver further options of patent exploitation for clients beyond traditional licensing and purchasing activities. Thus, many services of PMIs exceed the solution of typical valuation-pricing and cooperation problems of companies and universities in transactions. The business models represented by the PMIs vary to the extent that they emulate similar business models of neighbouring markets, for instance the financial market and the market for merger and acquisitions. Only a few business models seem to be novel and unparalleled because they are not comparable with analogues business models in other markets. Table 8 gives an account of how the models vary between emulation and novelty.

**Table 8: Business models in other markets**

Emulating business models in other markets	
1.A: Licensing agent model 1 B: IP brokering model	These models show a high similarity with brokering and agent models in the real estate market.
1.C: IP auction model	This model is established in various markets
1.D: Online IP market exchange model	This model is adapted from other e-bay-like web platforms
2.A: IP acquisition funds 2.B: IP-backed lending 2.C: Royalty stream securisation model	These models are akin to funding models provided in the financial sector.
3.A: IP development model	This model shows similarity to models of investors.
5. IP-based M&A advisory model	This model has its origin in the field of M&A of companies and provides similar services
6.A: Patent analytic software	Analytic software tools are similar to business intelligence tools used in other markets.
6.B: IP outsourcing model	This model is similar to any other outsourced management activity offered by consultancies.
Not emulating business models in other markets	
1.E: University technology transfer model	This model is explicitly designed for technology transfer between universities and firms.
3.B: Patent pool administration 3.C: Defensive patent aggregation	These models widely lack parallel examples in other markets. Pooling and aggregation result from the property characteristics of IP.
4.A: Litigation finance model 4.B: Patent licensing and enforcement model	These models are foremost profitable when stick licensing is possible. They result from the insufficient propertization and appropriation of patents.

### The primary markets for patents: PMIs as third party assistance

While analyzing the services, three dimensions became apparent that characterize the role of PMIs in the primary market for patents: 1. *creating or tackling transparency in the primary market for patents*, 2. *the bundling of competences*, and 3. *the search for control* on the part of the PMI:

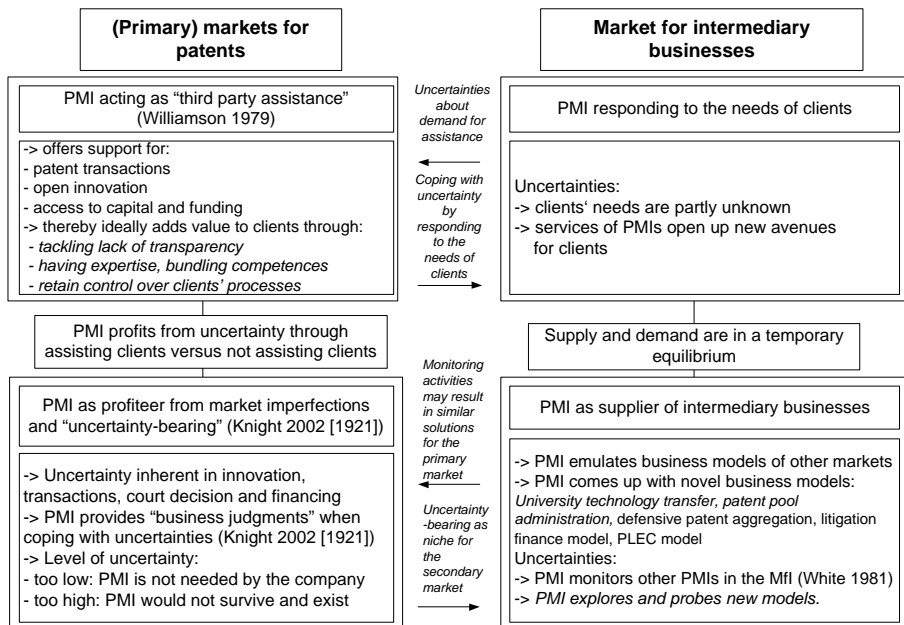
Various services tackle the *lack of transparency* in the primary market for patents. When reviewing invention disclosures and IP, PMIs gather legal, market and technical data to arrive at profound analyses and decisions. Moreover, they assist their clients in the search processes, either through brokering or through the IP transaction and exchange platforms. They help them to identify valuable technologies for further development. In doing so, they develop patent metrics and software-driven analytic tools themselves. Such tools are often complex because they comprise sophisticated technology-based and industry-based analyses. In order to offer such knowledge-intensive business services, PMIs *bundle competences* in the technical, economic and legal field. Towards their clients, they must be one step ahead in order

to be able to improve a firm’s innovation and IP managing process. In almost all business models, except for the online IP market exchange model (1.D), PMIs seek to gain *full control* over IP trading, financing, portfolio building, litigation and consulting processes. They strive to control the intermediation process for their clients to ensure that IP is effectively protected and the competitive landscape does not reveal unpleasant surprises. When PMIs manage the contacting and due diligence process, they ideally prevent a leakage of information among companies.

**The primary markets for patents: PMIs as profiteers from market imperfections and “uncertainty bearing”**

Due to uncertainty about the emerging market for intermediary businesses, the demand for assistance is often unknown to the PMIs. However, the needs of clients are important to PMIs when they intend to survive in the MfI. Furthermore, PMIs have adapted business models of other markets that also seem to work in the market for intermediary businesses. Emulation, imitation and monitoring of other market players result in similar solutions for the primary market for patents. Consequently, PMIs focus on similar market niches and a push towards homogeneity becomes possible. However, the uncertainties inherent in innovation, transactions, court decisions and financing allows for a high variety of niches in the MfI. PMIs came up with a number of unprecedented business models, though the majority of business models emulate similar models in other markets.

**Figure 18: Four functions of a PMI with extension**



### **The reconstructed Mfi**

In the two-mode network analysis, five core business-related categories could be identified. More than the half of PMIs in the core of the network have an IP trading model. This, once again, indicates that licensing and selling activities are important to the reconstructed structure of the Mfi. Exchange-related categories in the graph compose the “exchange-related sub-faction”. The PMIs located in this sub-faction are either offering their business to exclusive innovation communities or they are open to multiple firms. This sub-faction seems to be distinct from the “asset-related sub-faction”, which is placed in the middle-right area of the network. This distinction makes sense because prosecuting IP and identifying intellectual assets in new companies promise profitable alternatives to revenues from sales and licensing transactions of patents. The “extensive sub-faction” is characterized by non-specified services, technologies and objects of trade. The PMIs are open to multiple organizations and explicitly address valuation-pricing problems. Furthermore, they claim to be active in shaping the macrostructure of markets. This association implies that PMIs themselves recognize valuation-pricing problems to be crucial for the marketplace and are actively shaping the market.

The results from the reconstruction also suggest that the market for intermediary businesses is characterized by two dimensions: *exclusiveness versus openness* and *directing versus broad-ranging*. Exclusiveness means that some PMIs explicitly offer their service to certain groups of clients, for example those with little internal IP management resources, universities or patent pools. Others, however, are open to various types of clients, for instance those PMIs in the “extensive-related sub-faction”. Directing means that some PMIs tend to direct their services to a special purpose. For instance, patents are evaluated in order to find valuable assets for financing or patents are licensed to alleged infringers who do not wish to be involved in a costly litigation. Evaluation of IP and Licensing of IP are not the actual purpose of the business model. Other PMIs, however, offer a comprehensive evaluation of IP for different purposes. They seem to be broad-ranging. This interpretation, however, is tentative and subject to further qualification.

## **7.6 Conclusion**

This chapter investigated the functions and roles of patent market intermediaries (PMIs) and aimed at reconstructing the market for intermediary businesses (Mfi) by using the websites of PMIs. I assumed that patent market intermediaries (PMIs) have two functions in the primary markets for patents. They are “third party assistances” and “uncertainty bearer”. In the market for intermediary businesses, they respond to the demand of their clients and act as suppliers of intermediary business

services. While primary markets for patents are partly established, for instance licensing and sales transactions, the MFI, is unsettled and still emerging. Consequently, it was assumed that the needs of clients are partly unknown to the PMIs and that the services of PMIs may open up new ways of exploiting patents for client firms.

In the study, I attempted to show that despite technological and industrial differences the services of PMIs in the electronic and semiconductor industry do address similar valuation-pricing and cooperation problems raised in the previous chapters. Patent licensing plays a key role in the services, though many PMIs assist their clients in creating IP assets in a broader sense. Through the exploitation of patents PMIs realize new business opportunities that extend the assisting function of PMIs in IP management. Hence, some business models of PMIs obviously go beyond a mere reduction of uncertainty in patent licensing and transactions, e.g. IP aggregation and licensing enforcement (Tietze/Herstatt 2010). With an increasing awareness of the value of IP, PMIs develop models that exhaust the full range of possibilities that patents potentially provide: A monopoly right, asset and tradable good. Furthermore, some PMIs take part in initiatives to spur open innovation as well as to encourage a functioning marketplace for patents.

However, not all business models address the needs of clients and seem to spur the primary markets for patents. Litigation models may be a niche in the MFI but sticklicensing is not explicitly demanded by market actors in a primary market. These models cause coercive pressure on companies that either refuse to license-in an allegedly infringed patent or do not intend to license-out problematic patents. The models promise benefits only to some patent holders and PMIs. Consequently and strictly speaking, these services are not part of the market for intermediary businesses.

Many business models in the MFI seem to emulate models in other markets. For instance, the IP brokering model is similar to brokering in the real estate market while IP acquisition funds, IP-backed lending and royalty stream securization show parallels to funding models in the financial sector. The IP auction and online IP market exchange model is widespread in many types of markets. A smaller number of business models, however, do not show significant similarity to business models in other markets. Litigation models appear to be unparalleled and it is hard to find a comparable business to patent pool administration and defensive patent aggregation. These models are functioning in a secondary market for patents only because they are based on two key characteristics of IP – insufficient propertization and appropriation of patented technologies.

The second part of the study aimed at reconstructing the market for intermediary businesses through a two-mode network analysis. The two-mode network is based on the assumption that businesses of PMIs and the according positioning of interme-

diaries in the MFI correspond to each other. In the analysis, I identified business-related categories and PMIs located in the core and periphery of the network. It turned out that the network shows only one significant faction. This faction was divided in three sub-factions: an “exchange-related sub-faction”, an “asset-related sub-faction” and an “extensive sub-faction”. These three sub-factions suggest that the market for intermediary businesses is characterized by two dimensions: exclusiveness versus openness and directing versus broad-ranging. This interpretation, however, is subject to further qualification.

In fact, the study has several limitations. First, websites of PMIs are used to reconstruct the structure of the current MFI. This kind of data source certainly has a drawback. Websites are advertising and public relation material. So we surely have to be cautious characterizing PMIs as innovative or as shapers of the market environment because they are actively taking part in respective initiatives. Websites are valuable because they usually include up-to-date information about the intermediary organization. Furthermore, they show what a PMI claims to offer his clients. From this information we cannot derive whether and how the organization adds value to the clients. Second, the study does not show a clear demarcation between business services that respond to the needs of clients in the primary markets and other services that do not respond to the demand side. Such a demarcation would require a pre-study on the impact of services on the primary market. Hence, this part of the study is based on speculation.

There are many questions left for further research on patent market intermediaries and the secondary market for patents. For instance, it is not clear how business models in this market evolve, be it a tendency for differentiation or constant change of models. The role of reputation for PMIs is another question worth to be investigated. Last but not least, it would be interesting to find out how PMIs establish legitimacy in the primary markets for patents.

## 8 Conclusion and final discussion

### 8.1 Responding to the overarching research question

This thesis investigates different sources and facets of uncertainties that account for transaction-related obstacles in the (primary) markets for patents but allow for profit-making on a (secondary) market for intermediary businesses in which third parties or so-called patent market intermediaries offer their services to universities and firms. The overarching question of the thesis is: *Which uncertainties exist in patent transactions and how do managers cope with uncertainties?* The following section discusses how the three studies contributed to this overarching research question:

Chapter 4 and 5 inspected valuation-pricing and cooperation problems in transactions of patents on drugs in the late research stage (case 1 for high fundamental uncertainty) and clinical stage IIa (case 2 for low fundamental uncertainty) and compared these problems and the way managers cope with them. Thereby, the overall study focused on bilateral licensing transactions of patents on drug compounds. The results of chapter 4 showed that valuation-pricing problems, which allude to different facets of uncertainty, occur when TTO managers review the invention disclosure, BD managers seek valuable technologies of interest, and both parties negotiate financial issues. When TTO and BD managers negotiate upfront payments, royalties and milestone payments the most critical point relates to the attribution of numeric figures to a patent's value by using a future-oriented valuation approach. This problem is associated with procedural uncertainty and results from different assumptions which are based on different guesses and ideas about prospective R&D and market conditions. Cooperation problems mainly refer to rigid regulations of universities concerning warranties and indemnification in licensing that aim to diminish liabilities. Here, strategic uncertainty comes in when third party's IP rights are not known to the TTO managers which could cause to impair the grant of a patent. In the late research stage, strategic uncertainty is high but it affects the licensor and licensee likewise. This is because valuation-pricing and cooperation problems relate to factors that are placed outside the influence of licensor and licensee (e.g. the grant of the patent, actions of third parties and sublicensees). The findings suggest that future-oriented valuation methods are a "cognitive support" which helps managers to near future developments by including the most realistic assumptions in the light of doubt and ignorance (Dewey 1998 [1938]). Thus, confidence and a portion of imagination on both sides are necessary in the late research stage to cope with uncertainties.

Chapter 5 investigated patent transactions in the clinical stage IIa and at the same time served as a counter case to chapter 4. In this stage, strategic uncertainty is low because it becomes clear which information is potentially hidden. However, information and judgment devices are strategically used and thus, strategic behavior tends to be more pronounced than in case 1. One reason is that considerations concerning regulatory procedures, the high value of the patent and high costs of clinical trials in stage IIb and III, and competition become vital. Managers are less pragmatic in financial and legal negotiations. Valuation-pricing problems are based on confidential information which is obviously not disclosed to the other party. Despite non-disclosure agreements, managers typically hide confidential information and instead they demonstrate similarities or expertise to create trustworthiness. Cooperation problems occur when companies offer or seek patents and audit the technology in the due diligence phase. In the clinical stage IIa, procedural uncertainty is higher than in the late research stage. This is because the due diligence phase is usually more extensive and complex and more departments are involved in auditing the technology. The findings suggest that the strategic room for decision-making in negotiations is larger in this stage because both parties apply tactics to hide confidential information and also use judgment devices as a cue ball in negotiations. Uncertainty is originated inside the influential sphere of the actors and the information they handle. Managers cope with strategic and procedural uncertainty by signaling their trustworthiness and competence and confirm those issues on the other party. It was concluded that valuation-pricing and cooperation problems do not diminish from the late research stage to the clinical stage IIa but change in nature. This change goes along with a shift in strategic and procedural uncertainties and judgment devices.

Chapter 6 dealt with public IP auctions and explored Ocean Tomo's Live IP auction in fall 2008. The IP auction represents an arm's length sales transaction form which is less integrated than a bilateral licensing transaction. In such auctions, the degree of fundamental uncertainty about the innovative product and patent is typically low. The product market is widely fixed and the patent is granted. A third party, the auctioneer, assists suppliers and bidders in the auction process. In general, the auction process is confronted with similar valuation-pricing and cooperation problems as bilateral licensing transactions. Ocean Tomo LLC assists companies in identifying valuable patents of interest, in the valuation of patents, contacting, and in the exchange of confidential information. The intermediary firm makes numerous provisions to cope with uncertainty, for instance it established a software program with restricted access to confidential information ("online data room"), one-to-one meetings are held, and came up with an IP evaluation software. Additionally, the findings have shown that the intermediary himself is challenged by the wishes of



sellers and bidders. Often they long for complete information about the technology coupled with buyer and seller anonymity, enough time for due diligence, and standardized IP valuation. An extensive due diligence, however, is in conflict with the idea of an efficient and standardized market transaction. To mitigate this obstacle, the auctioneer attempts to convince corporations from different industries, universities as well as individual inventors of the advantages of IP auctions. Hence, the auction event is not only a marketing event for Ocean Tomo and their sponsors but the workshops allow the participants to learn about new IP business models, including the IP auction process. The communication about the experiences and practices of BD and TTO managers in the events appears to be a constitutive element for the emergence of arm's length transactions in the primary market for patents and of the market for intermediary businesses likewise.

Chapter 7 reconstructed structural features of the market for intermediary businesses and dealt with the role of patent market intermediaries. The services and products offered in the MFI respond to uncertainties in the primary market for patents that generate valuation-pricing and cooperation problems for companies and universities. They fulfill the desire of market actors for assistance in the primary market and at the same time they allow patent market intermediaries to exploit and profit from uncertainties inherent in patents and patent transactions. Despite technological and industrial differences, the services of patent market intermediaries (PMIs) in the electronic and semiconductor industry do address similar valuation-pricing and cooperation problems posed in the previous studies. Patent market intermediaries assist or entirely manage the preparation and processing of national and international patent applications. PMIs continuously work on statistically proven and predictive software-driven tools for patent valuation and litigation discovery. Patent licensing plays a key role in the services, though many PMIs assist their clients in creating IP assets in a broader sense. In the market for intermediary businesses, PMIs are themselves confronted with uncertainties about the needs of clients. It was hypothesized that PMIs monitor the activities of other intermediary firms (White 1981a; 1981b), which may lead to homogeneity among PMIs (DiMaggio/Powell 1991b). Furthermore, the market leaves room for PMIs to explore and probe new business models.

## **8.2 Bilateral patent licensing and arm's length sales**

The thesis distinguished between two forms of patent transactions, bilateral patent licensing on the one hand (chapter 4 and 5), and arm's length sales of stand-alone technologies (chapter 6) on the other hand. This sub-chapter briefly discusses these poles in the range of patent transactions.

Bilateral patent licensing is characterized by lengthy and non-standardized negotiations between a licensor and a licensee. Both parties are confronted with a small number-bargaining problem and non-transparent market conditions. This means that cooperation problems refer to finding the right company or university and the right manager in the organization. Due diligence processes, financial and legal negotiations are long and often burdensome. Price-making is the outcome of case-by-case negotiations and thus highly contingent. Since competitive bidding activities are not in place and resources and strategies of universities and companies highly differ, prices can be regarded as discriminatory and price discovery as non-transparent.

The IP auction ensures efficiency, transparency and non-discriminatory prices of patents in a given product market. However, the auction is more complex and pre-conditional than a mere two-party transaction. It requires an auctioneer who acts as third party assistance, and a functioning market for patents that brings numerous sellers and buyers together. The auction is not only a mechanism of allocation of patents but can be seen as a market device and a market-making event which has significant repercussions on the structure of the market.

Table 9 summarizes similarities and differences between the two transaction forms by bringing basic insights of chapter 4, 5 and 6 together:

**Table 9: Summary of similarities and differences between two transaction forms**

<b>Bilateral patent licensing transactions</b>	<b>Arm's length patent sales transactions</b>
Licensor and licensee primarily deal with cooperation and valuation-pricing problems.	Auctioneer as third party assistance makes numerous provisions to deal with cooperation and valuation-pricing problems
The good is a complex object of exchange which is interactively constructed in the course of negotiations. In this context the price of a patent is established.	The good is predefined as a lot that is assembled by the auctioneer prior to the auction. The bidding price is engendered by the auction mechanism.
Licensing agreements may be a starting point for ongoing collaboration between the licensor and licensee and an emerging atmosphere of trust and sharing between the transaction partners.	Sales transactions may be a starting point for ongoing collaboration with the auctioneer. Sellers and bidders simply exchange a bundle of IP instead of additional know-how and services
Option agreements and non-disclosure agreements control the flow of confidential information, though they are not fully non-standardized.	Online data room and patent rating software are devices which should standardize transactions and also control the flow of confidential information.
Networking and partnering opportunities are ways to get in contact with other market actors.	
Due diligence and valuation of the patent are procedures that give the licensor and licensee but also the seller and potential bidder in the auction an idea about the expected value of the patents.	
The parties (strive to) apply future-oriented valuation methods.	The auctioneer applies complex patent metrics which are future-oriented and transaction-oriented.

<b>Bilateral patent licensing transactions</b>	<b>Arm's length patent sales transactions</b>
Transaction prices for IPRs will not become public information in any case.	Transaction prices for IPRs will become public information.
Legal terms and conditions may be stipulated by the (risk) policy of a party (e.g. public US university or the auctioneer). These parts are not negotiable.	
Exploitation of the patent is relevant, a business plan is needed.	Exploitation of the patent is not relevant, a business plan is not needed.
Mutual concessions between the parties are an essential part of the financial and legal negotiations.	Concessions between the parties are not provided.
Renegotiations are usually expected.	Renegotiations are usually not expected.

In Chapter 6, it was argued that spot-on transactions seem to be unsuccessful and transactions are less likely to be fully standardized even though the patent allows for standardized transactions in principle. This argument needs further clarification:

Spot-on transactions are carried out promptly and are highly standardized and thereby involve classical contract-making (MacNeil 1980; Williamson 1979). These attributes, however, are hardly ever fulfilled in patent transactions. Chapter 2.2 and 2.3 provided a few good-related arguments: First, the complex context in which patentable inventions emerge, second the singular characteristics of the good and third, IP is less well defined and guaranteed than other forms of property. As opposed to other IPRs, the value of patents derives from future developments of markets and technologies. So even though a patent is relatively standardized compared to other forms of know-how and services, its value is still uncertain. Consequently, the exploration of the multi-faceted value of patents requires much time for the parties.

The auctioneer or third party is often not able to shorten the transaction process substantially. The involvement of such a party needs further time and resources because it requires conversations with the auctioneer. Likewise a third-party assistance, who is specialized in IP evaluation, elaborates on the valuation tool from time and time. Even in the case of Ocean Tomo's Live IP auction, which is designed to ensure efficiency, potential bidders obviously do prefer to conduct extensive due diligence and both, sellers and bidders wish to learn as much as possible about the value of the IP. This wish is contradictory to an expeditious transaction process. The long bidding time per lot in the fall 2008 auction indicated that bidders do apparently not long for prompt transactions on the auction floor. While arm's length transactions are possible with the assistance of a third party, prompt and speedy transactions are unlikely. One may speculate whether conversations with the auctioneer about the patent's value are more important to sellers and bidders than a short and timely procedure in the auction. This assumption, however, would need further qualification.

Chapter 4, 5 and 6 showed that impersonal and personal devices often go together in both transaction modes. For instance, anonymous arm's length transactions in the auction are paralleled by the buildup of relationships between managers in the auction event. This co-occurrence has a remarkable side-effect when the socio-cultural anchoring of the judgment devices is taken into account: In the various settings where judgment devices help to cope with uncertainty, they occasionally gain a meaning and function different from the one that would be typical for a given setting. Online platforms are not only a way to announce patents for sale to an unlimited number of companies but to make the company or university visible as patent holder to the public. This device brings sellers and buyers together and promotes technology holders at the same time. Ocean Tomo's Live IP auction can be considered as an efficient market device but it is also a place where conferences are held that have a similar set-up and purpose than scientific conferences and workshops. Contrary, scientific conferences often involve market arrangements that initiate a deal for universities and companies. Freedom-to-operate analyses put potential infringer under legal pressure but they commence a licensing transaction and may even become the outset of a long-term collaboration.

It is plausible that the multi-faceted meaning of a device has its root in the anchoring of the good between three perspectives emphasizing either technological-scientific, legal or economic aspects of the good. These perspectives on the patent obviously merge in some transaction phases and alter or diversify the meaning and purpose of a few devices. Another root may be found in the two dimensions of the market for intermediary businesses suggested in chapter 7: Exclusiveness versus openness and directing versus broad-ranging. Patent market intermediaries supply solutions to valuation-pricing and cooperation problems and they use and create devices themselves. Similar to the way, PMIs offer their services, the meaning and function of devices may be stirred between the two poles of the dimensions. In this vein, scientific conferences are arranged for exclusive circles ("exclusiveness") but at the same time they provide the opportunity to network with new organizations and other networks ("openness"). Online-platforms are open to many technology users and comprise a high variety of patents ("openness" and "broad ranging"). And they also direct market actors to the technology of interest that should fulfill a given purpose ("direct").

These two interpretations lead over to the extension of the pragmatist-cultural framework proposed in chapter 3.

### 8.3 Revisiting the pragmatist-cultural framework for analyzing patent transactions

Chapter 3 proposed a pragmatist-cultural framework for analyzing patent transactions which combines insights from the philosophy of economics and from pragmatist and cultural approaches in economic sociology. It was argued that established socio-structural, cultural and institutional approaches in economic sociology do not explicitly deal with uncertainty in transactions and market constitution. A pure cultural and pragmatist treatise on transactions and markets strengthens either a mere macro-level or micro-level analysis. Yet, both levels are significant to understand which uncertainties exist and how managers cope with them. The integration of pragmatist and cultural concepts under a common roof was found to be useful because the analytical framework would thereby consider cultural and action-related viewpoints on patent transactions. The pragmatist-cultural framework was used in chapter 4, 5 and 6 and partly in chapter 7.

At this point, the implications of the empirical studies for pragmatist and cultural concepts are briefly discussed, notably judgment and decision-making, inquiry and imagination, and judgment devices:

#### **Judgment and decision-making**

In the theories of Lucien Karpik (2010) and John Dewey (1938), judgments and judgment-making are a response to uncertain conditions. Particularly Karpik (2010: 41) asserts that judgment-making significantly differs from decision-making. A judgment tackles the unmeasurable. Or to speak with Dewey (1938: 135), judgment is the result of a transformation of an indeterminate situation into a determinate one. However, both, judgment and decision consist of a choice between alternatives and involve calculation. And any judgment and decision will alter the circumstances surrounding the original choice itself (Ford 1990).

The findings in chapter 5 suggest that judgment-making and decision-making coincide in different transaction phases in the late research stage as well as in the clinical stage IIa. The results indicate a tendency for judgment-making to cope with valuation-pricing problems in the late research stage because licensor and licensee acknowledge the indetermination of the situation. Judgment devices are in place but managers do not fully rely on them. Future-oriented valuation methods are rather seen as calculative attempts than as a tool, and milestones and business plans are expected to change. Managers act pragmatically with unmeasurability, though they strive to make conversation about contractual details. The results imply that Karpik's distinction between judgment and decision-making is useful to understand how choices are made. However, in reality both acts coincide and are rather mixed than distinctive.

Due to the complex nature of patents, different judgment criteria affect negotiations between licensor and licensee. As the transaction unfolds, technical-scientific, economic-managerial and legal perspectives on the patentable technology replace one another. Hence, different judgments emerge along the transaction process that are oriented to criteria that are constituted and shared by the professions involved in the phases – ranging from scientists, BD and TTO managers and patent attorneys. The study also shows that in no case, the multiplicity of different viewpoints on patents necessarily comes along with debates or a battle about the right criteria.

### **Inquiry and imagination**

Uncertainty is not only an obstacle to transactions, as Shackle (1958: 33) asserts, but leaves room for imagination and creative acts. In chapter 3, it was suggested that “inquiry” (Dewey 1938: 108-112) can be characterized as a systematic conduct of imagination and inspiration to reach a solution or find a judgment. In the late research stage, it was found that the communication about the assumption in financial models are rather akin to a discursive act that serves to agree upon assumptions than as haggling about them. Legal negotiations obviously serve to mutually envision eventualities that may arise in the contractual relationship.

In financial and legal negotiations, images and options of future moments are created through social interaction. When TTO and BD managers interact, the array of possible outcomes or scenarios is interactively constructed by the licensor and licensee. In line with Dewey (1938: 283), both parties interactively qualify a troubled situation as problematic, identify a problem, generate ideas about possible scenarios and provide a sophisticated analysis of ideas and propositions. Inquiry is a progressive act. However, even in the late research stage confidential information is rather hidden than disclosed, and assumptions are not freely spoken. In the clinical stage IIa, it becomes even more obvious that inquiring and reasoning are strategic matters. When both parties are not willing to disclose information, they need to find other ways to approach each other in their assumptions. It was found that two tactics (“beat around the bush” and “demonstration of competence”) are obviously successful in balancing the relationship between confidentiality of information and agreement.

### **Judgment devices**

Karpik (2010: 71) asserts that choosing a judgment device is to choose a criteria of judgment, “or a particular configuration of logics of action”. He also emphasizes that actors voluntarily rely on a judgment device to overcome uncertainty, though they may not understand how it works.

The results of chapter 4 indicate that managers do not simply rely on judgment devices to overcome strategic and procedural uncertainties. Under the condition of

high fundamental uncertainty, devices give orientation in an otherwise indeterminate situation - or in other words, they help managers to near or approximate future developments. Devices do not direct or rule managers nor do they promise a successful conduct of action. Instead, they are seen as (vague) tools which are nonetheless important to start such an attempt. Because of the complexity of the good and diversity of judgment criteria, the managers have a number of devices at hand. While technical-scientific, economic-managerial and legal perspectives on the patentable technology replace one another in the transaction process, some devices complement each other; e.g. conferences, partnering events and trade networks in the contacting phase. In a market characterized by a lack of transparency, different devices are in place to constitute the transparency necessary to establish contacts.

Chapter 5 suggests that judgment devices may well become an object of strategic interaction, e.g. a cue ball in negotiations. Moreover, it was found that the role and function of some devices, for instance the freedom-to-operate analyses, changes from the late research stage to the clinical stage IIa. With high fundamental uncertainty, devices give a tentative solution to a valuation-pricing and cooperation problem. Thus, strategic and procedural uncertainties are still present. With low fundamental uncertainty, judgment devices become representatives of successful conduct of action. Managers rely on them and at the same time, they hide them. As I will argue in the next section, the strategic handling and hiding of information and devices is not just a matter of distrust among actors. The fear of information disclosure and of prosecution of infringement inherent in the market let companies and universities act cautiously in transactions. This hints at the attempt of managers to control the diffusion of technological knowledge.

Lucien Karpik's framework widely suggests that judgment devices are culturally pre-defined and active forces because they inform, advise, teach, protect (Karpik 2010: 51-54). Judgment devices consist of credible knowledge which is external to the uncertain situation and helps to increase the actors' cognitive capacities (cf. Karpik 2010: 51, 200). The findings in chapter 4, 5 and 6, propose that some devices are (still) in the making or subject to continuous improvement. For instance, managers and patent market intermediaries develop and elaborate themselves on the devices, either as in-house tools or for clients. Particularly patent market intermediaries claim to provide the expertise and competence necessary to cope with valuation-pricing and cooperation problems in the primary market. One may infer from the studies that in emerging markets, judgment devices are not simply given to the managers. In the IP auction event, for example, it became obvious that BD, IP and TTO managers have had a high demand to inform others about their concerns and experiences and to listen to the experiences of others. Valuation tools, amongst others, were the subject of debates and discussions. Consequently, some tools do not qualify

as active forces that teach and protect. In a dynamic environment, devices are not static nor “cognitive artifacts” (Karpik 2010: 49-51) but flexible in terms of their meaning and their function.

For Karpik (2010: 49), actor and device ultimately form a composite entity which jointly acts to overcome uncertainty. Chapter 6 support this viewpoint on devices. It conveyed the insight that the auction process acts as a device or allocation mechanism but further arrangements on the part of the auctioneer, who acts as third party in the transactions, are necessary. Ocean Tomo is the host of the auction event but the IP auction is a joint effort in which many other market actors are involved, notably the sponsors. For this purpose, the firm regularly co-acts with many other PMIs.

#### **8.4 Three core dimensions: A lack of transparency, control and competence**

The basic insight of the thesis is that patent transactions, markets for patents and the social environment including scientific research in patent transactions are characterized by three core dimensions: *A lack of transparency, control and competence*. Likewise information and expertise on the part of market actors are decisive for successful patent transactions. The core dimensions inter-connect the findings of the three empirical studies.

##### **The lack of transparency**

A lack of transparency is associated with uncertainty but reaches far beyond. It is noticeable in the daily practice of patent licensing and IP auctions: In the case of high fundamental uncertainty, information about the technology and the market is fundamentally absent and thus primarily informed guesses and (business) judgments generate profit (Knight 2002 [1921]: 295) and change the quality of the situation from indetermination to settlement (Dewey 1938: 135). With the accession of relevant information, market actors often hide information with strategic value which causes non-transparency for the other party. In the due diligence process, manifold and complex data generate a lack of transparency that results in procedural uncertainty. The licensee is confronted with an indeterminate situation that requires a quest for certainty and inquiring acts that may ultimately effect a judgment about the patented technology (Dewey 1938: 135), as the findings in chapter 5 indicated. On a structural level, a lack of transparency refers to the search of the right manager and company which is indicative for a “blind market” (Gans/Stern 2008; Roth 2007).

In chapter 6, the case of Ocean Tomo’s Live IP auction illustrated how the auctioneer makes numerous provisions to create price transparency and facilitate IP value exploration but bidders often prefer to remain anonymous in the auction or use the post-auction for further deals. Intermediary firms, as law firms and patent agents,



provide market transparency and specialization in markets for patents (Lamoreaux/Sokoloff 1999; 2001; 2007). Chapter 7 showed that PMIs assist market actors in providing transparency, consult them when they try to figure out the value of patents and search for technologies of interest. For instance, they make out valuable technologies, which are aggregated for development, and manage the entire contacting process for clients to overcome a lack of transparency about the right company and right manager in a firm. PMIs profit from non-transparent conditions in the primary market for patents.

Judgment devices help to generate transparency in transactions, either through social interactions between actors (personal devices) or without personal contacts (impersonal devices). Ironically, non-transparency is likewise a feature of how managers use devices. For instance, calculative models are occasionally hidden, or they are used “in-house”, and in this way they engender non-transparency for other market actors in financial negotiations.

The institutional and cultural embedding of non-transparency is far reaching and obviously has implication for research in patent markets too: *A lack of data on patent transactions results from various institutional regulations and practices*. Most patent-related laws stipulate registration of licenses and change in ownership (“reassignment”), as for example in the United States, Japan and Germany (USPTO 2009; JPO 2009).<sup>131</sup> However, it is a fact that recording is protracted and not all reassignments may be recorded (Chesbrough 2006a; Chesbrough 2009). Second, official terms in statistics and antitrust guidelines are rather tailored for IP or technology transfer than for patent transactions. For instance, the OECD and World Bank use abstract terms<sup>132</sup> as “Royalty and license fees” (World Development Indicators) and

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<sup>131</sup> For example, the USPTO and the Office of Public Records Assignment offer easy access to the Electronic Patent Assignment System (EPAS). Inventors can submit a change in recordation electronically via the Internet. Commercial patent database providers, as the IFI database, offer comprehensive information on reassignments as well as sophisticated search tools to filter out a change in a firm’s name (see also Serrano 2006). However, these databases do not allow users to trace a change of ownership entirely back to its origin because assignment regulations do not stipulate the complete registration of causes for reassignment.

<sup>132</sup> “Royalty and license fees are payments and receipts between residents and nonresidents for the authorized use of intangible, nonproduced, nonfinancial assets and proprietary rights (such as patents, copyrights, trademarks, industrial processes, and franchises) and for the use, through licensing agreements, of produced originals of prototypes (such as films and manuscripts)” (World Bank 2008). The technology balance of payments “registers the commercial transactions related to international technology and know-how transfers. It consists of money paid or received for the use of patents, licences, know-how, trademarks, patterns, designs, technical services (including technical assistance) and for industrial research and development (R&D) carried out abroad, etc.”

“Technology balance of payments” (OECD). United States Antitrust Guidelines cover patent transactions under “Markets for technology” (U.S. Department of Justice 1995) and the EC Treaty to Technology Transfer Agreements under “Technology Markets” (European Commission 2004), which both consist of additional know-how and other technical services.<sup>133</sup> In either case, patent transactions are included. Abstraction and aggregation in legal and statistical terms dominate, and patent transactions are rarely reported as a stand-alone statistical unit.<sup>134</sup> Third, companies are not legally obliged to disclose revenues from pertinent transactions. Current accounting rules do not require firms to document royalty incomes in corporate reports, thus it remains for a company to decide whether it discloses information about licensing activities. Like dividends, royalties are seen as confidential information. Additionally, royalty streams and their complementary payments appear to be biased by tax minimization and other global strategic considerations (Kopits 1976; Contractor/Sagafi-Nejad 1981). This circumstance aggravates market research for practitioner and scientists likewise.

It is interesting to note that the disclosure of royalty streams has a signaling function in the relationship between companies and investors too (Gu/Lev 2004). Royalties signal quality and prospects of firms’ R&D expenditures. Nonetheless, they are widely regarded and treated as confidential information by firms and obviously only some IP pioneers make enough profit from licensing and sales transactions to signal quality. With US universities and pure licensors, however, the situation is rather vice versa. With patenting and licensing activities universities do not only aim at financial rewards but much more they seek to increase reputation and institutional prestige (Thursby/Jensen/Thursby 2001; Sine/Shane/Di Gregio 2003).

### **Control**

Chapter 2 stated that propertization of technological knowledge through patents comprises the assignment of ownership to a person, the effective exclusion of third parties from using the good and the legal enforceability of ownership. Propertization

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<sup>133</sup> The European market definition denotes “the licensed technology and its substitutes, i.e. other technologies which are regarded by the licensees as interchangeable with or substitutable for the licensed technology, by reason of the technologies’ characteristics, their royalties and their intended use” (European Commission 2004), whereas the US definition is related to “intellectual property that is licensed and its close substitute [...]” (U.S. Department of Justice 1995).

<sup>134</sup> Strangely, it has always been a challenge to scholars to define “technology” and “innovation” and forms of transfer and flow, and the literature has come up with numerous ideas and disputes with regard to this issue (reviewed by Zhao/Reisman 1992). In contrary, a traded patent is institutionally defined and relatively easy to “grasp”, yet it has been neglected by official statistics and research, except for law studies.

points towards control over technological knowledge that would otherwise seep out to rivals and impede inventors to harvest profits from inventing activities. In this vein, protection from piracy and exclusion of third parties are acts of control. The restricted monopoly right endows a patent holder with the legal power to prosecute infringers, though this often requires financial resources and time. With the grant of a license or a sale, the licensee and purchaser is entitled to control the utilization of the invention including sublicenses.

The legal side of patents and the legal viewpoint on IPRs emphasize the relevance of this core dimension. Chapter 4 argued that warranties and indemnification are a means to control actions of third parties, the patenting process and commercial success in the product market, as well as unknown changing conditions. In the light of uncertainty, it is indeed difficult to retain control over such conditions. For this reason, public US universities do not extend warranties and representations as to the validity or scope of patents, the commercial success of the patent or that a third party's right is known to the university. For a 15-year contractual relationship, contractual details are thoroughly discussed but in the end, BD managers seem to be aware that full control about external conditions is impossible, as chapter 4 showed.

Under more settled conditions in the clinical stage IIa, managers are better able to direct their monitoring activities towards a number of competitors and valuable drugs. However, this also requires substantial resources on the part of companies when carrying out a second freedom-to-operate analysis. Chapter 5 found that with low fundamental uncertainty about the innovative product and the patent, licensor and licensee are able to uncover information but they often hide confidential parts as well as judgment devices. The act of control is obviously more focused on strategic activities than in the late research stage. It shifts from external to internal conditions.

The study about Ocean Tomo's Live IP auction in chapter 6 demonstrated how the auctioneer made numerous arrangements to assert that anonymity of bidders is preserved and confidential information about the technology is fully controlled before and in the bidding process. The online data room and the valuation software, which were introduced and developed by Ocean Tomo, help to restrain the open flow of information among bidding companies. Besides, numerous other devices placed in the auction process and auction event indicate such an effort. So the control of information flow is not only generated by the devices but primarily through Ocean Tomo staff which is involved in all conversations between seller and registered bidders.

In chapter 7, it was argued that the dimension of control is uttered in almost all business models, except for the online IP market exchange model when the PMIs act quite passively (hands-off approach). In IP trading, financing, portfolio building, litigation and consulting processes, PMIs seek to gain full control over patents and

transaction activities. As indicated, they strive to control the intermediation process for their clients to ensure that IP is effectively protected and the competitive landscape does not reveal unpleasant surprises. To control IPRs in other jurisdictions, PMIs have contacts to partners abroad.

The institutional anchoring of this dimension can be localized in the *dominance of the legal sphere in patent trading*. This means that patent attorneys have a stake in decisive transaction phases (legal phase) and courts, adjudications, international and national patent laws do play a prominent role there. The USPTO, EPO and WIPO are affected by legislative initiatives, and thus these governmental organizations are largely involved in legislative practice, which gives direction to TTO and BD managers. Other professional non-governmental organizations and associations, the Licensing Executive Society (LES), have likewise a strong legal background, notably in Germany, with regard to its services and the structure of its members. These institutions have mainly been concerned with expanding and strengthening the appropriability of new useful knowledge through legal protection.

### **Competence**

Competence comes into play when a licensee acquires novel technological knowledge and the R&D personnel needs to comprehend the complex context of inventions (see chapter 2). As indicated, the appropriation and acquirement of the invention widely depends on the specific previous knowledge of the licensee and the capability of human actors to transform a hardly articulated context of meaning into action (Kitch 1980). With respect to patents and patent licensing, managers need to be competent in the legal, managerial-economic and technical field to demonstrate the inventive step of the innovation and its commercial potential. More precisely, they must be knowledgeable when valuation-pricing and cooperation problems occur.

The findings of chapter 4 and 5 imply that financial negotiations depend on the competence of TTO and BD managers to clarify assumptions in the models in order to arrive at a shared judgment about the patent's value and price. In the light of high fundamental uncertainty, they attempt to near future developments by including the most realistic assumptions. This act also requires a spot of imagination on the part of the managers to envision these developments and to arrive at a final choice and judgment (Dewey 1998 [1938]). With low fundamental uncertainty about the product and patent, it appeared that a correspondence between information and shared knowledge among managers contribute to solving valuation-pricing problems. If the licensor and licensee share common knowledge *and* information, it is obviously not necessary to demonstrate competence in the financial process (constellation 2). If

this is not the case (constellation 1), however, the demonstration of competence becomes important. The final result of the pricing process is dependent on how well the parties are able to convince the other side of a systematic and objective conduct in the valuation, as chapter 5 argued. Nonetheless, this is not only an act of persuasion about the “true” value of the patent but an act of creating trustworthiness because signaling similarities and competence are strategies to indicate trustworthiness (Beckert 2005). In the due diligence phase, managers must be competent enough to judge complex information adequately and be willing to cooperate with the personnel of other departments.

In general, competence and knowledge are important elements in markets (Aspers 2009b). Patent market intermediaries create devices and thereby incorporate their knowledge and competence in tools and other arrangements (e.g. patent analytic software). Chapter 6 showed that Ocean Tomo gives bidders an account on the expected value of a given lot in the auction catalogue. In doing so, the firm claims to be a competent evaluator but potentially influences the auction, though bids on a few technologies may significantly deviate from the expected value. To survive in the market for intermediary businesses, PMIs must be competent in order to be able to improve the client’s innovation and IP managing process.

This core dimension is structurally anchored *in the provision of training and education to TTO and BD managers in the field of patent licensing*. Educational training in IP management is mostly provided by non-governmental and private organizations, including PMIs, and through corporate training. The Licensing Executive Society offers regular workshops on IP valuation and licensing to its members and others. The mission of this organization is “to assist its members in improving their skills and techniques in licensing through self education, the conduct of special studies and research, the sponsorship of educational meetings [...]” (The Licensing Executive Society 2011). Patent lawyer’s offices organize seminars for their clients. Other governmental organizations, for instance the EPO, provide teaching material and e-learning modules on proceedings (European Patent Office 2011). Except for law studies, training in this field is hardly offered by academic institutions, though this is subject to change. This may be a reason why competence is appreciated and used to demonstrate a professional conduct.

It is interesting to note that many workshops and seminars on patent licensing put best practice of IP licensing in the foreground, usually in connection with practical advices of experienced IP managers. For example, these senior managers present a number of ways and possibilities of how to value patents systematically from their practice. The emphasis on best practice may result from a lack of standardized valuation methods and IP management methods.

## 8.5 Other factors reviewed

Many obstacles in transactions, though not all, can be attributed to fundamental, procedural and strategic uncertainty. This sub-chapter discusses the impact of three other factors on patent transactions in chapter 4 and 5, and limitations of the dissertation.

### **The private sector versus the public sector**

It is obvious that differences between the public and private sector (public universities versus private companies) come into play in patent transactions in chapter 4. They mainly refer to different interests and organizational mission and goals.

Despite the high difference among US TTOs, they have a central activity in common – to facilitate and manage the disclosure and licensing of inventions with commercial potential. In carrying out this mission, the TTO must balance the objectives of the university, which owns the invention, and the faculty, who produces scientific outcomes (Jensen/Thursby/Thursby 2003).

Despite a pressure to commercialize patents, universities still attribute high importance to publications, open science communication (i.e. conferences) and consulting (Cohen/Nelson 1998). The publication of scientific outcomes is a basic mission of universities and thus, it is not surprising that universities insist on the freedom to publish. Universities are confronted with the decision to either deter the chance of filing a patent for the sake of a publication or vice versa. For both alternatives, time and pace as well as novelty and non-obviousness of an idea play a significant role in order to gain profits, either through reputation in the scientific community or through royalties. TTOs are obviously aware about a trade-off in these missions but it is also recognized that the objectives do not conflict in any case (Colyvas, et al. 2002). Enhancing universities' revenues is not necessarily at odds with gaining rapid and widespread technology transfer but “there is no reason to believe, either, that policies that maximize a university's revenues are always aligned with those that maximize technology transfer” (ibid.: 68).

Yet, public and private interests and missions do not seem to conflict strongly on the transaction and interaction level. The way universities proceed with patentable knowledge has repercussion on licensees, as chapter 4 showed. However, the findings also indicate that, on the transaction and interaction level, different institutional backgrounds of managers play a minor role in contrast to the relevance of decisive information and expertise of the managers. TTO and BD managers hardly accused the other negotiation partner of being either in the ivory tower or of having a profit reaping mindset. And if they did, they referred to unprofessional practice in patent licensing and organizational hurdles in general. In the field of pharmaceuticals, TTO and BD managers have a similar professional background. In job postings, one will

find that universities seek to hire TTO managers from pharmaceutical companies and thereby attempt to import new industrial networks and relationships. BD managers have often embarked on a scientific career prior to their management activities.

As indicated, information and expertise matter on both sides. When valuation-pricing problems for universities occur, TTO managers often work together with scientists to figure out the value of a patent in a preliminary way and to assess the commercial potential of the invention. In a similar way, Jacob and Kwak (2003: 295) argue that for firms, “it is essential to get the appropriate people – both the right number of people and people with the right expertise. This could involve outside experts, representatives from several levels of management, as well as peers from other project teams. The two key factors here are the need to get sufficient breadth of experience, both scientific and business, as well as to develop a process that has broad-based support and buy-in.”

#### **The role of the inventor at public US universities**

The Bayh-Dole Act stipulates the disclosure of an invention to the TTO. Apart from this stipulation, inventors are encouraged to take part in initial transaction phases because TTO managers lack knowledge about technical and scientific details. Inventors are asked to give the TTO a professional assessment of the technical feasibility and commercial potential of the invention. They also assist in detecting potential product markets of the invention and in projecting the costs and development time of an invention. However, inventors do not manage the commercialization of publicly funded patents when the university has a TTO. And other than the scout, the inventor is not fully in charge of finding the right licensee.

Inventors are particularly helpful to the commercialization process when they maintain regular contact and relationships to industry. In a qualitative study, Colyvas et al. (2002) find that firms learn of inventions via interactions with inventors or through membership in scientific networks. This result well corresponds to the findings in chapter 4. In return, marketing activities of TTOs are likely to be most important for inventions that generate little industrial interest early on. When well-established networks between scientists and industry in a technological field or an initial promise of the invention are missing, TTO managers act more successfully in the contacting phase than inventors (*ibid.*).

But what is the incentive for the inventors to assist in the contacting phase and to engage in the due diligence phase?

Inventors benefit personally and indirectly from contacting and due diligence. First, any contacting yield additional opportunities for fund raising and R&D project collaborations which also provide financial sources for the inventor. The flow of

know-how between inventors and BD managers may offer alternative perspectives to the inventor, e.g. the creation of a start-up in collaboration with industry. The inventor is able to increase his chances for building network ties, for instance with a reference to venture capitalists (Shane/Somaya 2007). Second, US inventors receive a financial compensation for the invention according to the stipulation of the university and the terms of the employment contract. University policy regulates the income distribution from royalties and other licensing payments to the inventor, department and faculty. Inventors may well receive a financial compensation between 25% and 50% from regular payments. Apart from royalties, scientists may receive non-monetary rewards when technology transfer activities count towards promotion and tenure (Link/Siegel 2005). Thus, inventors usually profit from successful negotiations indirectly.

However, inventors will have a number of reasons to undermine the patent filing and licensing process, as the next sections shows.

### **Principal agent problems**

In line with Jensen and Meckling (1976: 308), an agency relationship is defined as “a contract under which one or more persons (the principal(s)) engage another person (the agent) to perform some service on their behalf which involves delegating some decision making authority to the agent.” Under the assumption that both parties involved are utility maximizers “there is good reason to believe that the agent will not always act in the best interest of the principal” (ibid.) Within the patent filing and licensing process, principal agent problems occur when scientists disclose their research outcome to the TTO and when the university or a company wishes to delegate the development of a technology to another company:

In the invention disclosure phase, the TTO act as the principal and the university scientist acts as the agent (Markman/Siegel/Wright 2008).<sup>135</sup> So, TTO managers have an intermediary position between the inventor and the BD managers. A number of studies report that scientists are often not willing to disclose inventions to the university’s TTO (Siegel/Veugelers/Wright 2007; Jensen/Thursby/Thursby 2003; Link/Siegel/Bozeman 2007; Owen-Smith/Powell 2001). Researchers often use the backdoor to start a new firm instead of disclosing inventions to the TTO with the prospect to license the invention to established firms (Aldridge/Audretsch 2010).

While the Bayh-Dole Act stipulates the disclosure of an invention to the TTO, this rule is rarely enforced (Siegel/Veugelers/Wright 2007). In a number of interviews

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<sup>135</sup> It is worth noting that the TTO may have two roles: The one of a principal described above, and the role of an agent on behalf of the university administration. However, for the purpose of this discussion, the TTO is considered to be the principal (Jensen/Thursby/Thursby 2003).



with TTO managers as well as scientists, Jensen et al., (2003) provide a few reasons why scientists do not disclose their invention. Faculty members are not likely to take the time to disclose inventions and work on further development. They are inclined to bypass the TTO and engage in informal commercialization and knowledge transfer, notably via start-up creation. This constitutes a moral hazard problem on the part of the scientists regarding their effort. Moreover, TTO managers also express discontent regarding the early stage of the majority of inventions disclosed to them (Jensen/Thursby 2001). Many inventions reported by scientists have not entered the end of the late research stage yet and thus, patentability of the invention and its commercial potential are hard to assess.

With respect to the further development of a technology, the licensor act as the principal while the licensee is considered as agent. In the search of the “right” licensee, principal agent problems become apparent. Chapter 4 and 5 identified a number of reasons why a licensor may suspect a licensee to deviate from his commitment to develop the technology further. They refer to strategic advantages over competitors through blocking, freedom-to-operate considerations and the high costs of development. Additionally, it is important to note that fundamental uncertainty on how the early stage invention might develop likewise makes it hard to choose the “right” licensee *ex ante*. In the case of US universities, the Bayh-Dole debates neglected the latter point (Colyvas, et al. 2002). Consequently, pure licensors operating under increasing licensing pressure need to balance the risks from principal agent problems against profits on a case-by-case basis.

Solutions to principal-agent problems are widely discussed in the literature. Some studies provide evidence that higher royalty shares for faculty members are associated with greater licensing income for the university (Friedman/Silberman 2003; Lach/Schankerman 2004). Based on this finding, Link and Siegel (2005) argue that monetary incentives for scientists and faculty members positively influence the invention disclosure process. Flexibility on the part of the university, which refers to less bureaucracy and a less conservative negotiation stance towards maximization of royalties, would not only lower organizational hurdles but decrease moral hazard of inventors. The design of a licensing contract has an effect on the behavior of licensees. Royalties allow the separation of the “bad application of the innovation from the good ones” (Macho-Stadler/Pérez-Castrillo/Veugelers 2005: 44). Flexible royalties have an effect on the behavior of the licensee because they either increase or decrease the (effective) marginal costs of using the new technology. In either way, flexible royalties work best when competition between companies in the market for products and technology is high (Macho-Stadler/Pérez-Castrillo/Veugelers 2005). This would also imply the grant of non-exclusive or co-exclusive licenses. However, it is widely argued that pharmaceutical companies are not willing to sign such con-

tracts and share the technology with other companies when development costs are high. For this reason, a fitting combination of milestone payments, upfront payments, royalties, legal clauses and constant monitoring on the part of the licensor seem to mitigate moral hazard problems.

### **Limitation of the thesis**

Due to the explorative nature of the three studies and recent developments in the primary markets for patents and the MfI, this thesis leaves a number of issues untackled. The first study came up with findings that need further qualification in dissimilar or similar social settings in which the difference between high and low fundamental uncertainty is not clear cut: Do confidence and imagination likewise prevail in transactions of other goods under similar conditions? Do these factors come into play when a drug on a different technology is traded? How do market actors in other industries cope with valuation-pricing and cooperation problems?

In the second study, the relationship between Callon's performativity approach and the concept of institutional entrepreneurship requires further clarification, notably a theoretical discussion about knowledge production, interests and institutions. Moreover, the meaning of dramaturgical and ceremonial elements, joint action and the role of prominent market players in field configuring events needs a further in-depth analysis that this thesis does not provide. This point could be tackled by exploring a similar or dissimilar event and then comparing the results with the findings of chapter 6. In the third study, it was hypothesized that PMIs have four functions on two markets. This assumptions and the relationship between the functions would need stronger empirical evidence to specify the role of PMIs. Furthermore, it would be interesting to find out what the significance of the market for intermediary business (MfI) actually is for primary markets for patents. The theoretical and methodological implications of a mode-two-network analysis would deserve further attention. To sum up, additional studies about uncertainty and market constitution in different settings and with other goods would help to generalize the findings.

## **8.6 Contribution to research**

Patent transactions and markets for patents are a case in point for uncertainties in transactions and markets. I argue that the three studies contribute to our understanding about how managers cope with uncertainties in different transactions forms (chapter 4, 5, 6) and how functioning markets are constituted (chapter 6 and 7). Thereby the thesis delivers insights into patent transactions on the micro-level and into markets for patents on the structural level.

Previous studies investigated patent transactions either from the perspective of the patent holder (Teece 1998), the awareness of open innovation and patent exploita-

tion in firms (Chesbrough 2006b; West 2006) or the value of patents (Gambardella/Giuri/Mariani 2005). While many studies on markets for patents miss out the viewpoint of the purchaser or licensee (Arora/Gambardella 2010), the first study even integrated the perspective of both, licensors *and* licensees, and thereby attempted to balance both perspectives and unravel puzzles in patent transactions and markets for patents. The thesis contributed to the understanding of two puzzles in the literature:

The first puzzle refers to the *contradiction between increasing IP transactions and obstacles in the market for patents*. In the thesis, I argued that a pressure to commercialize patented technologies exists for some actors, notably universities and small companies as pure licensors and pure licensees. Since their commercial well-being depends on a successful commercialization of patents and R&D projects, they are inclined to actively reach out to (other) companies and thereby using their networks and a number of impersonal devices to approach them. At the same time, companies that have not considered licensing so far are now more and more willing to license their technology even to and from companies which are not known from prior transactions. Furthermore, the thesis revealed a number of obstacles - good-related obstacles (e.g. singularity of the patent and indivisibility of inventions), a lack of institutional backing and transaction-related obstacles that allude to uncertainty. Except for increasing attempts from political institutions to stimulate the market for patents, good-related obstacles and uncertainty are found to be persistent. They are unlikely to change because they represent key features of patents and transactions of patents which stand in conflict with smooth and fast (spot-market) transactions in principle. For this reason, growing markets and obstacles in transactions co-exist.

The second puzzle refers to the *relationship between valuable and non-valuable patents*. Valuable patents are more likely to be licensed (Gambardella/Giuri/Mariani 2005) but licensees nonetheless fear that the market for patents is flooded by non-valuable patents (Pisano 1997). The findings in chapter 5 suggest that this puzzle results from the due diligence and negotiation process. Licensees obviously fear “lemons” and thus they spend a good time for auditing the technologies in order to identify the most promising drugs. The licensor is usually more knowledgeable about the scientific-technical side than the licensee but with a thorough due diligence, the licensee is able to inquire technical details and identify valuable patents. With regard to future developments in the product market, however, the licensee is often one step ahead. Information about future developments is considered to be confidential and is usually hidden from the licensor in financial negotiations. Obviously, the licensee is more likely to learn about technical details in an extensive due diligence than a licensor in negotiations about the product market.

### **Practical implications**

The dissertation conveys findings that may be of interest to IP and technology management in organizations and intermediary firms:

Chapter 2 may help practitioners in organizations to learn about the tradability of a patent. A patent shares characteristics of a (fictive) commodity and a singular good. TTO and BD managers should know about aspects and features that make a patent or patent licensing simple (as opposed to know how) or more complex than a tangible good and a CRADA. Companies and universities should understand that the insufficient propertization and appropriation of patented technologies pose obstacles to the tradability of patents. For instance, e-bay like auctions for patents are transaction cost efficient but also dangerous when confidentiality is not ensured. The key features of patents leave room for multiple business models for organizations but in the new and emerging MfI, we still lack experience.

The second study (chapter 6) advanced the argument that arm's length sales transactions in IP auctions are not efficient per se but require numerous efforts on the part of the auctioneer in order to make the auction ultimately efficient. This insight is useful for patent market intermediaries. A business model is foremost successful when the market device, be it an auction, online platform or valuation model, jointly acts with the PMI to overcome uncertainties. In other words, intermediary firms should better have a stake in IP managing and transaction processes and should not leave the device to the client. New and unprecedented business models are in need of clarification to firms and universities. This means that PMIs should not restrict their services on IP consulting but should also explain the IP-related services to the clients and at the same time convince them of the benefits.

The third study (chapter 7) informs technology management about the roles and functions of patent market intermediaries (PMIs). The study made the strong point that patent market intermediaries have four roles in the primary markets for patents and the market for intermediary businesses (MfI). In the primary market for patents, PMIs act as "third party assistance" (Williamson 1979) and profiteer from "uncertainty-bearing" (Knight 2002 [1921]). In the MfI, they respond to the needs of the demand side and act as suppliers of intermediary businesses. This insight may help intermediary organizations to assess their strengths and weaknesses. Like other organizations, PMIs should know about how and why it makes sense to adopt a service known from another market and then learn how to realize synergies.

Numerous business models of PMIs are known but the (secondary) market for intermediary businesses is still unexplored. By reconstructing the market for intermediary businesses, the dissertation identified three sub-factions. This finding contributes to the understanding of how intermediaries can position themselves in this market. For instance, when a large consulting firm may choose to enter the MfI and

offer IP-related services it is advised to take a position in a niche within the “extensive sub-faction”. A large firm is usually open to numerous organizations and thus able to hire experts from various fields in order to guarantee a comprehensive evaluation of IP. Consequently, this firm will most profit from a “broad ranging” strategy.

### **Theoretical contributions**

The thesis makes theoretical and methodological contributions to economic sociology and transaction-cost theory:

Traditionally, economic sociology is concerned with a structural analysis of markets. The processual viewpoint appears to be more pronounced on the macro level, notably with regard to institutional change, than on the micro level of social interactions between market actors. The latter viewpoint, as I argued, is important to reveal key uncertainties in patent transactions and to understand how managers cope with uncertainties. In order to address social interactions between managers in transactions, the theoretical framework attempted to combine pragmatist and cultural concepts in economic sociology beyond (pure) cultural, institutional and socio-structural explanations of transactions and market constitution. The thesis suggested a methodological way about how to investigate uncertainties in transaction processes. A three-step approach, which includes an objective-observer perspective, a subjective and transaction perspective, was advised to increase validity in the empirical field research. Economic sociology may profit from such a conduct.

Approaches in economic sociology broadened our understanding of structural elements and structural preconditions of established markets. In new and emerging markets, however, many constitutive elements are in flux and may either appear spontaneously or through regulation (Aspers 2009a; Möllering 2009). The second study (chapter 6), challenged two theories on market constitution: The performativity theory (Callon 1998; 2007) and the concept of institutional entrepreneurship (DiMaggio 1988; DiMaggio/Powell 1991a; Maguire/Hardy/Lawrence 2004; Eisenstadt 1980). While the performativity theory implies the top-down construction of markets - from theory to practice or from external (academic) institutions to the economic world - the theory of institutional entrepreneurship asserts that economic processes are also shaped by endogenous bottom-up initiatives of actors in the market. As indicated, the oppositeness of these two theses is not clear cut.

The case of the fall 2008 Live IP auction showed that both approaches rather complement than exclude one another. Assumptions derived from the performativity thesis held when the presenters tackled the concerns of IP holders and IP purchasers on the primary market for patents. Here, they strived for solutions to problems by using IP strategies in management studies, though the discussions among the panel-

lists also served to explore and assess roadblocks and pitfalls in the primary market. The panellists did not give clear advices but just illustrated options and possible ways for firms to handle problems. However, when presenters introduced new business-models to the audience, they tended to act interest-driven because the conference is an opportunity for PMIs to promote their business services and to signal expertise to inexperienced IP managers. The same holds true for incumbent companies with established in-house IP licensing strategies.

The results of the study confronted key propositions of the two approaches. Contrary to the approach of institutional entrepreneurship, the findings suggest that power struggles between different interest groups do not occur in any case. When a third party assistance organizes a field configuring event, confrontations between different interest groups may be avoided by this intermediary organization. The alleviating effect of intermediary organizations in interest-driven power struggles is overseen by this approach. The assertion of the performativity thesis about the role of powerful of knowledge is disconfirmed in this case. The presenters did not only instruct the audience with managerial knowledge or techniques on what is efficient or inefficient but asked them for their opinion. Consequently, the discussions themselves contributed to establishing best practice and performance in the market.

Industrial economics and the existing literature on technology transfer acknowledge that uncertainty impedes transactions, though the concept remains one-sided and vague. Transaction cost theory tends to treat uncertainty mainly as impeding factor that makes a contract to be a “mere promise, unsupported by credible commitments, [that, IT] will not be self-enforcing” (Williamson 2000: 601). Consequently, uncertainty triggers opportunistic behavior among market actors. Moreover, many economists do not differentiate between transactions under a high and low degree of fundamental uncertainty.

The findings in chapter 4 and 5, however, showed a more complex picture of patent transactions. In the case of high fundamental uncertainty about the innovative product and patent, managers are well aware that licensing contracts are incomplete and that renegotiations are inevitable. Licensing agreements are thoroughly negotiated but it is also anticipated that contractual terms are subject to change in the future. This insight ultimately let managers act pragmatically with regard to the licensing contract. The fact that the contract is just a promise and not self-enforcing, was not articulated as problematic in the case of high fundamental uncertainty. Instead, my findings suggest that confidence and a portion of imagination on both sides are decisive for the closure of an early stage contract. A lack of these factors poses problems when paired with opportunistic behavior. One reason for this finding is that both parties are equally affected by high fundamental uncertainties. Simply put, the

licensor and licensee are in the same boat. Interestingly, low fundamental uncertainty seems to be associated with opportunistic behavior. With more relevant information about the compound and the patent, market actors suspect each other to hide intentions and information. The problem of moral hazard and adverse selection is obviously more pronounced in the second case. As a consequence, it was found that trustworthiness and competence of managers come into play in the negotiation of a late stage contract.

My findings imply that transaction cost theory falls short that it tends to under-emphasize the role of trust, trustworthiness and competence and over-emphasize the importance of self-enforcing contracts when dealing with uncertainty. The theory is right in the assumptions that managers do not blindly trust in the commitment of the other party, as some sociologists asserted (cf. Macaulay 1963). But it is also wrong because the parties are not trapped in incomplete contracts that result from the indeterminacy of the future. The empirical results suggest that managers reflect this indeterminacy through conversations. Legal negotiations are not only effected to decide on risk sharing between licensor and licensee. They also help to envision future developments. Uncertainty prompts social interaction, notably to convince the other side through arguments (cf. Stark 2009) *and* to establish the trustworthiness that is needed to overcome uncertainty.





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## References

- 1980: *The Bayh-Dole Act*. PL 96-517, Patent and Trademark Act Amendments of 1980.
- 2003: *Agreement on trade-related aspects of intellectual property rights* WTO. <[http://www.wto.org/english/docs\\_e/legal\\_e/27-trips.pdf](http://www.wto.org/english/docs_e/legal_e/27-trips.pdf); 01/13/2010> (August 30, 2003).
- Akerlof, George A., 1970: The Market for "Lemons": Quality Uncertainty and the Market Mechanism. In: *Quarterly Journal of Economics* 84, 488-500.
- Aldridge, Taylor/David B. Audretsch, 2010: Does policy influence the commercialization route? Evidence from National Institutes of Health funded scientists. In: *Research Policy* 39, 583-588.
- Allain, Marie-Laure/Emeric Henry/Margaret Kyle, 2010: *The timing of licensing: theory and empirics*, Paper to be presented at the 8th Annual International Industrial Organization Conference 2010.
- Allison, John R./Mark A. Lemley, 2000: Who's Patenting What? An Empirical Exploration of Patent Prosecution. In: *Vand. L. Rev.* 53, 2099-2174.
- American Bar Association, 2009: *What is a Trademark?* Chicago: ABA Section of Intellectual Property Law.
- Amtsgericht Hamburg, 2010: *Aktenzeichen: 67b IN 182/10*. Hamburg: Amtsgericht Hamburg.
- Anand, Bharat N./Tarun Khanna, 2000: The structure of licensing contracts. In: *The Journal of Industrial Economics* XLVIII, 103-135.
- Anderson, Erin/David Schmittlein, 1984: Integration of the Sales Force: An Empirical Examination. In: *RAND Journal of Economics* 15, 385-395.
- Anonymous, 2003: *The Market for Lead Optimization Tools and Services. Applying the new 'omics' to enhance drug discovery*. Kalorama Information, November 2003: 14.
- Anonymous, 2004a: Effort afoot to create exchange for tech licenses; 'We can figure out how to trade corn, why (not) applied technology?' In: *Crain's Chicago Business*, 11/1/2004.
- Anonymous, 2004b: First Patent Auction Held in Shanghai. In: *AsiaInfo Service*, 05/01/2011.
- Anonymous, 2008: Ocean Tomo to Offer IDLE SCREEN Mobile Messaging Technology for Sale at IP Auction in Amsterdam on 26 June. In: *Pharma Investments, Ventures & Law Weekly*, 06/22/2008.

- Anonymous, 2009: Ocean Tomo, LLC Announces 10-Year Relationship with ICAP. In: *VerticalNews*, 06/25/2009.
- Antonelli, Cristiano, 2007: Technological knowledge as an essential facility. In: *Journal of Evolutionary Economics* 17, 451-471.
- Arora, Ashish/Marco Ceccagnoli, 2006: Patent Protection, Complementary Assets, and Firms' Incentives for Technology Licensing. In: *Management Science* 52, 293-308.
- Arora, Ashish/Andrea Fosfuri, 2003: Licensing the market for technology. In: *Journal of Economic Behavior & Organization* 52, 277-295.
- Arora, Ashish/Andrea Fosfuri/Alfonso Gambardella, 2001: *Markets for Technology. The Economics of Innovation and Corporate Strategy*. Cambridge: Massachusetts Institute of Technology.
- Arora, Ashish/Andrea Fosfuri/Alfonso Gambardella, 2002: Markets for technology in the knowledge economy. In: *International Social Science Journal* 54, 115-128.
- Arora, Ashish/Alfonso Gambardella, 2010: Ideas for Rent: An overview of markets for technology. In: *Industrial and Corporate Change* 19, 775-803.
- Arrow, Kenneth, 1962: Economic Welfare and the Allocation of Resources for Invention. In: Richard R. Nelson (ed.) *The Rate and Direction of Inventive Activity: Economic and Social Factors*. Princeton: Princeton University Press, 609-626.
- Arrow, Kenneth, 1969: Classificatory Notes on the Production and Transmission of Technological Knowledge. In: *American Economic Review* 52, 29-35.
- Arrow, Kenneth, 1985: Economic Welfare and the Allocation of Resources for Invention. In: Kenneth Arrow (ed.) *Production and Capital*. Cambridge, MA and London, England: The Belknap Press of Harvard University Press, 104-119.
- Arthur, W. Brian, 2007: The structure of invention. In: *Research Policy* 36, 274-287.
- Arundel, A./Pari Patel, 2003: *Strategic patenting. New Trends in IPR Policy*, Background Report for the Trend Chart Policy Benchmarking Workshop.
- Arundel, Anthony, 2001: The relative effectiveness of patents and secrecy for appropriation. In: *Research Policy* 30, 611-624.
- Arundel, Anthony/G. Van de Paal/Luc Soete, 1995: *Innovation Strategies of Europe's Largest Industrial Firms: Results of the PACE Survey for Information Sources, Public Research, Protection of Innovations and Government Programmes. Directorate General XIII. EIMS Publication 23* European Commission.
- Aspers, Patrick, 2006: Sociology of Markets. In: Jens Beckert/Milan Zafirovski (eds.), *International Encyclopedia of Economic Sociology*. London: Routledge, 427-432.

- Aspers, Patrick, 2008: Analyzing order: social structure and value in the economic sphere. In: *International Review of Sociology* 18, 301-316.
- Aspers, Patrik, 2007: Theory, Reality, and Performativity in Markets. In: *American Journal of Sociology* 66, 379-398.
- Aspers, Patrik, 2009a: *How are markets made?*, MPIfG Working Paper 09/2. Cologne: Max Planck Institute for the Study of Societies.
- Aspers, Patrik, 2009b: Knowledge and Valuation in Markets. In: *Theor Soc* 38, 111-131.
- Aspers, Patrik/Jens Beckert, 2008: Märkte. In: Andrea Maurer (ed.) *Handbuch der Wirtschaftssoziologie*. Wiesbaden: VS-Verlag.
- AUTM, 2007: *FY 2006 Licensing Activity Survey Summary*. Deerfield: The Association of University Technology Manager. <[http://www.autm.net/AM/Template.cfm?Section=Licensing\\_Surveys\\_Affiliate\\_d\\_Organizations&TEMPLATE=/CM/ContentDisplay.cfm&CONTENTID=2292; 03/04/2011](http://www.autm.net/AM/Template.cfm?Section=Licensing_Surveys_Affiliate_d_Organizations&TEMPLATE=/CM/ContentDisplay.cfm&CONTENTID=2292; 03/04/2011)>
- AUTM, 2011: *AUTM U.S. LICENSING ACTIVITY SURVEY HIGHLIGHTS: FY2010*. Deerfield: The Association of University Technology Manager. <<http://sherwood-autm.informz.net/sherwood-autm/data/images/2010susurveyhighlightsfinal.pdf, 09/05/2011>>
- Axelrod, Robert, 1984: *The Evolution of Cooperation*. New York: Basic Books.
- Bacharach, Michael/Diego Gambetta, 2001: Trust in Society. In: Gordon Cook (ed.) *Trust in society*. Cambridge: Cambridge University Press, 148-184.
- Bachmann, Reinhard, 1998: Conclusion: Trust – Conceptual Aspects of a Complex Phenomenon. In: Christel Lane/Reinhard Bachmann (eds.), *Trust Within and Between Organizations*. Oxford: Oxford University Press, 298-322.
- Bales, Robert F., 1976: *Interaction Process Analysis. A Model for the Study of Small Groups*. Chicago: University of Chicago Press.
- Bandelj, Nina 2009: Emotions in economic action and interaction. In: *Theory and Society* 38, 347–366.
- Bartenbach, Kurt, 2006: *Patentlizenz- und Know-how-Vertrag*. 6. Auflage. Köln: Otto Schmidt.
- Bartenbach, Kurt/Franz-Eugen Volz, 2004: *Arbeitnehmererfindungen: Praxisleitfaden mit Mustertexten*. 3. Auflage. Köln u.a.: Carl Heymanns Verlag KG.
- Baumol, William J., 2002: *The Free-Market Innovation Machine. Analyzing the Growth of Capitalism*. Princeton and Oxford: Princeton University Press.
- Beckert, Jens, 1996: What Is Sociological about Economic Sociology? Uncertainty and the Embeddedness of Economic Action. In: *Theory and Society* 25, 803-840.

- Beckert, Jens, 1999: Agency, Entrepreneurs, and Institutional Change. The Role of Strategic Choice and Institutional Practices in Organizations. In: *Organization Studies* 20, 777-799.
- Beckert, Jens, 2005: *Trust and the performative construction of markets*, MPIfG Discussion Paper 05/8. Cologne: Max Planck Institute for the Study of Society.
- Beckert, Jens, 2007a: Die Abenteuer der Kalkulation. Zur sozialen Einbettung ökonomischer Rationalität. In: *Leviathan* 35, 295-309.
- Beckert, Jens, 2007b: *The Social Order of Markets*, MPIfG Discussion Paper 07/15. Köln: Max-Planck-Institut für Gesellschaftsforschung.
- Beckert, Jens, 2009: The Social Order of Markets. In: *Theor Soc* 38, 245-269.
- Beckert, Jens, 2011: Where do prices come from? Sociological approaches to price formation. In: *Socio-Economic Review* 2011, 1-30.
- Bently, Lionel, 2008: The making of modern trade mark law. In: Lionel Bently/Jennifer Davis/Jane C. Ginsburg (eds.), *Trade Marks and Brands: An Interdisciplinary Critique*. Cambridge: Cambridge University Press, 3-41.
- Bercovitz, Janet/Maryann Feldman, 2006: Entrepreneurial universities and technology transfer: a conceptual framework for understanding knowledge-based economic development. In: *Journal of Technology Transfer* 31, 175-188.
- Berger, Peter L./Thomas Luckmann, 1967: *The Social Construction of Reality: A Treatise in the Sociology of Knowledge*. New York [u.a.]: Anchor Books.
- Berneman, Louis P., et al., 2009: U.S./Canadian Licensing In 2007-08: Survey Results. In: *Les Nouvelles* XLIV, 1-8.
- Bessant, John/Howard Rush, 1995: Building bridges for innovation: the role of consultants in technology transfer. In: *Research Policy* 24, 97-114.
- Bessen, James/Michael J. Meurer, 2008: *Patent Failure: How Judges, Bureaucrats, and Lawyers Put Innovators at Risk*. Princeton/Oxford: Princeton University Press.
- Beunza, Daniel/David Stark, 2004: Tools of the trade: the socio-technology of arbitrage in a Wall Street trading room. In: *Industrial and Corporate Change* 13, 369-400.
- Bianchi, Mattia, et al., 2011: Organisational modes for Open Innovation in the biopharmaceutical industry: An explorative analysis. In: *Technovation* 31, 22-33.
- Bidault, Francis, 1989: *Technology Pricing: From Principles to Strategy*. New York: St. Martin's Press.
- Bidault, Francis/William A. Fischer, 1994: Technology transactions: networks over markets. In: *R&D Management* 24, 373-386.

- BIO, 2010. <<http://bio.org/aboutbio/>> (06/25/2010).
- Blind, K./J. Edler/M. Friedewald, 2003: *Geistige Eigentumsrechte in der Informationsgesellschaft: Eine Analyse der Rolle gewerblicher Schutzrechte bei Gründung und Markteintritt sowie für die Innovations- und Wettbewerbsfähigkeit von Softwareunternehmen anhand unternehmens- und softwarebezogener Fallstudien*. Karlsruhe: Fraunhofer Institut.
- Blind, Knut, et al., 2006: Motives to patent: Empirical evidence from Germany. In: *Research Policy* 35, 655-672.
- Boettke, Peter J./Don Lavoie/Virgil Henry Storr, 2004: The subjectivist methodology of Austrian economics and Dewey's theory of inquiry. In: Elias L. Khalil (ed.) *Dewey, Pragmatism, and Economic Methodology*. London/New York: Routledge, 327-356.
- Borgatti, Stephen P., 2009: 2-Mode Concepts in Social Network Analysis. In: Robert A. Meyers (ed.) *Encyclopedia of Complexity and System Science*. New York: Springer.
- Borgatti, Stephen P./Martin G. Everett, 1997: Network analysis of 2-mode data. In: *Social Networks* 19, 243-269.
- Bozeman, Barry, 2000: Technology transfer and public policy: a review of research and theory. In: *Research Policy* 29, 627-655.
- Braithwaite, R. B., 1973: Editorial Foreword. In: John Maynard Keynes (ed.) *Treatise on Probability*. New York/Cambridge: The Royal Economic Society xv-xxii.
- Brennan, Miles B., 2000: Drug discovery. Filtering out failures early in the game. In: *Chemical Engineering News* 78, 63-74.
- Brousseau, Eric/Camille Chasserant/Christian Bessy, 2005: *An International Survey on Technology Licensing Practices. The Diversity of Technology Licensing Agreements and their Causes*. Paris: Centre National De La Recherche Scientifique supported by LES.
- Brousseau, Eric/Camille Chasserant/Christian Bessy, 2005: *An International Survey on Technology Licensing Practices. The Diversity of Technology Licensing Agreements and their Causes*. Paris: Centre National De La Recherche Scientifique supported by LES.
- Bundesverband der Pharmazeutischen Industrie e.V., 2005: *Studie zur aktuellen Situation der Pharmazeutischen Industrie in Deutschland 2005*. Berlin: Bundesverband der Pharmazeutischen Industrie e.V., Helbling Management Consulting GmbH.
- Burgess, Robert G., 1984: *In the Field: An Introduction to Field Research*, Contemporary social research series. London: Allen & Unwin.

## References

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- Burhop, Carsten, 2009: *The Transfer of Patents in Imperial Germany*, Preprint 2009/26. Bonn: Max Planck Institute for Research on Collective Goods.
- Burt, Ronald, 1992: *Structural Holes: The Social Structure of Competition*. Cambridge: Harvard University Press.
- Burton, Diana M., et al., 2005: Property Rights Protection of Biotechnology Innovations. In: *Journal of Economics & Management Strategy* 14, 779-812.
- Businesswire.com, 2007: *Ocean Tomo Spring 2007 Live Intellectual Property Auction Catalogue Now Available; Publication Summarizes Information for 1,000+ IP Assets Offered in 55+ Lots Including Ground-Breaking Innovative Technologies and an Internet Television Network*. <<http://www.businesswire.com:01/26/2007>>.
- Businesswire.com, 2008: *Ocean Tomo Auctions Announces Outstanding \$19.6M Results from Spring 2008 Live Intellectual Property Auction; Digital Media Systems & Management Lot Sells for a Record-Breaking \$6.6 Million*, Businesswire; 04/05/2008.
- Businesswire.com, 2009a: *Ocean Tomo Predicts New Direction in IP Transactions; Dipanjan Nag and Michael Anglin to Co-Head Efforts*, Businesswire; 03/02/2009.
- Businesswire.com, 2009b: *Ocean Tomo to Auction Intellectual Property Rights to Green Roadway Project on a State-by-State Basis; Sealed Bids Now Being Accepted for Rights to Harness Solar and Wind Energy Along Nation's Highways*, Businesswire; 05/20/2009.
- BuySellSignals, 2010: *Claymore/Ocean Tomo Growth Index ETF dips 0.4% on firm volume*. <[www.buysellsignals.com:01/06/2011](http://www.buysellsignals.com:01/06/2011)>.
- Callon, Michel, 1998: *The Laws of the Markets*. New York: Blackwell Publishers.
- Callon, Michel, 1999: *The Laws of the Markets*. New York: Blackwell Publishers.
- Callon, Michel, 2007: What Does it Mean to Say that Economics is Performative? In: Donald MacKenzie/Fabian Muniesa/Lucia Siu (eds.), *Do Economists Make Markets? On the Performativity of Economics*. Princeton: Princeton University Press, 311-357.
- Camerer, Colin/Martin Weber, 1992: Recent developments in modeling preferences: Uncertainty and ambiguity. In: *Journal of Risk and Uncertainty* 5, 325-370.
- Carruthers, Bruce G., 2006: *Power and the Basic Institutions of a capitalist Economy*. Department of Sociology, Northwestern University.
- Carruthers, Bruce G./Laura Ariovich, 2004: The Sociology of Property Rights. In: *Annual Review of Sociology* 30, 23-46.

- Cavalla, David, 2003: The extended pharmaceutical enterprise. In: *Drug Discovery Today* 8, 267-274.
- Centre for Medicines Research International, 2000: *Pharmaceutical research and development compendium*, 11/23/2008.
- Chesbrough, Henry, 2006a: *Emerging Secondary Markets for Intellectual Property: US and Japan Comparisons: Research Report to National Center for Industrial Property Information and Training (NCIPI)*
- Chesbrough, Henry, 2006b: Open Innovation: A New Paradigm for Understanding Industrial Innovation. In: Henry Chesbrough/Wim Vanhaverbeke/Joel West (eds.), *Open Innovation: Researching a New Paradigm*. Oxford/New York: Oxford University Press, 1-34.
- Chesbrough, Henry, 2009: *Specialisation and Markets for IP*. Presentation to FTC Hearings Haas School of Business, 5 May 2009. Berkeley. <<http://www.ftc.gov/bc/workshops/ipmarketplace/may4/docs/bchesbrough.pdf>; 12/11/2009>.
- Chesbrough, Henry/Richard S. Rosenbloom, 2002: The role of the business model in capturing value from innovation: Evidence from Xerox Corporation's technology spin-off companies. In: *Industrial and Corporate Change* 11, 529-555.
- Chicago Tribune, 2006: *New auction on the block; There's not much to look at except paperwork, but a Chicago firm is trying to raise the profile of selling intellectual property*, 10/20/2006.
- Choi, Jay Pil, 2003: *Patent Pools and Cross-Licensing in the Shadow of Patent Litigation*, CESifo Working Paper Series No. 1070
- Clark, David E./Christopher G. Newton, 2004: Outsourcing lead optimisation - the quiet revolution. In: *Drug Discovery Today* 9, 492-500.
- Clark, Don, 2006: Public Auction for Patents Fails to Sway Buyers. In: *Wall Street Journal*.
- Coase, R.H., 1960: The Problem of Social Cost. In: *The Journal of Law and Economics* 3, 1-44.
- Cockburn, Iain M./Rebecca M. Henderson, 2001: Publicly funded science and the productivity of the pharmaceutical industry. In: Adam B. Jaffe/Josh Lerner/Scott Stern (eds.), *Innovation Policy and the Economy*. Boston: MIT Press, 1-34.
- Cohen, Wesley M., 2005: Patents and Appropriation: Concerns and Evidence. In: *Journal of Technology Transfer* 30, 57-71.
- Cohen, Wesley M., et al., 2002: R&D spillovers, patents and the incentives to innovate in Japan and the United States. In: *Research Policy* 31, 1349-1367.

- Cohen, Wesley M./Richard Nelson, 1998: *The effects of university research on industrial R&D*, Draft Manuscript.
- Cohen, Wesley M./Richard R. Nelson/John P. Walsh, 2002: Links and impacts: the influence of public research on industrial R&D. In: *Management Science* 48, 1-23.
- Cohen, Wesley/Richard R. Nelson/John P. Walsh, 2000: *Protecting their intellectual assets: appropriability conditions and why U.S. manufacturing firms patent (or not)*, NBER Working Paper 7552. Cambridge: National Bureau of Economic Research.
- Coleman, James S., 1990: *Foundations of Social Theory*. Cambridge, MA: The Belknap Press.
- Colyvas, Jeannette A., 2007: From divergent meanings to common practices: The early institutionalization of technology transfer in the life sciences at Stanford University. In: *Research Policy* 36, 456-476.
- Colyvas, Jeannette A., et al., 2002: How Do University Inventions Get into Practice? In: *Management Science* 48, 61-72.
- Commons, John R., 1936: Institutional Economics. In: *American Economic Review* 26, 237-249.
- Contractor, Farok J./Tagi Sagafi-Nejad, 1981: International Technology Transfer: Major Issues and Policy Responses. In: *Journal of International Business Studies* 12, 113-135.
- Coriat, Benjamin/Olivier Weinstein, 2004: Institutions, échanges et marchés. In: *Revue d'Economie Industrielle* 107, 37-62.
- Cremers, Katrin, 2004: *Determinants of Patent Litigation in Germany*, Discussion Paper No. 04-72. Mannheim: ZEW. <<ftp://ftp.zew.de/pub/zew-docs/dp/dp0472.pdf>; 03/06/2009>
- Creswell, John W., 2003: *Research Design: Qualitative, Quantitative, and Mixed Methods* Thousand Oaks: Sage.
- Crocco, Marco, 2002: The concept of degrees of uncertainty in Keynes, Shackle, and Davidson. In: *Nova Economia* 12, 11-28.
- Dacin, Tina, 1997: Isomorphism in Context: The Power and Prescription of Institutional Norms. In: *The Academy of Management Journal* 40, 46-81.
- Dahlman, Carl J./Larry E. Westphal, 1981: The Meaning of Technological Mastery in Relation to Transfer of Technology. In: *Annals of the American Academy of Political and Social S.* 458, 12-26.
- David, Paul A., 1993: *The Evolution of Intellectual Property Institutions*, Working Paper 93-009. Maastricht.



- David, Paul A., 1998: Common Agency Contracting and the Emergence of "Open Science" Institutions. In: *American Economic Review* 88, 15-21.
- Davis, Lee, 2006: *Licensing Strategies of the Enterprising - But Vulnerable - "Intellectual property" Vendors*, DRUID Working Paper No. 06-12. Copenhagen Business School.
- De Brabandere, Luc de/Alan Iny, 2010: Scenarios and Creativity: Thinking in new boxes. In: *Technological Forecasting & Social Change* 77, 1506-1512.
- Debackere, Koenraad/Reinhilde Veugelers, 2005: The role of academic technology transfer organizations in improving industry science links. In: *Research Policy* 34, 321-342.
- Degroof, Jean-Jacques/Edward B. Roberts, 2003: Spinning-off New Ventures from Academic Institutions in Areas with Weak Entrepreneurial Infrastructure: Insights on the Impact of Spin-Off Processes on the Growth-orientation of Ventures. In: *Journal of Technology Transfer* 29, 327-352.
- Demsetz, Harold, 1967: Toward a Theory of Property Rights. In: *American Economic Review* 57, 347-359.
- Den Hertog, Pim 2000: Knowledge-Intensive Business Services as Co-Producers of Innovation. In: *International Journal of Innovation Management* 4, 491-528.
- Dequech, David, 2000: Fundamental Uncertainty and ambiguity. In: *Eastern Economic Journal* 26, 41-60.
- Dequech, David, 2001: Bounded rationality, institutions and uncertainty. In: *Journal of Economic Issues* 35, 911-929.
- Deutsche Bundesbank, 2006: *Technologische Dienstleistungen in der Zahlungsbilanz*: Deutsche Bundesbank.
- Dewey, John, 1938: *Logic - The Theory of Inquiry*. New York: Henry Holt.
- Dewey, John, 1960 [1929]: *The Quest for Certainty: A Study of the Relation of Knowledge and Action*. New York: Capricorn Books.
- Dewey, John, 1998 [1938]: The Pattern of Inquiry. In: Larry A. Hickman/Thomas M. Alexander (eds.), *The Essential Dewey: Ethics, Logic, Psychology*. Vol. 2. Bloomington: Indiana University Press, 169-179.
- Diessel, Benjamin H., 2007: Trolling the Trolls. In: *Michigan Law Review* 106, 305-345.
- DiMaggio, Paul, 1988: Interest and Agency in Institutional Theory. In: Lynne G. Zucker (ed.) *Institutional Patterns and Organizations. Culture and Environment*. Cambridge, MA: Ballinger, 3-21.

- DiMaggio, Paul J./Walter W. Powell, 1991a: Introduction. In: Walter W. Powell/Paul J. DiMaggio (eds.), *The New Institutionalism in Organizational Analysis*. Chicago: The University of Chicago Press, 1-38.
- DiMaggio, Paul J./Walter W. Powell, 1991b: The Iron Cage Revisited: Institutional Isomorphism and Collective Rationality in Organizational Fields. In: Walter W. Powell/Paul J. DiMaggio (eds.), *The New Institutionalism in Organizational Analysis*. Chicago: The University of Chicago Press, 63-82.
- DiMasi, Joseph A./Ronald W. Hansen/Henry G. Grabowski, 2003: The price of innovation: new estimates of drug development costs. In: *Journal of Health Economics* 22, 151-186.
- Dimitri, Nicola, 2008: On the stage division mechanism in pharmaceuticals development processes. In: *Drug Discovery Today* 13, 902-906.
- Djelic, Marie-Laure/Sigrid Quack, 2007: Overcoming Path Dependency: Path Generation in Open Systems. In: *Theory and Society* 36, 161-186.
- Dobbin, Frank, 1994: *Forging Industrial Policy: The United States, Britain and France in the Railway Age*. Cambridge: Cambridge University Press.
- Dosi, Giovanni/M. Egidi, 1991: Substantive and procedural uncertainty. An exploration of economic behaviours in changing environments. In: *Journal of Evolutionary Economics* 1, 145-168.
- Drews, Jürgen, 2003: Strategic trends in the drug industry. In: *Drug Discovery Today* 8, 411-420.
- Drucker, Peter, 1993: *Die postkapitalistische Gesellschaft*. Düsseldorf: ECON.
- Durance, Philippe/Michel Godet, 2010: Scenario building: Uses and abuses. In: *Technological Forecasting & Social Change* 77, 1488-1492.
- Easdale, Christine/Colin W. Vose, 2009: Development. In: H. P. Rang (ed.) *Drug Discovery and Development: Technology in Transition*. Edinburgh [et al.]: Elsevier Churchill Livingstone.
- Edwards, Mark G./Fiona Murray/Robert Yu, 2003: Value creation and sharing among universities, biotechnology and pharma. In: *Nature Biotechnology* 21, 618-624.
- Eisenberg, Rebecca S., 1989: Patents and the Progress of Science—Exclusive Rights and Experimental Use. In: *University of Chicago Law Review* 56, 1017-1086.
- Eisenstadt, Samuel, 1980: Cultural orientations, institutional entrepreneurs and social change: Comparative analyses of traditional civilizations. In: *American Journal of Sociology* 85, 840-869.
- Ekins, Sean (ed.) 2006: *Computer Applications in Pharmaceutical Research and Development*. Hoboken: John Wiley & Sons.

- Ensthaler, Jürgen/Kai Strübbe, 2006: *Patentbewertung*. Berlin/Heidelberg: Springer.
- Epstein, Larry G., 1999: A Definition of Uncertainty Aversion. In: *Review of Economic Studies* 66, 579-608.
- Etzkowitz, Henry, 1998: The norms of entrepreneurial science: cognitive effects of the new university–industry linkages. In: *Research Policy* 27, 823–833.
- Etzkowitz, Henry, 2000: Academia, Interrupted: Normative Change in Science. In: *Scipolicy, The Journal of Science and Health Policy* 1, 1-22.
- European Commission, 2004: *Guidelines on the application of Article 81 of the EC Treaty to technology transfer agreements*, European Commission: Official Journal C 101. Vol. Commission notice, 27 April 2004
- European Patent Office, 2011. <<http://www.epo.org/learning-events.html>; 09/20/2011>.
- eWeek.com, 2004: *Commerce One Patents Auctioned Off; In a controversial auction, 39 Web services patents developed by Commerce One went to mysterious high bidder JGR Acquisition for \$15.5 million*, 12/08/2004.
- Flick, Uwe, 2002: *Qualitative Sozialforschung*. Reinbek: Rowohlt Taschenbuch
- Fligstein, Neil, 1996: Markets as Politics: A Political-Cultural Approach to Market Institutions. In: *American Sociological Review* 61, 656-673.
- Fligstein, Neil, 1997: Social skill and institutional theory. In: *American Behavioral Scientist* 40, 397-405.
- Fligstein, Neil, 2001a: *The Architecture of Markets: an economic sociology of twenty-first-century capitalist societies*. Princeton/Oxford: Princeton University Press.
- Fligstein, Neil, 2001b: Social skills and the theory of fields. In: *Sociological Theory* 19, 105-125.
- Fligstein, Neil/Luke Dauter, 2007: The Sociology of Markets. In: *Annual Review of Sociology* 33, 105-128.
- Foray, Dominique, 2004: *Economics of Knowledge*. Cambridge, Mass.: MIT Press.
- Ford, James L., 1990: Introduction. In: James L. Ford (ed.) *Time, Expectations and Uncertainty in Economics: Selected Essays by G. L. S. Shackle*. Aldershot: Edward Elgar, ix-xvii.
- Fosfuri, Andrea, 2006: The Licensing Dilemma: Understanding the determinants of the rate of technology licensing. In: *Strategic Management Journal* 27, 1141-1158.
- FreePatentAuction, 2009. <[www.freepatentauction.com](http://www.freepatentauction.com); 04/02/2009>.
- Friedman, Joseph/Jonathan Silberman, 2003: University Technology Transfer: Do Incentives, Management, and Location Matter? In: *Journal of Technology Transfer* 28, 17-30.

- Gallini, Nancy T., 2002: The Economics of Patents: Lessons from Recent U.S. Patent Reform. In: *Journal of Economic Perspectives* 16, 131-154.
- Galunic, Charles D./Simon Rodan, 21998: Resource recombinations in the firm: Knowledge structures and the potential for Schumpeterian innovation. In: *Strategic Management Journal* 19, 1193-1201.
- Gambardella, Alfonso, 1995: *Science and innovation: the US pharmaceutical industry during the 1980s*. Cambridge: Cambridge University Press.
- Gambardella, Alfonso/Marco S. Giarratana, 2009: *General Technologies, Product Market Fragmentation, and Markets for Technology: Evidence from the Software Security Industry*, Paper: Bocconi University.
- Gambardella, Alfonso/Paola Giuri/Allessandra Luzzi, 2006: *The Market for Patents in Europe*, LEM Working Paper Series. Vol. 2006/04. Pisa: San't Anna School of Advanced Studies.
- Gambardella, Alfonso/Paola Giuri/Allessandra Luzzi, 2007: The Market for Patents in Europe. In: *Research Policy* 36, 1163-1183.
- Gambardella, Alfonso/Paola Giuri/Myriam Mariani, 2005: *The Value of European Patents. Evidence From a Survey of European Inventors. Final Report of the PatVal EU Project*. Pisa: Laboratory of Economics and Management (LEM), San't Anna School of Advanced Studies.
- Gambardella, Alfonso/Dietmar Harhoff/Bart Verspagen, 2006: *The Value of Patents*. NN.  
<[http://www.ffii.se/erik/EPIP2006/Alfonso%20Gambardella\\_Value%20of%20Patents.pdf](http://www.ffii.se/erik/EPIP2006/Alfonso%20Gambardella_Value%20of%20Patents.pdf); 02/10/2010>.
- Gans, Joshua S./David H. Hsu/Scott Stern, 2008: The impact of uncertain intellectual property rights on the market for ideas: Evidence from patent grant delays. In: *Management Science* 54, 982-997.
- Gans, Joshua S./Scott Stern, 2008: *Is there a market for ideas?: Working Paper*. <<http://ssrn.com/abstract=1334882>; 12/14/2009>
- Ganssmann, Heiner, 2007: Doppelte Kontingenz und wirtschaftliches Handeln. In: Jens Beckert/Rainer Diaz-Bone/Heiner Ganssmann (eds.), *Märkte als soziale Strukturen*. Frankfurt a. M.: Campus, 63-78.
- Garcia-Parpet, Marie-France, 2007: The Social Construction of a Perfect Market: The Strawberry Auction at Fontaines-en-Sologne. In: Donald MacKenzie/Fabian Muniesa/Lucia Siu (eds.), *Do Economists Make Markets? On the Performativity of Economics*. Princeton: Princeton University Press, 20-53.
- Garud, Raghuram/Cynthia Hardy/Steve Maguire, 2007: Institutional Entrepreneurship as Embedded Agency: An Introduction to the Special Issue. In: *Organization Studies* 28, 957-969.

- Garud, Raghu/Sanjay Jain/Arun Kumaraswamy, 2002: Institutional Entrepreneurship in the Sponsorship of Common Technological Standards: The Case of Sun Microsystems and Java. In: *The Academy of Management Journal* 45, 196-214.
- Gassmann, Oliver/Gerrit Reepmeyer, 2005: Organizing Pharmaceutical Innovation: From Science-based Knowledge Creators to Drug-oriented Knowledge Brokers. In: *Organizing Pharmaceutical Innovation* 14, 233-245.
- Gassmann, Oliver/Gerrit Reepmeyer/Maximilian von Zedtwitz, 2008: *Leading Pharmaceutical Innovation: Trends and Drivers for Growth in the Pharmaceutical Industry*. Berlin [u.a.]: Springer
- George, Edmund D./Suzanne S. Fabrid, 2008: Strategic Biopharmaceutical Portfolio Development: An Analysis of Constraint-Induced Implications. In: *Biotechnol. Prog.* 24, 698-713.
- Getz, Kenneth A., 1997: The Expanding Outside Clinical Services Contractor Marketplace. In: *Clinical Research and Regulatory Affairs* 14, 191-204.
- Gilbert, Jim/Preston Henske/Ashish Singh, 2003: Rebuilding big pharma's business model. In: *In Vivo* 21, 1-10.
- Gläser, Jochen/Grit Laudel, 2006: *Experteninterviews und qualitative Inhaltsanalyse*. Wiesbaden: VS Verlag für Sozialwissenschaften.
- Goffin, John, 2009: Introduction to Clinical Trials. In: Shayne Cox Gad (ed.) *Clinical Trials Handbook*. New York: Wiley, 1-22.
- Goffman, Erving, 1969: *Strategic Interaction*. Pennsylvania Press: Philadelphia.
- Goffman, Erving, 1986: *Frame Analysis: An Essay on the Organization of Experience*. Lebanon: Northeastern University Press.
- Gold, Raymond, 1958: Roles in Sociological Field Observation. In: *Social Forces* 36, 217-223.
- Gonzales, Raul, 2005: *From the Lab to the Market: The Commercialisation Strategy of Patented Inventions*, Job Market Paper: Universitat Pompeu Fabra.
- Götting, Horst-Peter, 2007: *Gewerblicher Rechtsschutz*. 8. Auflage. München: Beck.
- Grabowski, Henry G./John Vernon/Joseph A. DiMasi, 2002: Returns on research and development for 1990s new drug introductions. In: *Pharmacoeconomics* 20, 11-29.
- Granovetter, Mark, 1985: Economic Action and Social Structure: The Problem of Embeddedness. In: *American Journal of Sociology* 91, 481-510.
- Granovetter, Mark S., 1973: The Strength of Weak Ties. In: *American Journal of Sociology* 78, 1360-1378.

- Granstrand, Ove, 2000: *The Economics and Management of Intellectual Property. Towards Intellectual Capitalism*. Cheltenham: Edward Elgar.
- Greenwood, Royston/Roy Suddaby/C.R. Hinings, 2002: Theorizing Change: The Role of Professional Associations in the Transformation of Institutional Fields. In: *Academy of Management Journal* 45, 58-80.
- Griliches, Zvi/George C. Eads/Edwin Mansfield, 1984: R&D and Innovation: Some Empirical Findings. In: Zvi Griliches (ed.) *R&D, Patents and Productivity*. Chicago: University of Chicago Press, 127-154.
- Grindley, Peter C./David J. Teece, 1997: Managing Intellectual Capital: Licensing and cross-licensing in semiconductors and electronics. In: *California Management Review* 39, 8-41.
- Groß, Michael, 2007: *Der Lizenzvertrag*. 9. Auflage. Frankfurt a.M.: Verlag Recht und Wirtschaft GmbH.
- Grubb, Philip W., 2004: *Patents for Chemicals, Pharmaceuticals and Biotechnology: Fundamentals of Global Law, Practice and Strategy*. New York: Oxford University Press.
- Grubb, Philip W., 2009: Protecting the assets: Patenting and intellectual property. In: H. P. Rang (ed.) *Drug Discovery and Development: Technology in Transition*. Edinburgh [et al.]: Elsevier Churchill Livingstone, 273-280.
- Gschwend, Thomas/Frank Schimmelpfennig, 2007: Forschungsdesign in der Politikwissenschaft: Ein Dialog zwischen Theorie und Daten. In: Thomas Gschwend/Frank Schimmelpfennig (eds.), *Forschungsdesign in der Politikwissenschaft: Probleme, Strategien, Anwendungen*. Frankfurt a. M. [u.a.]: Campus Verlag, 13-35.
- Gu, Feng/Baruch Lev, 2004: The Information Content of Royalty Income. In: *Accounting Horizons* 18, 1-12.
- Guellec, Dominique/Bruno van Pottelsberghe/Nicolas van Zeebroeck, 2007: Patent as a Market Instrument. In: Dominique Guellec/Bruno van Pottelsberghe (eds.), *The Economics of the European Patent System. IP Policy for Innovation and Competition*. Oxford: Oxford University Press, 85-113.
- Hagedoorn, John, 1993: Understanding the rationale of strategic technology partnering: Interorganizational modes of cooperation and sectoral differences. In: *Strategic Management Journal* 14, 371-385.
- Hägglöf, Inger/Asa Holmgren, 2009: Regulatory Affairs. In: H. P. Rang (ed.) *Drug Discovery and Development: Technology in Transition*. Edinburgh [et al.]: Elsevier Churchill Livingstone, 281-298.

- Hall, Bronwyn H./Albert N. Link/John Scott, 2000: Barriers inhibiting industry from partnering with universities: evidence from the advanced technology program. In: *Journal of Technology Transfer* 26, 87-98.
- Hall, Bronwyn H./Rosemarie Ham Ziedonis, 2001: The Patent Paradox Revisited: An Empirical Study of Patenting in the U.S. Semiconductor Industry, 1979-1995. In: *RAND Journal of Economics* 32, 101-128.
- Hall, Peter A./David Soskice, 2001: An Introduction to Varieties of Capitalism. In: Peter A. Hall/David Soskice (eds.), *Varieties of Capitalism. The Institutional Foundations of Comparative Advantage*. Oxford: Oxford University Press, 1-68.
- Hanel, Petr, 2006: Intellectual property rights business management practices: A survey of the literature. In: *Technovation* 26, 895-931.
- Hanneman, Robert/Mark Riddle, 2005: *Introduction to social network methods*. Riverside: University of California. <[http://faculty.ucr.edu/~hanneman/nettext/C17\\_Two\\_mode.html](http://faculty.ucr.edu/~hanneman/nettext/C17_Two_mode.html); 08/01/2010>
- Hargadon, Andrew/Robert I. Sutton, 1997: Technology Brokering and Innovation in a Product Development Firm. In: *Administrative Science Quarterly* 42, 716-749.
- Harhoff, Dietmar, 2006: *Intellectual property rights in Europe - where do we stand and where should we go?*, Contribution to the project "Globalisation Challenges for Europe and Finland" organised by the Secretariat of the Economic Council.
- Harhoff, Dietmar/Markus Reitzig, 2004: Determinants of opposition against EPO patent grants—the case of biotechnology and pharmaceuticals In: *International Journal of Industrial Organization* 22, 443-480.
- Harhoff, Dietmar/Frederic M. Scherer/Katrin Vopel, 2003: Citations, family size, opposition and the value of patent rights. In: *Research Policy* 32, 1343-1363.
- Hart, Oliver/John Moore, 1999: Foundations of Incomplete Contracts. In: *Review of Economic Studies* 66, 115-138.
- Hassoun, Jean-Pierre 2005: Emotions on the trading floor: Social and symbolic expressions. In: Karin Knorr Cetina/Alex Preda (eds.), *The sociology of financial markets*. Oxford: Oxford University Press, 102-120.
- Hayek, Friedrich August von, 1980: *Individualism and economic order*. Chicago u.a.: University of Chicago Press.
- Heller, Michael A./Rebecca S. Eisenberg, 1998: Can Patents Deter Innovation? The Anticommons in Biomedical Research. In: *Science* 280, 698-701.
- Herrling, Paul, 2009: Organization and management of a large drug discovery department. In: H. P. Rang (ed.) *Drug Discovery and Development: Technology in Transition*. Edinburgh [et al.]: Elsevier Churchill Livingstone, 199-217.

- Herrmann, Andrea M., 2008: *One Political Economy, One Competitive Strategy?* Oxford: Oxford University Press.
- Hilty, Reto M., 2006: *Märkte und Schutzrechte*. München.
- Hoffmann, Markus/Peter Adler, 2002: *Lizenzvertragsgestaltung: Inhalte, Strategien, Muster*. Neuwied: Luchterland.
- Horwitz, Morton J., 1973: The Transformation in the Conception of Property in American Law, 1780-1860. In: *The University of Chicago Law Review* 40, 248-290.
- Howells, Jeremy, 1996: Tacit Knowledge, Innovation and Technology Transfer. In: *Technology Analysis & Strategic Management* 8, 91-106.
- Howells, Jeremy, 2006: Intermediation and the role of intermediaries in innovation. In: *Research Policy* 35, 715-728.
- Huebner, Stefan Rolf, 2005: Patent due diligence in emerging technology businesses: how it's done - what it achieves. In: *The Journal of private equity* 8, 1-4.
- Hughes, Bethan, 2009: 2008 FDA drug approvals. In: *Nature Reviews Drug Discovery* 8, 93-96.
- ICAP Ocean Tomo, 2010a: *ICAP Ocean Tomo Auction Sees Record Bidding*. <[www.icapoceantomo.com](http://www.icapoceantomo.com); 03/26/2010>.
- ICAP Ocean Tomo, 2010b: *ICAP Ocean Tomo Now Accepting Patent Submissions for Spring 2011 Live IP Auction March 30-30st in New York City*. <[www.icapoceantomo.com](http://www.icapoceantomo.com); 12/15/2010>.
- ICAP Ocean Tomo, 2010c: *ICAP Ocean Tomo Pharma Small Molecule Live Auction*. <[www.icapoceantomo.com/pharma](http://www.icapoceantomo.com/pharma); 01/07/2011>.
- IP-Auction GmbH, 2009. <[www.ip-auctions.eu](http://www.ip-auctions.eu); 04/02/2009>.
- IPAuctions, 2009. <[www.ipauctions.com](http://www.ipauctions.com); 04/02/2009>.
- Jacob, William F./Young Hoon Kwak, 2003: In search of innovative techniques to evaluate pharmaceutical R&D projects. In: *Technovation* 23, 291-296.
- Jaffe, Adam B., 2000: The US patent system in transition: policy innovation and the innovation process. In: *Research Policy* 29, 531-557.
- Jaffe, Adam B./Josh Lerner, 2004: *Innovation and Its Discontents: how our broken patent system is endangering innovation and progress, and what to do about it* Princeton: Princeton University Press.
- James, William, 2007 [1907]: *Pragmatism: A New Name for Some Old Ways of Thinking, Popular Lectures on Philosophy*. Minneapolis: Filiquarian Pub.
- Japan Patent Office, 2004: *Results of the Survey on Intellectual Property-Related Activities: Status of Intellectual Property Activities in Japan. Part 3*. Tokyo: JPO.



- Jarosz, John, et al., 2010: Patent Auctions: How far have we come? In: *Les Nouvelles* March 2010, 11-30.
- Jarrett, E. L., 2000: The role of risk in business decision-making or how to stop worrying and love bombs. In: *Research-Technology Management* 43, 44-46.
- Jauch, Lawrence R./Kenneth L. Kraft, 1986: Strategic Management of Uncertainty. In: *The Academy of Management Review* 11, 777-790.
- Jensen, Michael C./William H. Meckling, 1976: Theory of the Firm: Managerial Behaviour, Agency Cost and Ownership Structure. In: Jay M. Shafritz/J. Steven Ott/Yong Suk Jang (eds.), *Classics of Organization Theory*. Belmont: Wadsworth, 267-274.
- Jensen, Richard/Jerry G. Thursby/Marie C. Thursby, 2003: The Disclosure and Licensing of University Inventions: "The best we can do with the s\*\*t we get to work with". In: *International Journal of Industrial Organization* 21, 1271-1300.
- Jensen, Richard/Marie C. Thursby, 2001: Proofs and Prototypes for Sale: The Licensing of University Inventions. In: *The American Economic Review* 91, 240-259.
- Jessop, Bob, 2007: Knowledge as a Fictitious Commodity: Insights and Limits of a Polanyian Perspective. In: Ayse Bugra/Kaan Agartan (eds.), *Reading Karl Polanyi for the Twenty-First Century. Market Economy as a Political Project*. New York: Palgrave Macmillan, 115-133.
- JPO, 2009: *Request for the recording of a change in ownership*. <[http://www.jpo.go.jp/torikumi/kaisei/kaisei2/pdf/wipo\\_yousik\\_mm5.pdf](http://www.jpo.go.jp/torikumi/kaisei/kaisei2/pdf/wipo_yousik_mm5.pdf); 12/16/2009>.
- Kagel, John H./Dan Levin, 2002: *Common value auctions and the winner's curse* Princeton: Princeton University Press.
- Kamiyama, Shigeki/Jerry Sheehan/Catalina Martinez, 2006: *Valuation and Exploitation of Intellectual Property*, STI WORKING PAPER 2006/5. Paris: OECD.
- Karpik, Lucien, 2010: *Valuing the Unique: The Economics of Singularities*. Princeton: Princeton University Press.
- Keynes, John Maynard, 1936: *The General Theory of Employment, Interest and Money*. London: Macmillan.
- Keynes, John Maynard, 1973 [1921]: *A Treatise on Probability*. New York/Cambridge: The Royal Economic Society
- Khan, B. Zorina, 2002: *Intellectual Property and Economic Development: Lessons from American and European History*. Study Paper 1a. Brunswick/Maine: Report to the IPR Commission.

- Khan, B. Zorina/Kenneth L. Sokoloff, 2001: History Lessons. The Early Development of Intellectual Property Institutions in the United States. In: *Journal of Economic Perspectives* 15, 233-246.
- Kitch, Edmund W., 1980: The Law and Economics of Rights in Valuable Information. In: *The Journal of Legal Studies* 9, 683-723.
- Kjellberg, Hans/Claes-Fredrik Helgesson, 2006: Multiple versions of markets: Multiplicity and performativity in market practice In: *Industrial Marketing Management* 35, 839-855.
- Kline, David, 2003: Sharing the Corporate Crown Jewels. In: *MIT Sloan management review of Economic Studies* 44, 89-93.
- Knight, Frank H., 2002 [1921]: *Risk, uncertainty and profit*. Washington, DC: Beard Books.
- Kogut, Bruce, 1989: The stability of joint ventures. In: *Journal of Industrial Economics* 38, 1-16.
- Kopits, George F., 1976: Intra-firm Royalties Crossing Frontiers and Transfer-Pricing Behaviour. In: *Economic Journal* 86, 791-805.
- Kotler, Philip, 1986: Megamarketing. In: *Havard Business Review* 64, 117-125.
- Krishna, Vijay, 2002: *Auction Theory*. San Diego/London: Academic Press.
- Kumar, Nirmalya/Lisa Scheer/Philip Kotler, 2000: From Market Driven to Market Driving. In: *European Management Journal* 18, 129-142.
- Lab Business Week, 2009: *OCEAN TOMO, LLC; Ocean Tomo Predicts New Direction in IP Transactions* (03/22/2009).
- Lach, Saul/Mark Schankerman, 2004: Royalty Sharing and Technology Licensing in Universities. In: *Journal of European Economic Association* 2-3, 252-264.
- Lamoreaux, Naomi R./Kenneth L. Sokoloff, 1999: *Inventive Activity and the Market for Technology in the United States, 1840-1920*: NBER Working Paper 7107.
- Lamoreaux, Naomi R./Kenneth L. Sokoloff, 2001: Market Trade in Patents and the Rise of a Class of Specialized Inventors in the 19th-Century United States. In: *The American Economic Review* 91, 39-44.
- Lamoreaux, Naomi R./Kenneth L. Sokoloff, 2007: The Market for Technology and the Organization of Invention in U.S. History. In: Eytan Sheshinski/Robert J. Strom/William J. Baumol (eds.), *Entrepreneurship, Innovation, and the Growth Mechanism of the Free-Enterprise Economies*. Princeton/Oxford: Princeton University Press, 213-243.
- Lampel, Joseph/Alan D. Meyer, 2008: Field-configuring Events as Structuring Mechanisms: How conferences, Ceremonies, and Trade Shows Constitute New Tech-

- nologies, Industries, and Markets. In: *Journal of Management Studies* 45, 1025-1035.
- Lanjouw, Jean O., 1992: *Under Threat: Potential Competition, Litigation and the Private Value of Patent Protection*. Vol. EI/6. London: Suntory and Toyota International Centres for Economics and Related Disciplines.
- Lanjouw, Jean O./Mark Schankerman, 1998: *Stylized Facts of Patent Litigation: Value, Scope and Ownership*. Vol. EI/20. London: Suntory and Toyota International Centres for Economics and Related Disciplines.
- Lanjouw, Jean O./Mark Schankerman, 2001: Characteristics of Patent Litigation: A Window on Competition. In: *RAND Journal of Economics* 32, 129-151.
- Lawrence, Thomas/Nelson Phillips, 2004: From Moby Dick to Free Willy: Macro-Cultural Discourse and Institutional Entrepreneurship in Emerging Institutional Fields. In: *Organization* 11, 689-711.
- Lawson, Tony, 1985: Uncertainty and Economic Analysis. In: *The Economic Journal* 95, 909-927.
- Lednicer, Daniel (ed.) 1993: *Chronicles of drug discovery*. Washington, DC: American Chemical Society.
- Lemley, Mark A., 2005: Property, Intellectual Property, and Free Riding. In: *Texas Law Review* 83, 1031.
- Lemley, Mark A./Nathan Myhrvold, 2008: *How to make a patent market*: Stanford Law and Economics Olin Working Paper 347.
- Lemley, Mark A./Carl Shapiro, 2005: Probabilistic Patents. In: *Journal of Economic Perspectives* 19, 75-98.
- Lente, Harro van, et al., 2003: Roles of Systemic Intermediaries in Transition Processes. In: *International Journal of Innovation Management* 7, 247-279.
- Lépinay, Vincent-Antonin, 2007: Decoding Finance: Articulation and Liquidity around a Trading Room. In: Donald MacKenzie/Fabian Muniesa/Lucia Siu (eds.), *Do Economists Make Markets? On the Performativity of Economics*. Princeton: Princeton University Press, 87-127.
- Lerner, Josh, 1995: Patenting in the Shadow of Competitors. In: *Journal of Law and Economics* 38, 463-496.
- Lerner, Joshua, 1994: The Importance of Patent Scope: An Empirical Analysis. In: *The Rand Journal of Economics* 25, 319-333.
- Levin, R. C., et al., 1987: *Appropriating the returns from industrial research and development*: Brookings Papers on Economic Activity, 783-831.

- LeVine, Harry/H. P. Rang, 2009: The role of genomics and bioinformatics. In: H. P. Rang (ed.) *Drug Discovery and Development: Technology in Transition*. Edinburgh [et al.]: Elsevier Churchill Livingstone, 77-98.
- Lichtenthaler, Ulrich, 2005: External commercialization of knowledge: Review and research agenda. In: *International Journal of Management Reviews* 7, 231-255.
- Lichtenthaler, Ulrich/Holger Ernst, 2008: Innovation Intermediaries: Why Internet Marketplaces for Technology Have Not Yet Met the Expectations. In: *Creativity and Innovation Management* 17, 14-25.
- Lichtenthaler, Ulrich/Holger Ernst, 2009: Technology licensing strategies: the interaction of process and content characteristics. In: *Strategic Organization* 7, 183-221.
- Lieberman, Marvin B., 1984: The Learning Curve and Pricing in the Chemical Processing Industries. In: *The Rand Journal of Economics* 15, 213-228.
- Lieberman, Marvin B., 1987: The learning curve, diffusion and competitive strategy. In: *Strategic Management Journal* 8, 441-452.
- Lieberman, Marvin B./David B. Montgomery, 1998: First-Mover (Dis)Advantages: Retrospective and Link with the Resource-Based View. In: *Strategic Management Journal* 19, 1111-1125.
- Link, Albert N./Donald S. Siegel, 2005: Generating Science-based Growth: An Econometric Analysis of the Impact of Organizational Incentives on University-Industry Technology Transfer. In: *European Journal of Finance* 11, 169-182.
- Link, Albert N./Donald S. Siegel/Barry Bozeman, 2007: An empirical analysis of the propensity to engage in informal university technology transfer. In: *Industrial and Corporate Change* 16, 641-655.
- Lipfert, Stephan/Boris Bend, 2009: Europa: Innovationsfinanzierung bleibt eine Herausforderung. In: *IP-Manager* 1/2009, 26-27.
- Loasby, Brian J. , 2007: Uncertainty, intelligence and imagination: George Shackle's guide to human progress. In: Geoffrey M. Hodgson (ed.) *The Evolution of Economic Institutions* Cheltenham: Edward Elgar, 183-197.
- Lockett, Andy/Donald S. Siegel/Michael D. Ensley, 2005: The Creation of Spin-off Firms at Public Research Institutions: Managerial and Policy Implications. In: *Research Policy* 34, 981-993.
- Lockett, Andy/Mike Wright/Stephen Franklin, 2003: Technology Transfer and Universities' Spin-Out Strategies. In: *Small Business Economics* 20, 185-200.
- Lopez, Henry/Wim Vanhaverbeke, 2009: *How innovation intermediaries are shaping the technology market? An analysis of their business model*, MPRA Paper No. 20458. Munich: Munich Personal RePEc Archive.

- Louis, Karen S. , et al., 1989: Entrepreneurs in Academe: An Exploration of Behaviours among Life Scientists. In: *Administrative Science Quarterly* 34, 110-131.
- Lounsbury, Michael/Mary A. Glynn, 2001: Cultural entrepreneurship: Stories, legitimacy and the acquisition of resources. In: *Strategic Management Journal* 22, 545-564.
- Luhmann, Niklas, 1984: *Soziale Systeme: Grundriß einer allgemeinen Theorie*. Frankfurt a. M.: Suhrkamp.
- Luhmann, Niklas, 1988: Familiarity, Confidence, Trust: Problems and Alternatives In: Diego Gambetta (ed.) *Trust. Making and Breaking Cooperative Relations*. New York: Blackwell, 94-107.
- Luhmann, Niklas, 1997: Disziplinierung durch Kontingenz: zu einer Theorie des politischen Entscheidens. In: Stefan Hradil (ed.) *Differenz und Integration* Frankfurt a. M. [u.a.]: Kongreß der Deutschen Gesellschaft für Soziologie 1075-1088.
- Luhmann, Niklas, 2000 [1968]: *Vertrauen*. 4. Auflage. Stuttgart: Lucius & Lucius.
- Macaulay, Stewart, 1963: Non-Contractual Relations in Business: A Preliminary Study. In: *American Sociological Review* 28, 55-67.
- Machlup, Fritz, 1984: *The Economics of Information and Human Capital* Princeton, NJ: Princeton University Press.
- Macho-Stadler, Ines/Xavier Martinez-Giralt/David J. Pérez-Castrillo, 1996: The role of information in licensing contract design. In: *Research Policy* 25, 43-57.
- Macho-Stadler, Ines/David Pérez-Castrillo, 1991: Contrats de licences et asymétrie d'information In: *Annales d'économie et de statistiques* 24, 189-208.
- Macho-Stadler, Ines/David Pérez-Castrillo/Reinhilde Veugelers, 2005: *Licensing of University Inventions: The Role of a Technology Transfer Office*, Working Paper Bilbao/Madrid: Fundacion BBVA.
- MacKenzie, Donald, 2006: *An Engine, Not a Camera: How Financial Models Shape Markets*. London/Cambridge: MIT Press.
- MacKenzie, Donald, 2007: Is economics performative? Option theory and the construction of derivatives markets. In: Donald MacKenzie/Fabian Muniesa/Lucia Siu (eds.), *Do economists make markets?* Princeton: Princeton University Press, 54-86.
- MacKenzie, Donald/Fabian Muniesa/Lucia Siu, 2007: Introduction. In: Donald MacKenzie/Fabian Muniesa/Lucia Siu (eds.), *Do Economists Make Markets?* Princeton: Princeton University Press, 1-19.
- MacNeil, Ian R. , 1980: *The new social contract*. New Haven/London: Yale University.

- Maguire, Steve/Cynthia Hardy/Steve Lawrence, 2004: Institutional entrepreneurship in emerging fields: HIV/AIDS treatment advocacy in Canada. In: *Academy of Management Journal* 47, 657-679.
- Malackowski, James E., 2006: The Intellectual Property Marketplace: Past, Present and Future. In: *the John Marshall Review of Intellectual Property Law* 5, 605-616.
- Malackowski, James E./Frederic D. Floberg, 2006: This too shall pass. In: *Americas IP Focus* 2006. <[www.managingip.com](http://www.managingip.com); 07/23/2010>
- Mann, Chris /Fiona Stewart, 2000: *Internet communication and qualitative research: a handbook for researching*. London: Sage Pub.
- Mannheim, Karl, 1985 [1929]: *Ideologie und Utopie*. Frankfurt a. M.: Vittorio Klostermann.
- Mansfield, Edwin, 1985: How Rapidly Does New Industrial Technology Leak Out? In: *The Journal of Industrial Economics* 34, 217-223.
- Mansfield, Edwin, 1986: Patents and Innovation: An Empirical Study. In: *Management Science* 32, 173-181.
- Mansfield, Edwin/Mark Schwartz/Samuel Wagner, 1981: Imitation Costs and Patents: An Empirical Study. In: *The Economic Journal* 91, 907-918.
- March, James G., 1981: Footnotes to Organizational Change. In: *Administrative Science Quarterly* 26, 563-577.
- March, James G./Martha S. Feldman, 1981: Information in Organizations as Signal and Symbol. In: *Administrative Science Quarterly* 26, 171-186.
- Markman, Gideon D. /Donald S. Siegel/Mike Wright, 2008: Research and Technology Commercialization. In: *Journal of Management Studies* 45, 1401-1423.
- Marshall, Alfred, [1920] 1961: *Principles of Economics*. London: Macmillan and Co.
- Maskin, Eric/Jean Tirole, 1999: Unforeseen Contingencies and Incomplete Contracts. In: *The Review of Economic Studies* 66, 83-114.
- Mason, Richard/Nicos Savva/Stefan Scholtes, 2008: The economics of licensing contracts. In: *Nature Biotechnology* 26, 855-857.
- Mayring, Philipp, 2007: *Qualitative Inhaltsanalyse. Grundlagen und Techniken*. Stuttgart: UTB.
- McCalman, Phillip, 2001: Reaping what you sow: an empirical analysis of international patent harmonization. In: *Journal of International Economics* 55, 161-186.
- McClure, Ian, 2008-2009: Commoditizing Intellectual Property Rights: The Practicability of a Commercialized and Transparent International IPR Market and the

- Need for International Standards. In: *Buffalo Intellectual Property Law* 6, 13-33.
- McClure, Ian/James E. Malackowski, 2011: The Next Big Thing in Monetizing IP: A Natural Progression to Exchange-Traded Units. In: *Landslide* 3, NN.
- McMullen, Jeffery/Dean A. Shepherd, 2006: Entrepreneurial Action and the Role of Uncertainty in the Theory of the Entrepreneur. In: *Academy of Management Review* 31, 132-152.
- Medical Device Daily, 2010: *Patent watch: ICAP offers to sell condensed three perfusion circuit patents*, 06/15/2010.
- Meijer, Ineke S. M./Marko P. Hekkert/Joop F. M. Koppenjan, 2007: How perceived uncertainties influence transitions: the case of micro-CHP in the Netherlands. In: *Technological Forecasting & Social Change* 74, 519-537.
- Merges, Robert, 1999: *Intellectual property rights, transactions and the value of intangible assets*. Draft. Berkeley: University of Berkeley. <<https://www.law.berkeley.edu/institutes/bclt/pubs/merges/iprights.pdf>; 12/12/2009>
- Merges, Robert/Richard Nelson, 1990: On the Complex Economics of Patent Scope. In: *Columbia Law Review* 839-876.
- Mersch, Christian, 2005: Die Welt der Patente. Eine soziologische Analyse des Weltpatentensystems. In: *Zeitschrift für Soziologie, Sonderheft "Weltgesellschaft"*, 239-259.
- Meurer, Michael J., 1989: The Settlement of Patent Litigation. In: *The Rand Journal of Economics* 20, 77-91.
- Meyer, Ann, 2009: Selling intellectual property; Firms cash in on patents, trademarks they're not using. In: *Chicago Tribune*, 02/02/2009.
- Millien, Raymond/Ron Laurie, 2008: Meet the middlemen. In: *Intellectual Asset Management* February/March 2008, 53-58.
- Milliken, Frances, 1987: Three Types of Perceived Uncertainty About the Environment: State, Effect, and Response Uncertainty. In: *Academy of Management Review* 12, 133-143.
- Mirowski, Philip/Edward Nik-Khan, 2007: Markets Made Flesh: Performativity, and a Problem of Science Studies, Augmented with Consideration of the FCC Auctions. In: Donald MacKenzie/Fabian Muniesa/Lucia Siu (eds.), *Do Economists Make Markets? On the Performativity of Economics*. Princeton: Princeton University Press, 190-224.
- Mokyr, Joel, 2002: *The Gifts of Athena. Historical Origins of the Knowledge Economy*. Princeton: Princeton University Press.

- Möllering, Guido, 2005: *Understanding Trust from the Perspective of Sociological Neoinstitutionalism: The Interplay of Institutions and Agency*, MPIfG Discussion Paper 05/13. Cologne: Max Planck Institute for the Study of Societies.
- Möllering, Guido, 2006: *Trust: Reason, Routine, Reflexivity*. Oxford: Elsevier.
- Möllering, Guido, 2008: *Inviting or Avoiding Deception through Trust? Conceptual Exploration of an Ambivalent Relationship*, MPIfG Working Paper 08/1. Cologne: Max Planck Institute for the Study of Societies
- Möllering, Guido, 2009: *Market Constitution Analysis*, MPIfG Working Paper 09/07. Köln: MPIfG.
- Möllering, Guido, 2010: *Collective Market-making Efforts at an Engineering Conference*, MPIfG Discussion Paper 10/2. Cologne: Max Planck Institute for the Study of Societies.
- Monk, Ashby H. B., 2009: The emerging market for intellectual property: drivers, restraints, and implications. In: *Journal of Economic Geography* 9, 469–491.
- Motohashi, Kazuyuki, 2004: Understanding Business Patenting and Licensing: Results of a Survey. In: OECD (ed.) *Patents, Innovation and Economic Performance: OECD Conference Proceedings*. Paris, 53-82.
- Motohashi, Kazuyuki, 2005: *Understanding Technology Market: Quantitative Analysis of Licensing Activities in Japan*. Presentation at EPO-OECD-BMWA International Conference on Intellectual Property as an Economic Asset : Key Issues in Valuation and Exploitation, 30 June to 1 July 2005. Berlin. <[www.oecd.org/sti/ipr;12/12/2009](http://www.oecd.org/sti/ipr;12/12/2009)>.
- Motohashi, Kazuyuki, 2006: *Licensing or Not Licensing?: Empirical Analysis on Strategic Use of Patent in Japanese Firms*, RIETI Discussion Paper Series, 06-E-021. Tokyo.
- Mowery, David C., et al., 2001: The Growth of Patenting and Licensing by U.S. Universities: An Assessment of the Effects of the Bayh-Dole Act of 1980. In: *Research Policy* 30, 99-119.
- Mowery, David C./Arvids A. Ziedonis, 2002: Academic patent quality and quantity before and after the Bayh-Dole Act in the United States. In: *Research Policy* 31, 399-418.
- Mowery, David, et al., 2004: *Ivory Tower and Industrial Innovation*. Stanford: Stanford University Press.
- Mowery, David/Arvids A. Ziedonis, 2001: Numbers, Quality, and Entry: How Has the Bayh-Dole Act Affected US University Patenting and Licensing? In: Adam B. Jaffe/Josh Lerner/Scott Stern (eds.), *Innovation Policy and the Economy 1*. Cambridge, MA: The MIT Press, 187-220.



- Muniesa, Fabian/Yuval Millo/Michel Callon, 2007: An Introduction to Market Devices. In: Fabian Muniesa/Yuval Millo/Michel Callon (eds.), *Market Devices*. New York: Blackwell Publishing, 1-12.
- Münnich, Sascha, 2010: *Interessen und Ideen: Die Entstehung der Arbeitslosenversicherung in Deutschland und den USA*. Frankfurt a. M.: Campus Verlag.
- Murray, Fiona/Siobhan O'Mahony, 2007: Exploring the Foundations of Cumulative Innovation: Implications for Organization Science. In: *Organization Science* 18, 1006-1021.
- National Cancer Institute, 2009: *Health Information National Trends Survey*. <<https://cissecure.nci.nih.gov/ncipubs/home.aspx?js=1; 12/18/2009>>.
- Nelson, Richard, 2004: The market economy, and the scientific commons. In: *Research Policy* 33, 455-471.
- Nelson, Richard R., 1989: What is Private and What is Public about Technology? In: *Science, Technology, & Human Values* 14, 229-241.
- Nelson, Richard R., 1959: The simple economics of basic scientific research. In: *Journal of Political Economy* 67, 297-306.
- Newswire, PR, 2010: *ICAP Ocean Tomo's Life Sciences Group to Hold World's First Pharma Small Molecule Live Auction March 31, 2011 in New York City*, 09/15/2010.
- Nicholson, Sean/Patricia M. Danzon/Jeffrey McCullough, 2005: Biotech-Pharmaceutical Alliances as a Signal of Asset and Firm Quality. In: *Journal of Business* 78, 1433-1464.
- Nik-Khan, Edward, 2008: A Tale of Two Auctions. In: *Journal of Institutional Economics* 4, 73-97.
- Nishimura, Junichi/Yosuke Okada, 2010: *R&D Portfolios and Pharmaceutical Licensing*, Global COE Hi-Stat Discussion Paper Series 155.
- Nonaka, I./H. Takeuchi, 1995: *The Knowledge-Creating Company: How Japanese Companies Create the Dynamics of Innovation*. New York: Oxford University Press.
- North, Douglass C., 1986: The New Institutional Economics. In: *Journal of Institutional and Theoretical Economics* 142, 230-237.
- o. V., 2000 [1959]: *Richtlinien für die Vergütung von Arbeitnehmererfindungen im privaten Dienst*: Bundesministerium für Arbeit und Sozialordnung. Vol. BAnz. Nr. 169 S. 9994.
- Ocean Tomo, 2007: *Ocean Tomo Live Intellectual Property Auction*, Presentation. Chicago: Ocean Tomo.

- OECD, 2006: *Creating Value From Intellectual Assets*: Meeting of the OECD Council at Ministerial Level.
- Otsuyama, H., 2003: Patent Valuation and Intellectual Assets Management In: M. Samejima (ed.) *Patent Strategy Handbook, Chapter 5*. Tokyo: Chuokeizaisha.
- Overington, John P./Bissan Al-Lazikani/Andrew L. Hopkins, 2006: How many drug targets are there? In: *Nature Reviews* 5, 993-996.
- Owen-Smith, Jason/Walter Powell, 2001: To patent or not: Faculty decisions and institutional success at technology transfer. In: *Journal of Technology Transfer* 26, 99-114.
- Owen-Smith, Jason/Walter W. Powell, 2003: The expanding role of university patenting in the life sciences: assessing the importance of experience and connectivity. In: *Research Policy* 32, 1695-1711.
- Pagano, Ugo/Maria Alessandra Rossi, 2004: Incomplete Contracts, Intellectual Property and Institutional Complementarities. In: *European Journal of Law and Economics* 18, 55-76.
- Pakes, Ariel, 1986: Patents as Options: Some Estimates of the Value of Holding European Patent Stocks. In: *Econometrica* 54, 755-784.
- Pandey, Mohan, 2003: Investment decisions in pharmaceutical R&D projects. In: *Drug Discovery Today* 8, 968-971.
- Parr, Chris, 2006: Due Diligence: Worth a Look? In: *Business Law Review* 10, 232-233.
- Parr, Russell/Patrick Sullivan, 1996: *Technology Licensing: Corporate Strategies for Maximizing Value*. New York: Wiley.
- Perez Pugatch, Meir, 2004a: *The International Political Economy of Intellectual Property Rights*. Cheltenham/Northampton: Edward Elgar.
- Perez Pugatch, Meir, 2004b: What is the value of your patent? Theory, myth and reality. In: *IPR Helpdesk Bulletin* 17, Oct.-Nov. 2004, 2-3.
- Pisano, Gary P., 1990: The R&D Boundaries of the Firm: An Empirical Analysis. In: *Administrative Science Quarterly. Special Issue: Technology, Organizations, and Innovation* 35, 153-176.
- Pisano, Gary P., 1991: The governance of innovation: Vertical integration and collaborative arrangements in the biotechnology industry. In: *Research Policy* 20, 237-249.
- Pisano, Gary P., 1997: *R&D performance, collaborative arrangements and the market for know-how: A test of the lemons hypothesis in biotechnology*, SSRN Working Paper Series. <<http://ssrn.com/abstract=41980>; 07/18/2011>

- Pitkethly, Robert, 2001: Intellectual property in Japanese and UK companies: patent licensing decisions and learning opportunities. In: *Research Policy* 30, 425-442.
- Plan, Philipp H./Donald S. Siegel, 2006: *The effectiveness of university technology transfer: Foundation and Trends in Entrepreneurship*. Hanover [MA]: now Publishers Inc.
- Polanyi, Karl, 1957: *The great transformation*. Beacon Hill [u.a.]: Beacon Press.
- Polanyi, Michael, 1966: *The Tacit Dimension*. Chicago: University of Chicago Press.
- Porter, Michael E., 1998: *On Competition*. Boston: Harvard Business School Publishing.
- Powell, Walter/Kenneth W. Koput/Laurel Smith-Doerr, 1996: Interorganizational Collaboration and the Locus of Innovation: Networks of Learning in Biotechnology. In: *Administrative Science Quarterly* 41, 116-145.
- Poyago-Theotoky, Joanna/John Beath/Donald S. Siegel, 2002: Universities and Fundamental Research: Reflections on the Growth of University-Industry Partnerships. In: *Oxford Review of Economic Policy* 18, 10-21.
- Ragin, Charles, 1987: *The Comparative Method* Berkeley: University of California Press.
- Rang, H. P., 2009a: Choosing the project. In: H. P. Rang (ed.) *Drug Discovery and Development: Technology in Transition*. Edinburgh [et al.]: Elsevier Churchill Livingstone, 57-62.
- Rang, H. P., 2009b: Drug development: introduction. In: H. P. Rang (ed.) *Drug Discovery and Development: Technology in Transition*. Edinburgh [et al.]: Elsevier Churchill Livingstone, 221-228.
- Rang, H. P., 2009c: Drug discovery and development - facts and figures. In: H. P. Rang (ed.) *Drug Discovery and Development: Technology in Transition*. Edinburgh [et al.]: Elsevier Churchill Livingstone, 311-327.
- Rang, H. P., 2009d: The drug discovery process: general principles and some case histories. In: H. P. Rang (ed.) *Drug Discovery and Development: Technology in Transition*. Edinburgh [et al.]: Elsevier Churchill Livingstone, 43-62.
- Rang, H. P./Harry LeVine, 2009: Therapeutic modalities. In: H. P. Rang (ed.) *Drug Discovery and Development: Technology in Transition*. Edinburgh [et al.]: Elsevier Churchill Livingstone, 33-40.
- Rask-Andersen, Mathias/Markus Sällman Almén/Helgi B. Schiöth, 2011: Trends in the exploitation of novel drug targets. In: *Nature Reviews* 10, 579-590.
- Razgaitis, Richard, 2002: Technology Valuation. In: Robert Goldscheider (ed.) *Licensing Best Practices: The LESI Guide to Strategic Issues and Contemporary Realities*. New York: Wiley, 3-18.

- Razgaitis, Richard, 2003: *Valuation and Pricing of Technology-Based Intellectual Property*. Chichester: John Wiley & Sons.
- Reiffenstein, Tim, 2009: Specialization, Centralization, and the Distribution of Patent Intermediaries in the USA and Japan. In: *Regional Studies* 43, 571-588.
- Reiss, Thomas/Sybille Hinze, 2000: Innovation Process and Techno-Scientific Dynamics. In: Andre Jungmittag/Guido Reger/Thomas Reiss (eds.), *Changing Innovation in the Pharmaceutical Industry: Globalization and New Ways of Drug Development*. Berlin: Springer, 53-69.
- Reitzig, Markus, 2003: What determines patent value? Insights from the semiconductor industry. In: *Research Policy* 32, 13-26.
- Reitzig, Markus, 2004: The Private Values of 'Thickets' and 'Fences': Towards an Updated Picture of the Use of Patents Across Industries. In: *Economics of Innovation & New Technology* 13, 457-476.
- Rivette, Kevin G./David Kline, 2000a: Discovering New Value in Intellectual Property. In: *Harvard Business Review* 78, 54-66.
- Rivette, Kevin G./David Kline, 2000b: *Rembrandts in the Attic: Unlocking the Hidden Value of Patents*. Boston: Harvard Business School Press.
- Rosenberg, Nathan, 1982: *Inside the black box: Technology and economics*. Cambridge: Cambridge University Press.
- Rosenberg, Nathan, 1994: *Exploring the Black Box. Technology, Economics, and History*. Cambridge: University Press.
- Roth, Alvin E., 2007: The Art of Designing Markets. In: *Harvard Business Review* 85, 118-126.
- Sampat, Bhaven N., 2006: Patenting and US academic research in the 20th century: The world before and after Bayh-Dole. In: *Research Policy* 35, 772-789.
- Samuelson, Pamela/Suzanne Scotchmer, 2001: The Law and Economics of Reverse Engineering. In: *Yale Law Journal* 111, 1575-1664.
- Santos, Ana C./Joao Rodrigues, 2009: Economics as social engineering? Questioning the performativity thesis. In: *Cambridge Journal of Economics* 33, 985-1000.
- Saxenian, AnnaLee, 1994: *Regional advantage. Culture and competition in Silicon Valley and Route 128*. Cambridge: Cambridge University Press.
- Scassa, Teresa, 2001: Patents for Second Medical Indications and Their Potential Impact on Pharmacare in Canada. In: *Health Law Journal* 9, 23-59.
- Schankerman, Mark, 1998: How Valuable Is Patent Protection: Estimates by Technology Field. In: *RAND Journal of Economics* 29, 77-107.

- Scheler, Max, 1960: *Die Wissensformen und die Gesellschaft*. 2. Auflage. Berlin: Francke Verlag.
- Schelling, Thomas C., 1960: *The Strategy of Conflict*. Cambridge, MA: Harvard University Press.
- Schumpeter, Joseph, 1911: *Theorie der wirtschaftlichen Entwicklung*. Berlin: Duncker & Humblot.
- Seaton, R. A. F./M. Cordey-Hayes, 1993: The development and application of interactive models of industrial technology transfer. In: *Technovation* 13, 45-53.
- Sell, Susan K., 1999: Multinational Corporations as Agents of Change: The Globalization of Intellectual Property Rights. In: A. Claire Cutler/Virginia Haufler/Tony Porter (eds.), *Private Authority and International Affairs*. New York: State University of New York Press, 169-197.
- Serrano, Carlos J., 2006: *The Market for Intellectual Property: Evidence from the Transfer of Patents*, Working Paper. Toronto: University of Toronto.
- Shackle, George L. S., 1969: *Decision, Order and Time in Human Affairs*. Cambridge: Cambridge University Press.
- Shackle, George L. S., 1976: Time and Choice. In: *British Journal for the Philosophy of Science* 9, 285-298.
- Shackle, George L. S., 1990 [1954]: The Complex Nature of Time as a Concept in Economics *Time, Expectations and Uncertainty in Economics: Selected Essays by G. L. S. Shackle*. Aldershot: Edward Elgar.
- Shackle, George L., 1959: Time and Thought. In: *The British Journal for the Philosophy of Science* 9, 285-298.
- Shackle, George L. S., 1958: *Time in Economics*. Amsterdam: North-Holland.
- Shane, Kite, 2009: Intellectual Property may soon be traded as its own 'asset class'. In: *Securities Industry News*, 08/03/2009.
- Shane, Scott/Deepak Somaya, 2007: The effects of patent litigation on university licensing efforts. In: *Journal of Economic Behavior & Organization* 63, 739-755.
- Shapiro, Carl, 2001: Navigating the Patent Thicket: Cross Licenses, Patent Pools and Standard-Setting. In: Adam B. Jaffe/Joshua Lerner/Scott Stern (eds.), *Innovation Policy and the Economy, Volume I*. Cambridge MA: The MIT Press, 119-150.
- Shapiro, Carl/Hal R. Varian, 1999: *Information Rules. A Strategic Guide to the Network Economy*. Boston, MA: Harvard Business School Press.

- Siegel, Donald S./Reinhilde Veugelers/Mike Wright, 2007: Technology transfer offices and commercialization of university intellectual property: performance and policy implications. In: *Oxford Review of Economic Policy* 23, 640-660.
- Siegel, Donald S./David A. Waldman/Albert N. Link, 2003: Assessing the Impact of Organizational Practices on the Productivity of University Technology Transfer Offices: An Exploratory Study. In: *Research Policy* 32, 27-48.
- Simon, Herbert, 1957: *Models of Man*. Chichester: John Wiley.
- Simon, Herbert, 1992: *Economics, Bounded Rationality and the Cognitive Revolution*. Brookfield: Elgar.
- Sine, Wesley D./Scott Shane/Dante Di Gregio, 2003: The Halo Effect and Technology Licensing: The Influence of Institutional Prestige on Licensing of University Inventions. In: *Management Science* 49, 478-494.
- Skoglösa, Ylva/Annika Unge, 2009: *Patenting protein pharmaceuticals in Europa: Managing Intellectual Property: The Global IP Resource*. <[www.managingip.com/11/24/2010](http://www.managingip.com/11/24/2010)>.
- Smith, Charles W., 1990: *Auctions. The Social Construction of Value*. Berkeley/ Los Angeles: University of California Press.
- Stark, David, 2009: *The Sense of dissonance: Accounts of Worth in Economic Life*. Princeton/Oxford: Princeton University Press.
- Stehr, Nico, 2001: *Wissen und Wirtschaften*. Frankfurt a. M.: Suhrkamp.
- Stehr, Nico, 2002: Wissen. In: Nico Stehr (ed.) *Wissen - Nichtwissen - Unsicheres Wissen*. Baden-Baden: Nomos Verlagsgesellschaft, 17-34.
- Stoeckli, Kurt A./Hubert Haag, 2009: High-throughput screening. In: H. P. Rang (ed.) *Drug Discovery and Development: Technology in Transition*. Edinburgh [et al.]: Elsevier Churchill Livingstone, 99-120.
- Strauss, Anselm/Juliet Corbin, 1991: *Basics of qualitative research: grounded theory procedures and techniques*. Newbury Park: Sage Pub.
- Streeck, Wolfgang/Kathleen Thelen, 2005: Introduction. In: Wolfgang Streeck/Kathleen Thelen (eds.), *Beyond Continuity*. Oxford: Oxford University Press, 1-39.
- Suddaby, Roy/Royston Greenwood, 2005: Rhetorical Strategies of Legitimacy. In: *Administrative Science Quarterly* 50, 35-67.
- Sullivan, Patrick, 2000: *Value Driven Intellectual Capital: How to Convert Intangible Corporate Assets Into Market Value*. New York: John Wiley & Sons.
- Sullivan, Patrick H., 1996: Key Terms and Strategic Positioning. In: Russell Parr/Patrick Sullivan (eds.), *Technology Licensing: Corporate Strategies for Maximizing Value*. New York: Wiley, 15-26.

- Swedberg, Richard, 2003: Markets in History. In: Richard Swedberg (ed.) *Principles of Economic Sociology*. Princeton: Princeton University Press, 131-157.
- Taylor, C./Z. Silberston, 1973: *The Economic Impact of the Patent System: A study of the British experience*. Cambridge: Cambridge University Press.
- Teece, David J., 1977: Technology Transfer by Multinational Firms: The Resource Cost of Transferring Technological Know-how. In: *Economic Journal* 87, 242-261.
- Teece, David J., 1981: The Market for Know-How and the Efficient International Transfer of Technology. In: *The Annals of the American Academy of Political and Social Science* 458, 81-96.
- Teece, David J., 1986: Profiting from technological innovation: implications for integration, collaboration, licensing and public policy. In: *Research Policy* 15, 285-305.
- Teece, David J., 1998: Capturing Value from Knowledge Assets: The New Economy, Markets For Know-how, And Intangible Assets. In: *California Management Review* 40, 55-79.
- Teece, David J., 2010: Business Models, Business Strategy and Innovation. In: *Long Range Planning* 43, 172-194.
- The Licensing Executive Society, 2011. <<http://www.lesi.org/about-lesi>; 09/21/2011>.
- The Licensing Executives Society, 2008: *LES Biopharmaceutical Royalty Rates and Deal Terms Survey Report*
- Thursby, Jerry G./Richard Jensen/Marie C. Thursby, 2001: Objectives, characteristics and outcomes of university licensing: a survey of major U.S. universities. In: *Journal of Technology Transfer* 26, 59-72.
- Thursby, Jerry G./Sukanya Kemp, 2002: Growth and productive efficiency of university intellectual property licensing In: *Research Policy* 31, 109-124.
- Thursby, Jerry G./Marie C. Thursby, 2002: Who is Selling the Ivory Tower? Sources of Growth in University Licensing. In: *Management Science* 48, 90-1054.
- Thursby, Jerry G./Marie C. Thursby, 2007: University licensing. In: *Oxford Review of Economic Policy* 23, 620-639.
- Tietze, Frank, 2010: *A Typology of Technology Market Intermediaries*, Working Paper No. 60. Hamburg: TUHH.
- Tietze, Frank/Cornelius Herstatt, 2010: *Technology Market Intermediaries and Innovation - Why they emerge and how they facilitate transactions*, Working Paper Nr. 59. Hamburg: Universität Hamburg.

- Tran, Yen/Juliana Hsuan/Volker Mahnke, 2010: How do innovation intermediaries add value? Insight from new product development in fashion markets. In: *R&D Management* 41, 80-91.
- Tritle, Gary L./Eric F.V. Scriven/Alan R. Fusfeld, 2000: Resolving Uncertainty in R&D Portfolios In: *Research-Technology Management* 43, 47-55.
- Troy, Irene, 2010: Ein Markt für Patente? Unsicherheiten im Handel mit geistigem Eigentum. In: *Kongressband zum 34. DGS Kongress. CD-Rom*.
- Troy, Irene/Raymund Werle, 2008: *Uncertainty and the Market for Patents*, MPIFG Working Paper 08/2. Cologne: Max Planck Institute for the Study of Societies.
- Troy, Irene/Raymund Werle, Forthcoming: Wissen handelbar gemacht? Politik und Patente. In: Andreas Busch/Jeanette Hofmann (eds.), *Politik und die Regulierung von Information. PVS Sonderband 46*. Baden-Baden: Nomos Verlag.
- Tversky, Amos/Daniel Kahneman, 2000: Judgment under Uncertainty: Heuristics and Biases. In: Terry Connolly/Hal R. Arkes/Kenneth R. Hammond (eds.), *Judgment and Decision Making: An Interdisciplinary Reader*. Cambridge: Cambridge University Press, 35-53.
- U.S. Department of Justice, 1995: *Antitrust Guidelines for the Licensing of Intellectual Property* U.S. Department of Justice and Federal Trade Commission; 04/06/1995.
- U.S. Small Business Administration, 2009.  
<<http://www.sba.gov/aboutsba/sbaprograms/sbir/index.html>; 09.11.2009>.
- USPTO, 2008: *United States Patent and Trademark Office Fee Schedule, Effective October 2, 2008*: United States Patent and Trademark Office.  
<<http://www.uspto.gov/web/offices/ac/qs/ope/fee2009september15.htm#patapp>; 06/17/2010>.
- USPTO, 2009: *Change of Owner (Assignment) and Change of Owner Name*.  
<<http://www.uspto.gov/patents/process/changeownership.jsp>; 16/12/2009>.
- Van de Ven, Andrew H., et al., 1999: *The Innovation Journey*. New York: Oxford University Press.
- Viscounty, Perry J./Michael Woodrow De Vries/Eric M. Kennedy, 2006: Patent auctions: emerging trend? In: *The National Law Journal*, 05/08/2006.
- Von Hippel, Eric, 1994: "Sticky Information" and the Locus of Problem Solving: Implications for Innovation. In: *Management Science* 4, 429-439.
- Walpole, Christopher S., 2009: The role of chemistry in the drug discovery process. In: H. P. Rang (ed.) *Drug Discovery and Development: Technology in Transition*. Edinburgh [et al.]: Elsevier Churchill Livingstone, 121-140.



- Walsh, Gary, 2003: *Biopharmaceuticals: Biochemistry and Biotechnology*. Chichester: John Wiley and Sons Ltd.
- Weber, Max, 1980 [1920]: *Wirtschaft und Gesellschaft* 5. Auflage. Tübingen: Mohr.
- West, Joel, 2006: Does Appropriability Enable or Retard Open Innovation? In: Henry Chesbrough/Wim Vanhaverbeke/Joel West (eds.), *Open Innovation: Researching a New Paradigm*. Oxford: Oxford University Press, 109-133.
- White, Harrison, 1981a: Production Markets as Induced Role Structures. In: Samuel L. Leihardt (ed.) *Sociological Methodology*. San Francisco: Jossey-Bass, 1-57.
- White, Harrison, 1981b: Where Do Markets Come From? In: *American Journal of Sociology* 87, 517-547.
- White, Harrison, 1992: *Identity and Control: A Structural Theory of Social Action*. Princeton, NJ: Princeton University Press.
- White, Harrison, 2002: *Markets from Networks: Socioeconomic Models of Production*. Princeton: Princeton University Press.
- White, Harrison C., 1988: Varieties of Markets. In: Barry Wellman/S. D. Berkowitz (eds.), *Social Structure: A Network Approach*. New York: Cambridge University Press, 226-260.
- Williamson, Oliver E., 1979: Transaction-Cost Economics: The Governance of Contractual Relations. In: *Journal of Law and Economics* 22, 233-261.
- Williamson, Oliver E., 1981: The Economics of Organization: The Transaction Cost Approach. In: *American Journal of Sociology* 87, 548-577.
- Williamson, Oliver E., 1989: Transaction Cost Economics. In: Richard Schmalensee/Robert D. Willig (eds.), *Handbook of Industrial Organization, Bd. 1*. Amsterdam: North-Holland, 135-182.
- Williamson, Oliver E., 1991: Comparative Economic Organization: The Analysis of Discrete Structural Alternatives. In: *Administrative Science Quarterly* 36, 269-296.
- Williamson, Oliver E., 2000: The New Institutional Economics: Taking Stock, Looking ahead. In: *Journal of Economic Literature* 38, 595-613.
- Winter, Sidney G., 2006: *The Logic of Appropriability: From Schumpeter to Arrow to Teece*, LEM Working Paper Series 2006/21. Pisa: Laboratory of Economics and Management.
- WIPO, 2008: *World Patent Report: A Statistical Review*. Geneva: WIPO. <[http://www.wipo.int/export/sites/www/ipstats/en/statistics/patents/pdf/wipo\\_pub\\_931.pdf](http://www.wipo.int/export/sites/www/ipstats/en/statistics/patents/pdf/wipo_pub_931.pdf); 10/16/2009>

- WIPO, 2009: *World Intellectual Property Indicators*. Geneva: WIPO. <[http://www.wipo.int/export/sites/www/ipstats/en/statistics/patents/pdf/wipo\\_pub\\_941.pdf](http://www.wipo.int/export/sites/www/ipstats/en/statistics/patents/pdf/wipo_pub_941.pdf); 10/16/2009>
- World Bank, 2008: *World Development Indicators*. <<http://search.worldbank.org/all?qterm=World%20development>; 11/11/2009>.
- Wurzer, Alexander J./Benno Fonrobert, 2004: Finanzmarktorientierte Informationsdienstleistungen im Patentmanagement. In: *Information Professional* 2011, 75-80.
- Yanagisawa, Tomoya/Dominique Guellec, 2009: *The Emerging Patent Marketplace*, OECD Science, Technology and Industry Working Papers 2009/9: OECD.
- Zelditch, Morris Jr., 1962: Some Methodological Problems of Field Studies. In: *American Journal of Sociology* 67, 566-576.
- Zelizer, Viviana A. Rotman, 2009: *Morals and Markets*. New York: Columbia University Press.
- Zhao, L.M./A. Reisman, 1992: Toward meta research on technology-transfer. In: *EEE Transactions on Engineering Management* 139, 13-21.
- Ziedonis, Rosemarie Ham, 2004: Don't Fence Me In: Fragmented Markets for Technology and the Patent Acquisition Strategies of Firms. In: *Management Science* 50, 804-820.
- Zilber, Tammar B., 2002: Institutionalization as an interplay between actions, meanings and actors: The case of a rape crisis center in Israel. In: *Academy of Management Journal* 45, 234-254.
- Zorn, Hendrik, 2009: *Recounting the Beans: The Statistical Construction of Fiscal Reality*, Dissertation. Köln: Universität Köln.
- Zucker, Lynne G., 1987: Institutional Theories of Organization. In: *Annual Review of Sociology* 13, 443-464.
- Zucker, Lynne G./Michael R. Darby/Marilynn B. Brewer, 1998: Intellectual Human Capital and the Birth of U.S. Biotechnology Enterprises. In: *The American Economic Review* 88, 290-306.
- Zukin, Sharon/Paul DiMaggio, 1990: Introduction. In: Sharon Zukin/Paul DiMaggio (eds.), *Structures of Capital*. Cambridge: Cambridge University Press, 1-36.

## Appendixes

### Appendix 1: Chapter 4 - study 1, case 1

#### List of interviewees

<b>Interviews:</b>	<b>S/Licensors: U.S. TTOs</b>	<b>D/Licensees: German companies</b>
<b>Small-size /Middle-size units</b>	<p>S1: TTO1</p> <ul style="list-style-type: none"> <li>- Few resources: two to three employees</li> <li>- Patent filings p.a.: &lt; 9 patents</li> <li>-Licenses executed p.a.: &lt;6 licenses</li> </ul> <p>Size of in-depth sample: 2 managers</p> <p>Group #S1.1: Practitioner interviews with TTO managers of group #S1</p> <p>Group #S1.2: Documents released by Group #S1</p>	<p>D1: Pharmaceutical-biotech company</p> <ul style="list-style-type: none"> <li>- Small size: Less than 50 employees</li> </ul> <p>Size of in-depth sample: 3 managers</p> <p>Group #D1.1: Practitioner interviews with BD managers of group #D1</p> <p>Group #D1.2: Documents released by group #D1</p>
<b>Middle-size units</b>	<p>S2: TTO2</p> <ul style="list-style-type: none"> <li>- Few resources: 15 employees</li> <li>- Patent filings p.a: 9-249 employees</li> <li>-Licenses executed p.a.: 6-59 licenses</li> </ul> <p>Size of in-depth sample: 6 managers</p> <p>Group #S2.1: Practitioner interviews with TTO managers of group #S2</p> <p>Group #S2.2: Documents released by Group #S2</p>	<p>D2: Pharmaceutical company</p> <ul style="list-style-type: none"> <li>- Middle size: 50-500 employees</li> </ul> <p>Size of in-depth sample: 4 managers</p> <p>Group #D2.1: Practitioner interviews with BD managers of group #D2</p> <p>Group #D2.2: Documents released by group #D2</p>
<b>Large-size units</b>	<p>S3: TTO3</p> <ul style="list-style-type: none"> <li>- Few resources: two to three employees</li> <li>- Patent filings p.a: &gt;249 patents</li> <li>-Licenses executed p.a.: &gt;59 licenses</li> </ul> <p>Size of in-depth sample: 4 managers</p> <p>Group #S3.1: Practitioner interviews with TTO managers of group #S3</p> <p>Group #S3.2: Documents released by Group #S3</p>	<p>D3: Pharmaceutical company</p> <ul style="list-style-type: none"> <li>- Large size: More than 500 employees</li> </ul> <p>Size of in-depth sample: 5 managers</p> <p>Group #D3.1: Practitioner interviews with BD managers of group #D3</p> <p>Group #D3.2: Documents released by group #D3</p>
<b>Sum:</b>	<p>Information provided by 12 managers.</p> <p>Universities were predominantly located at the US east coast.</p>	<p>Information provided by 12 managers.</p> <p>Companies were predominantly located in North-Rhine Westphalia, Hessen and Bavaria. One company was Swiss.</p>

**Appendix 2: Chapter 5 - study 1, case 2**

**List of interviewees**

<b>Interviews:</b>	<b>S/Licensors: German pharmaceutical companies</b>
<b>S/Pure licensors</b>	<p>S1: Pharmaceutical-biotech company</p> <ul style="list-style-type: none"> <li>- 2 small size: Less than 50 employees</li> <li>- 2 middle size: 50-500 employees</li> </ul> <p>Size of in-depth sample: 4 managers</p> <p>Group #S1.1: Practitioner interviews with BD managers of group #S1            Group #S1.2: Documents released by Group #S1</p>
<b>S/Non-pure licensors</b>	<p>S2: Pharmaceutical company</p> <ul style="list-style-type: none"> <li>- 2 small size: Less than 50 employees</li> <li>- 3 middle size: 50-500 employees</li> </ul> <p>Size of in-depth sample: 5 managers</p> <p>Group #S2.1: Practitioner interviews with BD managers of group #S2            Group #S2.2: Documents released by Group #S2</p>
<b>D/Pure licensees</b>	<p>Group #D1: Pharmaceutical company</p> <ul style="list-style-type: none"> <li>- 3 middle size: 50-500 employees</li> <li>- 3 large size: large size: More than 500 employees</li> </ul> <p>Size of in-depth sample: 6 managers</p> <p>Group #D1.1: Practitioner interviews with BD managers of group #D1            Group #D1.2: Documents released by Group #D1</p>
<b>D/Non-pure licensees</b>	<p>Group #D2: Pharmaceutical company</p> <ul style="list-style-type: none"> <li>- 2 middle size: 50-500 employees</li> <li>- 3 large size: More than 500 employees</li> </ul> <p>Size of in-depth sample: 5 managers</p> <p>Group #D2.1: Practitioner interviews with BD managers of group #D2            Group #D2.2: Documents released by Group #D2</p>
<b>Sum:</b>	<p>Information provided by 20 BD managers from German pharmaceutical companies. Companies were predominantly located in Berlin, North-Rhine Westphalia, Hessen and Bavaria.</p>

## Appendix 3: Chapter 6 – study 2

### Appendix 3.1: Interviews with Ocean Tomo LLC managers

#O.T.1: Andrew Ramer, #O.T.2: Ragnar Olson, #O.T.3: Robert Silver, #O.T.4: DJ Nag.

### Appendix 3.2: Observation checklist

<b>Observation</b>	<b>Live IP Auction event in October 2008 in Chicago, hosted by Ocean Tomo LLC</b>
<b>Details:</b>	Semi-structured participant observation Location: Chicago Trump Center, Grand Ballroom Historic Stock Exchange, Chicago Cultural Center, Chicago Time: October 29 and 30, 2008
<b>1. Open re-cording:</b>	1.1 Spatial and temporal arrangements in the conference, gala dinner and IP auction 1.2 Information about sponsors and other PMIs 1.3 Behavior of key speakers 1.4 Informal talks with other participants 1.5 Order of the topics in the discussions 1.6 Who is asking and giving feedback in the discussion
<b>2. Interaction process analysis (Bales 1976):</b>	The discussant: 2.1 ...asks for information, orientation and confirmation ("orientation): y/n, if yes what kind of orientation?  2.2 ...gives information, , orientation and confirmation ("orientation): y/n, if yes what kind of orientation?  2.3 ... asks for opinions, wishes and assessments ("opinion"): y/n, if yes what kind of opinion?  2.4 ... expresses opinions, wishes, and gives assessments ("opinion"): y/n, if yes what kind of opinion?  2.5 ... asks for suggestions, instructions and solutions to a problem ("suggestion"). y/n, if yes what kind of suggestion?  2.6 ... gives suggestions, instructions and solutions to a problem ("suggestion"). y/n, if yes what kind of suggestion?
<b>3. Open re-cording on the framing of the event (Goffman 1969, 1986):</b>	3.1 Regrounds (role-exchange): Which ones? How many? Who is involved?  3.2 Technical redoings: Which ones? How many? Who is involved?  3.3 Strategic actions and interactions of participants: Which ones? How many? Who is involved?

## Appendix 4: Chapter 7 – study 3

### Appendix 4.1: Operationalization

#### 4.1.1

Codes	Variable “activities” with codes:	Characterization of the codes
1.	Matching	Supply and demand are matched without active search by PMI. PMI provides a marketplace where supply and demand are brought together.
2.	Evaluation	Valuation of IP and evaluation of technologies.
3.	License_sell_disseminate	Disseminate in a broader sense: PMI is involved as insider and actively searching for demand and supply; He is brokering activities for patent holders, but not owning the patent This category includes contract negotiations.
4.	Acquire_buy	PMI helps to acquire the technology, brings its clients the opportunity to acquire new technologies.
5.	Develop	PMI is involved in the further development of a technology without manufacturing.
6.	Create Assets	Several options to enhance the value of the IP through internal and external exploitation of the patent. Also including the formation of a company and creation of a spin-off with IP.
7.	Prosecute_enforce IP	PMI prosecutes infringement of third party, offers freedom-to-operate services and gives patent infringement opinions.
8.	Funding_invest	PMI provides financial resources: funding and supporting inventors; investment character included.
9.	Identifying	PMI is involved reviewing activities: patent search; prior art search, strategic searches, patent filings and application.
10.	Other services	PMI offers related activities: training, advisory, mentoring, clearing.

#### 4.1.2

Codes	Variable “missions and goals” with codes:	Characterization of the codes The PMI seeks to...
1.	To be at the cutting edge	invest in and offer new technologies.
2.	Support inventors	support individual inventors.
3.	Expand underutilized assets	exploit intangible assets.
4.	Facilitating transfer of IP	expand and enable the market.
5.	Control_protect IP	control the market through strategic actions to use market and legal power.
6.	Start ventures	start ventures in order to get a return on investment, providing access to intangible resources which are vital for running a venture (finance innovations)

### 4.1.3

Codes	Variable “technologies” with codes:	Characterization of the codes
1.	Comprise	The PMI has knowledge in various technological fields and offers intermediation for organizations in different industries.
2.	Software	The PMI has a profound knowledge in the field of software and offers intermediation for organizations in the software or software-related industries.
3.	Electronic_semiconductor	The PMI has a profound knowledge in the field of electronics and/or semiconductor and offers intermediation for organizations in the respective industries.

### 4.1.4

Codes	Variable “primary object” with codes:	Characterization of the codes
1.	Ideas	The primary objects of intermediation provided by the PMI are ideas of inventors that are not (yet) patented.
2.	Patented technologies	The primary objects of intermediation provided by the PMI are patented technologies.
3.	Other IP	The primary object of intermediation provided by the PMI covers different kinds of Intellectual Property (including patents, trademarks and copyright).
4.	Companies	The primary object of intermediation provided by the PMI is a company or organization.

### 4.1.5

Codes	Variable “shaping macrostructures”	Characterization of the codes
1.	Yes	The PMI takes part in initiatives that should spur the secondary market for patents directly and indirectly. The PMI mentions activities on the websites by referring to the social benefit of the initiative.
2.	Implicit	The PMI supports initiatives that should spur the secondary market for patents directly and indirectly. His missions and goals include a reference to the social benefit.
3.	No	The PMI does not mention the participation nor the support of initiatives that should spur the secondary market for patents.

## Appendix 4.2: Descriptive analysis

### 4.2.1: Number of activities per PMIs

Number of Activities	Number of PMIs	Percentage of PMIs
0	4	4,08%
1	23	23,47%
2	30	30,61%
3	24	24,49%
4	10	10,20%
5	4	4,08%
6	3	3,06%
Sum:	96	100,00%

### 4.2.2: Frequency of the variable “activity”

Category	Variable “activity”	Absolute Number *	Percentage	Category	Variable “activity”	Absolute Number *	Percentage
1.	Matching	8	3.4%	6.	Create Assets	17	7.3%
2.	Evaluation	27	11.6%	7.	Prosecute_enforce IP	26	11.2%
3.	License_sell_disseminate	61	26.3%	8.	Funding_invest	11	4.7%
4.	Acquire_buy	18	7.8%	9.	Identifying	26	11.2%
5.	Develop	15	6.5%	10.	Other services	23	9.9%
						232	100 %

\*Multiple records of services on the websites of 96 PMIs that match up with the “activity” variable. In sum, 232 service records on the websites could be assigned to ten activities.



### 4.2.3: Frequency of the variable “missions and goals”

Category	Variable “missions and goals”	Absolute Number *	%	Category	Variable “missions and goals”	Absolute Number *	%
1.	To be at the cutting edge	6	6,3%	4.	Facilitate transfer of IP	28	29,5 %
2.	Support inventors	9	9,5%	5.	Control and protect IP	16	16,8 %
3.	Expand underutilized assets	32	33,7 %	6.	Start ventures	4	4,2%
					Sum:	95	100%

\*One PMI website does not mention the company’s mission.

## Appendix 4.3: Crosstabs and contingency analysis

### 4.3.1

Case Processing Summary						
	Cases					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
missions * activities	124	100.0%	0	.0%	124	100.0%

**Appendixes**

**4.3.2**

		activities				
		Aevaluation	Alicenselldiss	Aprosecenf	Aidentif	Total
missions Mexpass	Count	14	19	9	13	55
	Expected Count	12.0	22.2	11.1	9.8	55.0
	% within missions	25.5%	34.5%	16.4%	23.6%	100.0%
	% within activities	51.9%	38.0%	36.0%	59.1%	44.4%
MfacIPtr	Count	11	19	4	4	38
	Expected Count	8.3	15.3	7.7	6.7	38.0
	% within missions	28.9%	50.0%	10.5%	10.5%	100.0%
	% within activities	40.7%	38.0%	16.0%	18.2%	30.6%
Mcontrprot	Count	2	12	12	5	31
	Expected Count	6.8	12.5	6.2	5.5	31.0
	% within missions	6.5%	38.7%	38.7%	16.1%	100.0%
	% within activities	7.4%	24.0%	48.0%	22.7%	25.0%
Total	Count	27	50	25	22	124
	Expected Count	27.0	50.0	25.0	22.0	124.0
	% within missions	21.8%	40.3%	20.2%	17.7%	100.0%
	% within activities	100.0%	100.0%	100.0%	100.0%	100.0%

### 4.3.3

Chi-Square Tests			
	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	15.611 <sup>a</sup>	6	.016
Likelihood Ratio	16.119	6	.013
Linear-by-Linear Association	.611	1	.434
N of Valid Cases	124		

a. 0 cells (.0%) have expected count less than 5. The minimum expected count is 5.50.

### 4.3.4

Symmetric Measures			
		Value	Approx. Sig.
Nominal by Nominal	Phi	.355	.016
	Cramer's V	.251	.016
	Contingency Coefficient	.334	.016
	N of Valid Cases	124	

## Appendix 4.4: Two-mode network analysis

2-Mode Core/Periphery Model	Categorial	2-Mode Faction Model	Categorial
Starting fitness: 0.381 Final fitness: 0.383		Starting fitness: 0.052 Final fitness: 0.269 Correlation to ideal: 0.269	
Density matrix 1 2 ----- 1 0.564 0.191 2 0.479 0.181		Density matrix 1 2 ----- 1 0.186 0.316 2 0.096 0.389	

Appendix 4.5: Websites of PMIs

#	PMIs	Coop. and valuation problems	2-mode SNA	URL Source Retrieved between: 04/02 and 06/02/2009 (Checked: 10/31/2011)	Business model
1	ZALE	X	X	<a href="http://zalelaw.com/index_files/Page726.htm">http://zalelaw.com/index_files/Page726.htm</a>	5
2	License Management International	x	x	<a href="http://www.lmicp.com">http://www.lmicp.com</a>	5
3	Miller Patent Services		x	<a href="http://www.patent-inventions.com">http://www.patent-inventions.com</a>	5
4	Network-1	x	x	<a href="http://www.network-1.com">http://www.network-1.com</a>	5
5	Raj Abhyanker LLP	x	x	<a href="http://www.rajpatent.com">http://www.rajpatent.com</a>	5
6	Barnacle IP Management		x	<a href="http://www.barnacleip.com">http://www.barnacleip.com</a>	5
7	Smith Patent Consulting	x	x	<a href="http://www.smithpatent.com">http://www.smithpatent.com</a>	5
8	Taylor Russell	x	x	<a href="http://www.russell-law.com">http://www.russell-law.com</a>	5
9	Livingston firm	x	x	<a href="http://www.thelivingstonfirm.com">http://www.thelivingstonfirm.com</a>	5
10	Tracy P Jong		x	<a href="http://www.rochesterpatents.com">http://www.rochesterpatents.com</a>	5
11	Invention Marketing Service Inc		x	<a href="http://www.inventit.com">http://www.inventit.com</a>	5
12	apex juris	x	x	<a href="http://www.apexjurisadvocates.ae">http://www.apexjurisadvocates.ae</a>	5
13	MPEG		x	<a href="http://www.mpeg.org">http://www.mpeg.org</a>	3B
14	Vern maine		x	<a href="http://www.vernmaine.com">http://www.vernmaine.com</a>	6B
15	IPTL	x	x	<a href="http://www.hultquistip.com">http://www.hultquistip.com</a>	5
16	Salter michaelson		x	<a href="http://www.saltermichaelson.com">http://www.saltermichaelson.com</a>	5
17	Discovision Associates	x	x	<a href="http://www.discovision.com">http://www.discovision.com</a>	3A
18	Williams morgan	x	x	<a href="http://www.wmalaw.com">http://www.wmalaw.com</a>	4A
19	5iprinciplesgroup			<a href="http://www.5iprincipalsgroup.com">http://www.5iprincipalsgroup.com</a>	5
20	Sherwood	x		<a href="http://www.shrwood.com">http://www.shrwood.com</a>	2A
21	Qed-ip	x		<a href="http://qed-ip.com">http://qed-ip.com</a>	6B
22	Acorn Technologies	x		<a href="http://acorntech.com">http://acorntech.com</a>	3A
23	Anadeus	x		<a href="http://www.anadeus.com">http://www.anadeus.com</a>	3A
24	Catch Curve	x		<a href="http://catchcurve.com">http://catchcurve.com</a>	3A
25	Chipworks	x		<a href="http://www.chipworks.com">http://www.chipworks.com</a>	6B
26	Competitive Technologies	x		<a href="http://competitivetech.net">http://competitivetech.net</a>	6B
27	Idea Trade Network			<a href="http://www.newideatrade.com">http://www.newideatrade.com</a>	1B
28	General patents			<a href="http://www.generalpatent.com">http://www.generalpatent.com</a>	4B
29	Invent Resources			<a href="http://www.weinvent.com">http://www.weinvent.com</a>	3A
30	Maxiam	x		<a href="http://www.maxiam.com">http://www.maxiam.com</a>	2A, B
31	Nwpatentfunding	x		<a href="http://www.nwpatentfunding.com">http://www.nwpatentfunding.com</a>	2A, B

**Appendixes**

#	PMIs	Coop. and valuation problems	2-mode SNA	URL Source Retrieved between: 04/02 and 06/02/2009 (Checked: 10/31/2011)	Business model
32	Niro	x		<a href="http://www.niroscavone.com">http://www.niroscavone.com</a>	5
33	PatentBridge	x		<a href="http://www.patentbridge.com">http://www.patentbridge.com</a>	3A
34	Acacia Research	x	x	<a href="http://www.acaciaresearch.com">http://www.acaciaresearch.com</a>	4B
35	Ferguson Patent Properties	x	x	<a href="http://fergasonpatents.com">http://fergasonpatents.com</a>	4B
36	Jerome Lemelson		x	<a href="http://www.lemelson.org">http://www.lemelson.org</a>	6B
37	LPL Financial		x	<a href="http://lplfinancial.lpl.com">http://lplfinancial.lpl.com</a>	4B
38	Patriot Scientific	x	x	<a href="http://www.ptsc.com">http://www.ptsc.com</a>	4B
39	TLC	x	x	<a href="http://www.tlc-ip.com">http://www.tlc-ip.com</a>	4B
40	TPL groupalliance	x	x	<a href="http://www.tplgroup.net">http://www.tplgroup.net</a>	4B
41	New venture			<a href="http://www.new-ventures.org">http://www.new-ventures.org</a>	3A, C
42	Ocean Tomo		x	<a href="http://www.oceantomo.com">http://www.oceantomo.com</a>	6B, 1C
43	Coller ip		x	<a href="http://www.colleripmanagement.com">http://www.colleripmanagement.com</a>	6B
44	Intellectual ventures	x	x	<a href="http://www.intellectualventures.com">http://www.intellectualventures.com</a>	2A,C
45	Amber waive	x	x	<a href="http://www.amberwave.com">http://www.amberwave.com</a>	3A
46	InterDigital		x	<a href="http://www.interdigital.com">http://www.interdigital.com</a>	3A
47	MOSAID	x	x	<a href="http://www.mosaid.com">http://www.mosaid.com</a>	3A
48	Qualcomm	x	x	<a href="http://www.qualcomm.com">http://www.qualcomm.com</a>	3A
49	Rambus	x	x	<a href="http://www.rambus.com/us">http://www.rambus.com/us</a>	3A
50	Tessera	x	x	<a href="http://www.tessera.com">http://www.tessera.com</a>	3A
51	Walker		x	<a href="http://www.walkerdigital.com">http://www.walkerdigital.com</a>	3A
52	Wi-lan	x	x	<a href="http://www.wi-lan.com">http://www.wi-lan.com</a>	3A
53	Fairfield Resources Int.	x	x	<a href="http://www.frlicense.com">http://www.frlicense.com</a>	1A
54	FLUID INNOVATION		x	<a href="http://www.fluidinnovation.com">http://www.fluidinnovation.com</a>	1A
55	IPCAPITAL Group	x	x	<a href="http://www.ipcg.com">http://www.ipcg.com</a>	1A
56	ipvalue	x	x	<a href="http://www.ipvalue.com">http://www.ipvalue.com</a>	1A
57	ThinkFire	x	x	<a href="http://www.thinkfire.com">http://www.thinkfire.com</a>	1A
58	Altitude		x	<a href="http://www.altitudecp.com">http://www.altitudecp.com</a>	4A
59	Ipfinance	x	x	<a href="http://ip-finance.com">http:// ip-finance.com</a>	4A
60	Rembrandt		x	<a href="http://www.rembrandtip.com">http://www.rembrandtip.com</a>	4A
61	Nw patent funding		x	<a href="http://www.nwpatentfunding.com">http://www.nwpatentfunding.com</a>	4A
62	Oasis Legal Finance		x	<a href="http://www.oasislegal.com">http://www.oasislegal.com</a>	4A
63	Bramsonpressman	x	x	<a href="http://www.b-p.com">http://www.b-p.com</a>	1B
64	ICEBERG Transactions	x	x	<a href="http://www.iceberg-cap.com">http://www.iceberg-cap.com</a>	1B
65	Ipotential	x	x	<a href="http://ipotential.com">http://ipotential.com</a>	1B
66	PCT Capital	x	x	<a href="http://www.pctcapital.com">http://www.pctcapital.com</a>	1B

## Appendixes

#	PMIs	coop. and valuation problems	2-mode SNA	URL Source Retrieved between: 04/02 and 06/02/2009 (Checked:10/31/2011)	Business model
67	Pluritas	x	x	<a href="http://www.pluritas.com">http://www.pluritas.com</a>	1B
68	Semiconductor insights	x	x	<a href="http://www.semiconductor.com">http://www.semiconductor.com</a>	1B
69	Blueprint Ventures		x	<a href="http://www.blueprintventures.com">http://www.blueprintventures.com</a>	2B, C
70	Inflexion Point		x	<a href="http://www.ip-strategy.com">http://www.ip-strategy.com</a>	5
71	IpAuctions		x	<a href="http://www.ipauctions.com">http://www.ipauctions.com</a>	1C
72	Ip Bewertungs AG	x	x	<a href="http://www.ip-auctions.eu">http://www.ip-auctions.eu</a>	1C
73	Free patent auction	x	x	<a href="http://www.freepatentauction.com">www.freepatentauction.com</a>	1C
74	Innocentive		x	<a href="http://www.innocentive.com">http://www.innocentive.com</a>	1D
75	Ninesigma		x	<a href="http://www.ninesigma.com">http://www.ninesigma.com</a>	1D
76	Novience	x	x	<a href="http://www.novience.com">http://www.novience.com</a>	1D
77	OpenIP consortium		x	<a href="http://www.patentsonline.com.au">http:// www.patentsonline.com.au</a>	1D
78	Tynax	x	x	<a href="http://www.tynax.com">http://www.tynax.com</a>	1D
79	Ipeg	x	x	<a href="http://www.ipegconsultancy.nl">http://www.ipegconsultancy.nl</a>	2B
80	AlsetIP		x	<a href="http://alsetip.com/">http://alsetip.com/</a>	2C
81	1790 analytics patent		x	<a href="http://www.1790analytics.com">http://www.1790analytics.com</a>	6A
82	Intellectual assets		x	<a href="http://www.intelassets.com">http://www.intelassets.com</a>	6A
83	IP checkups		x	<a href="http://www.ipcheckups.com">http:// www.ipcheckups.com</a>	6A
84	Next step research		x	<a href="http://www.nextstepsresearch.com">http:// www.nextstepsresearch.com</a>	6A
85	Patentcafe		x	<a href="http://www.patentcafe.com">http://www.patentcafe.com</a>	6A
86	TAEUS		x	<a href="http://www.taeus.com">http://www.taeus.com</a>	6A
87	Patentboard		x	<a href="http://www.patentboard.com">http://www.patentboard.com</a>	6A
88	Topcap		x	<a href="http://www.steelcityre.com">http://www.steelcityre.com</a>	6A
89	UTEK	x	x	<a href="http://utekcorp.com">http://utekcorp.com</a>	1E
90	Texelerate	x	x	<a href="http://www.texelerate.net">http://www.texelerate.net</a>	1E
91	yet2com	x	x	<a href="http://www.yet2.com">http://www.yet2.com</a>	1D
92	gathering2.0		x	<a href="http://www.gathering2.com">http://www.gathering2.com</a>	1D
93	Ipxi	x	x	<a href="http://www.ipxi.com">http://www.ipxi.com</a>	1D
94	Constellationcapital		x	<a href="http://www.constellationcapital.com">http://www.constellationcapital.com</a>	3B
95	Openinventionnetwork	x	x	<a href="http://www.openinventionnetwork.com">http://www.openinventionnetwork.com</a>	3B
96	IgniteIP		x	<a href="http://www.igniteip.com">http://www.igniteip.com</a>	4A

## Summary

Recent studies discover growing markets for technologies and patents and provide evidence for significant international IP licensing activities during the past decades. Parallel, results from international surveys indicate imperfect markets and high transaction costs in IP transactions (Teece 1981; Gambardella/Luzzi 2007; Motohashi 2005). While some obstacles in patent transactions result from the characteristics of the good, e.g. the high specificity of the asset (Williamson 1979), knowledge as semi-public good (Nelson 1989), the indivisibility of inventions and the information disclosure problem (Arrow 1962), as well as a lack of institutional backing, other obstacles are transaction-related.

It is important to note that patent transactions widely differ across industries and technologies (licensing in R&D projects, cross-licensing, pooling, sales) and are embedded in complex IP management strategies and strategic games between companies (Bidault 1989; Hall/Ziedonis 2001; Reitzig 2004). Previous studies investigated patent transactions either from the perspective of the patent holder (Teece 1998), the awareness of open innovation and patent exploitation in firms (Chesbrough 2006; West 2006) or the value of patents (Gambardella/Mariani 2005). The role of managers and of patent transactions has been widely ignored. This thesis explores patent transactions from the theoretical viewpoint of economic sociology and analyzes interactions of technology transfer and business development managers and the role of cultural arrangements to overcome uncertainties (so-called ‘judgment devices’ (Karpik 2010)). Furthermore, it inspects the function of patent market intermediaries and explores the structure of a secondary market for patents (the “market for intermediary businesses”).

The overarching question of the thesis is: *Which uncertainties exist in patent transactions and how do managers cope with uncertainties?* The thesis consists of two conceptual chapters, chapter 2 and 3, and three empirical studies which are presented in chapter 4, 5, 6 and 7:

**Chapter 2** elaborates on the peculiarities of patent transactions and market(s) for patents as distinguished from other goods and markets. It aims to answer the question of whether and why arm’s length transactions of patents are possible (or impossible) in principle. The chapter analyzes two preconditions for a functioning market for patents, the proprietization and appropriation of patents. In doing so, patents are treated as tradable and transferrable goods that are marked by two sides, the exclusive right on the one hand and the technological knowledge including complementary know-how and services that is protected by the patent right on the other hand.

Using the example of patents on (bio)pharmaceuticals, notably drugs and therapeutic methods, it is discussed to what extent these patents fulfill the two preconditions mentioned above. Finally, the trend towards commercialization of patentable inventions from universities and companies is briefly reviewed.

Most studies on the trade in patents center strategic interactions between market players, the structure of the market(s) for patents and the role of transaction costs without investigating the conditions under which managers act when they initiate, negotiate and close patent licensing contracts. In **chapter 3**, a pragmatist-cultural framework is developed in order to study patent transactions on the micro level. The theoretical framework combines concepts from pragmatist and cultural approaches in economic sociology, e.g. John Dewey's theory of inquiry and Lucien Karpik's concept of judgment devices (Dewey 1938; Karpik 2010). Both strands contribute to the understanding of uncertainties in transactions. In this chapter, a methodological way of how to investigate uncertainties in transaction processes and social interactions between managers is proposed. The pilot study preceding the thesis identified two sources of uncertainty that seem to play a pivotal role in patent transactions: Uncertainties in the innovation and patenting process and uncertainties relating to the market for patents, notably valuation-pricing and cooperation problems. A proposition of the thesis discussed in this chapter is that the effect of fundamental uncertainty on patent transactions differs in two degrees (high versus low).

The first and principal empirical study is presented in **chapter 4**. It investigates transactions of (provisional) patents on early stage drug compounds, notably product technologies. This chapter focuses on exclusive patent licensing transactions between public US universities and German companies. The pharmaceutical industry is known for active licensing activities, and patents play a key role for companies. The licensing field of the pharmaceutical industry is a very dynamic setting. Patent transactions at the late research stage of the clinical pipeline are associated with high fundamental uncertainty about the compound and the patent. In this stage, the technology is a late research outcome and the patent is provisional. Chapter 4 poses the question of how technology transfer managers from universities and business development managers from German companies value and price provisional patents of early stage drugs. How do (potential) licensors and licensees find the right match in the light of lacking market transparency and then cooperate in the negotiation of a long-term contractual relationship? In the late research stage, valuation-pricing problems, which allude to uncertainty, occur when TTO and BD managers negotiate upfront payments, royalties and milestone payments. The most critical point relates to the attribution of numeric figures to a patent's value by using a future-oriented



valuation approach. This problem results from different assumptions which are based on different guesses and ideas about prospective R&D and market conditions. The most critical cooperation problem refers to university policy on warranties and indemnification. Public US universities do not extend warranties for economic exploitability and profitability of patents and tend to cede costly trials to the exclusive licensee. The findings revealed that confidence and a portion of imagination on both sides are necessary in the late research stage to cope with uncertainties, notably with those which are originated outside the sweep of market actors (e.g. the grant of the patent, actions of third parties and sublicenses).

**Chapter 5** presents a counter case study to chapter 4 in order to study the effect of high fundamental uncertainty on patent transactions. It deals with patent transactions at the clinical stage IIa in which fundamental uncertainty about the product and the patent is expected to be lower. In the clinical stage IIa, BD managers do apply future-oriented models. A systematic valuation using product market information follows forward-looking principles. However, the models themselves are often hidden from the other party because BD managers obviously fear that the other party may be able to infer confidential information from the architecture of the financial models. In this case, the devices (financial models) themselves become a cue ball in the negotiations. Financial negotiations succeed when both parties signal their trustworthiness and competence and confirm those issues on the other party. Finally, similarities and dissimilarities of patent transactions in the late research stage and clinical stage IIa are analyzed. In the late research stage, uncertainties tend to result from outside the sphere of influence of licensor and licensees and affect both parties. In the clinical stage IIa, valuation and cooperation problems stem from inside the sphere of influence of market actors which means that problems have their origin in the information itself and the social relationship between the market actors.

**Chapter 6** deals with the question of how uncertainties are tackled in patent auctions and analyzes the role of the auctioneer Ocean Tomo, LLC as third party assistance and looks at the firm's attempt to apply a systematic valuation of patents. An explorative case study of the Ocean Tomo's fall 2008 Live IP auction furnish anecdotic evidence that IP auctions contribute to the conscious constitution of primary markets for patents and the market for intermediary businesses. This event can be seen as an initiative for market making (Aspers 2009a). By assessing the relevance of the performativity theory (Callon 1998; 2007) and the concept of institutional entrepreneurship (DiMaggio 1988; DiMaggio/Powell 1991a; Maguire/Hardy/Lawrence 2004; Eisenstadt 1980), the study analyzes the purpose and role of the auction event including conferences, gala dinner and speeches. It

concludes that these devices are not only a fancy by-product of the auction nor the result of a marketing strategy but a necessary step for the implementation of the IP auction and for market constitution in general. The auction event helps to establish new business models as best practice in IP management.

**Chapter 7** inspects the role of patent market intermediaries (PMIs) that act as third party assistances to universities and companies in order to facilitate patent transactions as well as IP management activities in principal. Furthermore, the chapter attempts to reconstruct the structure of a secondary market for patents - “the market for intermediary businesses” (Mfi) - in which patent market intermediaries are involved in patent transactions. While the primary market for patents deals with patents as object of trade, the good being transferred in the Mfi comprises consultancy and assisting services of PMIs. The Mfi responds to the need for consultancy and assistance of companies and universities active in managing and transferring IP and technologies. An important insight of this chapter is that some business models of patent market intermediaries do not explicitly address the needs of clients nor do they seem to spur the primary market for patents. For instance patent litigation models and patent pool administration promise benefits only to a few exclusive groups of patent holders and patent market intermediaries. These services also significantly differ from services and business models offered in other markets. It is argued that these services are functioning in the Mfi only because they are based on two key characteristics of intellectual property rights – insufficient propertization and appropriation of patented technologies.

**Chapter 8** summarizes the main findings of each chapter by responding to the overarching research question: *Which uncertainties exist in patent transactions and how do managers cope with uncertainties?* Overall, it was found that judgment devices, e.g. valuation methods, symposia and conferences, serve as “cognitive support” to managers (chapter 4) but also as cue balls in strategic interactions (chapter 5). The IP auction guarantees efficient patent transactions in a perfect market as a nutshell but the auctioneer also needs to make numerous provisions to cope with uncertainty, e.g. establishing and designing judgment devices that help to reduce valuation-pricing and cooperation problems. PMIs continuously work on statistically proven and predictive software-driven tools for patent valuation and litigation discovery, and thus they create devices themselves. At the same time PMIs profit from uncertainties in the (primary) market of patents.

In addition, the chapter discusses two poles in the range of patent transactions - bilateral licensing transactions and arm’s length sales transactions of patents - and elaborates on main differences. Furthermore, the pragmatist-cultural framework is revisited to bridge the core concepts presented in chapter 3 which is judgment, deci-

sion-making, inquiry, imagination, and judgment devices. Another sub-chapter distills three core dimensions that characterize the trade in patents and market(s) for patents in general: A lack of transparency, control and competence in patent transactions. It is further argued that information, expertise and control on the part of market actors are decisive for successful patent transactions because these factors mitigate a lack of transparency, of control and of competence in patent transactions. The last section briefly reviews factors that do not relate to uncertainty but seem to have a significant effect on patent transactions though. Finally, chapter 8 summarizes theoretical and methodological contributions of the thesis to economic sociology and transaction-cost theory.



## Samenvatting

Recente studies wijzen op groeiende markten voor technologieën en patenten en leveren bewijs voor significante internationale IP licentie activiteiten gedurende de afgelopen decennia. Tevens wijzen resultaten uit internationale enquêtes op imperfecte markten en hoge transactiekosten bij IP transacties (Teece 1981; Gambardella/Luzzi 2007; Motohashi 2005). Terwijl sommige obstakels in patent transacties het resultaat zijn van de aard van het product, zoals de hoge specificiteit van de activa (Williamson 1979), kennis als een semipubliek goed (Nelson 1989), de ondeelbaarheid van uitvindingen en het probleem van informatie openbaring (Arrow 1962), evenals het gebrek aan institutionele steun, zijn andere transactie gerelateerde obstakels.

Het is belangrijk om op te merken dat patent transacties sterk verschillen tussen industrieën en technologieën (licenties in R&D projecten, crosslicenties, pooling, verkopen) en zijn ingebed in complexe IP strategieën and strategische interacties tussen bedrijven (Bidault 1989; Hall/Ziedonis 2001; Reitzig 2004). Eerdere studies hebben patent transacties onderzocht vanuit het perspectief van de patenthouder (Teece 1998), het bewustzijn van open innovatie en de exploitatie van patenten in bedrijven (Chesbroug 2006; West 2006), of de waarde van patenten (Gambardella/Mariani 2005). De rol van managers op patent transacties is op grote schaal genegeerd. Dit proefschrift verkent patent transacties vanuit het theoretisch kader van de economische sociologie en analyseert de interacties tussen de overdracht van technologie en business ontwikkelings managers en de rol van culturele regelingen om onzekerheden te overwinnen (de zogenoemde 'judgement devices' (Karpik 2010)). Verder wordt de functie van markt intermediairs voor patenten en de structuur van een secundaire markt voor patenten onderzocht (de markt voor intermediaire bedrijven).

De overkoepelde vraag van het proefschrift is: Welke onzekerheden bestaan er in patent transacties en hoe gaan managers om met deze onzekerheden? De thesis bestaat uit twee conceptuele hoofdstukken, hoofdstuk 2 en 3, en drie empirische studies welke worden gepresenteerd in hoofdstuk 4, 5, 6 en 7:

**Hoofdstuk 2** gaat dieper in op de eigenaardigheden van patent transacties en markt(en) voor patenten ten opzichte van andere goederen en markten. Het heeft het doel om antwoord te vinden of en waarom marktconforme transacties principieel (on-) mogelijk zijn. Het hoofdstuk onderzoekt twee randvoorwaarden voor een goed

functionerende markt voor patenten, de overdracht en acquisitie van patenten. Hierbij worden patenten behandeld als verhandelbare en overdraagbare goederen die door twee aspecten worden gekenmerkt, het exclusieve recht aan de ene kant en de technologische kennis, waaronder complementaire knowhow, en diensten die worden beschermd door het patentrecht aan de andere kant. Met behulp van de patenten van de (bio-)farmaceutische industrie, voornamelijk geneesmiddelen en therapeutische methoden, wordt besproken in welke mate deze patenten voldoen aan de twee randvoorwaarden die hierboven zijn gesteld. Ten slotte wordt de trend richting de commercialisatie van patenteerbare uitvindingen van universiteiten en bedrijven kort besproken.

De meeste studies over handel in patenten richten zich op strategische interacties tussen de markt actoren, de structuur van de markt(en) voor patenten en de rol van transactie kosten zonder te onderzoeken wat de omstandigheden zijn waarin managers de patent overeenkomst initiëren, onderhandelen en sluiten. In **hoofdstuk 3** wordt een pragmatistcultureel kader ontwikkeld om patent transacties te bestuderen op microniveau. Het theoretische raamwerk combineert concepten van pragmatische en culturele methoden in de economische sociologie, zoals John Dewey's theorie van onderzoek en Lucien Karpik's concept van 'judgement devices' (Dewey 1938; Karpik 2010). Beide stromingen dragen bij aan het begrijpen van onzekerheden in transacties. In dit hoofdstuk wordt een methodiek voorgesteld waarin de onzekerheden in transactieprocessen en sociale interacties tussen managers kunnen worden onderzocht. Een pilotstudie voorafgaand aan het proefschrift heeft twee bronnen van onzekerheid die een centrale rol spelen in patent transacties geïdentificeerd: onzekerheden in het innovatie en het patent aanvraag proces en onzekerheden met betrekking tot de patentenmarkt, voornamelijk de financiële waardering en coöperatie problemen. Een voorstel van het proefschrift besproken in dit hoofdstuk is dat het effect van de fundamentele onzekerheid over patent transacties in twee graden verschilt (hoog versus laag).

De eerste en voornaamste empirische studie is gepresenteerd in **hoofdstuk 4**. Het onderzoekt transacties van (voorlopige) patenten van vroegtijdige drugs verbindingen, voornamelijk producttechnologieën. Dit hoofdstuk richt zich op exclusieve patentlicentie overeenkomsten tussen publieke universiteiten in de VS en Duitse bedrijven. De farmaceutische industrie is bekend om zijn actieve licentie activiteiten en patenten spelen een belangrijke rol voor bedrijven. Het licentie gebied van de farmaceutische industrie is een zeer dynamische omgeving. Patent transacties aan het einde van de onderzoeksfase van de klinische pijplijn worden geassocieerd met hoge fundamentele onzekerheid over de verbinding en het patent. In dit stadium

representeert de technologie het resultaat aan het einde van het onderzoek en is het patent voorlopig. Hoofdstuk 4 stelt de vraag hoe de Technologie Overdracht Managers (TOMs) van universiteiten en de Business Ontwikkeling Managers (BOMs) van Duitse bedrijven de waarde van voorlopige patenten voor beginnende medicijnen bepalen. Hoe vinden (potentiële) licentiegevers en licentiehouders de juiste match met oog op het ontbreken van markttransparantie om vervolgens samen te werken in de onderhandelingen over een contractuele lange termijn relatie? In de late onderzoeksfase ontstaan de financiële waardering problemen, welke zinspelen op onzekerheid wanneer BOMs en TOMs managers onderhandelen over betalingen vooraf, royalty's en mijlpaalbetalingen. Het meest kritische punt heeft betrekking tot de toekenning van de financiële waarde van een patent als er wordt gewerkt met een toekomstig verwachte waarde. Dit probleem resulteert uit de verschillende gissingen en ideeën over de toekomstige R&D en markt omstandigheden. Het meest kritische samenwerkingsprobleem verwijst naar universiteitsbeleid ten aanzien van garanties en vrijwaringen. Publieke universiteiten in de VS geven geen garanties af voor economische exploitatie en winstgevendheid van patenten en neigen de kostbare proeven af te staan aan de exclusieve licentiehouders.

Uit deze bevindingen blijkt dat vertrouwen en portie verbeelding aan beide kanten nodig zijn om om te gaan met onzekerheden, voornamelijk voor die welke zijn ontstaan buiten het bereik van markt actoren (bijvoorbeeld de verlening van het patent, acties van derden en sublicenties).

In **Hoofdstuk 5** wordt een kritische case studie voor hoofdstuk 4 gepresenteerd met het doel het effect van hoge fundamentele onzekerheid op patent transacties te onderzoeken. Het onderzoekt patent transacties tijdens de klinische fase IIa, waarin fundamentele onzekerheid over het product en het patent naar verwachting lager is. In de klinische fase IIa gebruiken BOMs toekomst georiënteerde modellen. Een systematische waardering met behulp van markt informatie volgt op de toekomst gerichte principes. Echter, de modellen zelf zijn vaak verborgen voor de andere partij omdat BOMs bang zijn dat de andere partij hierdoor in staat is vertrouwelijke informatie af te leiden uit de architectuur van de financiële modellen. In dit geval zijn de instrumenten (de financiële modellen) zelf uitgegroeid tot een speelbal in de onderhandelingen. Financiële onderhandelingen slagen als beiden partijen hun betrouwbaarheid en deskundigheid weten over te brengen aan de andere partij en dit weten te bevestigen. Tot slot worden overeenkomsten en verschillen van de patent transactie tijdens de late onderzoeksfase en klinische fase IIa geanalyseerd. Tijdens de late onderzoeksfase hebben onzekerheden de neiging om het gevolg te zijn van invloed buiten de invloedssfeer van de licentiegever en de licentiehouders en beide

partijen te beïnvloeden. Tijdens de klinische fase IIa komen waardering en coöperatie problemen voor binnen de invloedssfeer van markt actoren, wat betekent dat problemen hun oorsprong vinden in de informatie zelf en de sociale relatie tussen de markt actoren.

**Hoofdstuk 6** gaat in op de vraag hoe onzekerheden worden aangepakt tijdens patent veilingen en analyseert de rol van de veilingmeester Ocean Tomo, Inc. als derde partij ondersteuning en kijkt naar de poging van het bedrijf om een systematische financiële waardering van patenten toe te passen. Een verkennende case studie van de val van de Ocean Tomo's in 2008 live IP veiling leveren anekdotisch bewijs dat IP veilingen bijdragen aan de bewuste samenstelling van primaire markten voor patenten en de markt voor intermediaire bedrijven. Dit evenement kan gezien worden als initiatief voor markt ontwikkeling (Aspers 2009a). Door de relevantie van de performativiteit theorie (Callon 1998; 2007) en het concept institutionele ondernemerschap (DiMaggio 1988; DiMaggio/Powell 1991a; Maguire/Hardy/Lawrence 2004; Eisenstadt 1980) te onderzoeken analyseert deze studie het doel en de rol van de veiling, waaronder conferenties, een gala diner en toespraken. Er wordt geconcludeerd dat deze activiteiten niet alleen een fancy bijproduct van de veiling zijn, noch het resultaat van een marketing strategie, maar een noodzakelijke stap voor de IP veiling en voor de marktontwikkeling in het algemeen zijn. De veiling helpt om nieuwe businessmodellen te vestigen als 'best practices' in IP management.

**Hoofdstuk 7** onderzoekt de rol van Markt Intermediairs voor Patenten (MIvP) die fungeren als ondersteuning vanuit een derde partij aan universiteiten en bedrijven met het doel patent transacties en IP beheer te faciliteren. Daarnaast tracht het hoofdstuk om de structuur van de secundaire markt voor patenten te reconstrueren – "de Markt voor Intermediaire Bedrijven (MvIB)" – waarin MIvP betrokken zijn bij patent transacties. Hoewel de primaire markt voor patenten handelt met patenten als handelsobject, het overgedragen product in de MvIB bestaat uit consultancy en ondersteuning van MIvP. De MvIB speelt in op de behoefte aan consultancy en ondersteuning van universiteiten en bedrijven die actief zijn in het beheren en overdragen van IP en technologieën. Een belangrijk inzicht van dit hoofdstuk is dat bepaalde businessmodellen van MIvP op de markt niet expliciet voorzien in de behoeften van de klanten en tevens lijken ze de primaire markt voor patenten niet aan te moedigen. Bijvoorbeeld, patent geschillen en patent pool administratie belooft voordelen voor slechts een kleine exclusieve groep van patenthouders en MIvP. Daarnaast verschillen deze diensten significant van diensten en businessmodellen welke worden aangeboden in andere markten. Er wordt gesteld



dat deze diensten werken in de MvIB enkel omdat ze zijn gebaseerd op twee karakteristieken van IP rechten namelijk onvoldoende overdracht en acquisitie van gepanteerde technologieën.

**Hoofdstuk 8** vat de belangrijkste bevinden van elk hoofdstuk samen door te reageren op de overkoepelende onderzoeksvraag: Welke onzekerheden bestaan er in patent transacties en hoe gaan managers om met deze onzekerheden? Het werd bevonden dat ‘judgement devices’, zoals financiële waarderingmethoden, symposia en conferenties, dienen als “cognitieve steun” aan managers (hoofdstuk 4), maar ook als springplank voor strategische interacties (hoofdstuk 5). De IP veiling staat garant voor efficiënte patent transacties in een perfecte markt maar de veilingmeester moet ook een tal van keuzes maken om om te gaan met onzekerheid, zoals het ontwikkelen van instrumenten welke helpen om de problemen van de financiële waardering en samenwerking te verminderen. MIVP werken continu aan statistische bewezen en voorspellend gedreven software voor patent waardering en geschillen ontdekking, en zo creëren ze de instrumenten zelf. Tegelijkertijd profiteren MIVP van onzekerheden in de (primaire) markt van patenten.

Daarnaast bespreekt het hoofdstuk twee polen in het bereik van patent transacties – bilaterale licentie transacties en marktconforme transacties van patenten – en gaat dieper in op de belangrijkste verschillen. Bovendien is het pragmatischculturele raamwerk herzien om een brug te slaan tussen de kernbegrippen in hoofdstuk 3: oordeel, besluitvorming, onderzoek, verbeelding en de waardering methodiek. Een ander subhoofdstuk onderscheid drie kerndimensies die de handel in patenten en markt(en) voor patent karakteriseren: het gebrek aan transparantie, controle en competentie in patent transacties. Verder wordt beargumenteerd dat informatie, expertise en controle aan de kant van marktpartijen bepalend zijn voor een succesvolle patent transactie omdat deze factoren het gebrek aan transparantie, controle en competentie beperken. De laatste sectie gaat kort in op de factoren die geen verbanden hebben met onzekerheid, maar toch een significant effect lijken te hebben op patent transacties. Ten slotte vat hoofdstuk 8 de theoretische en methodologische bijdragen van het proefschrift aan de economische sociologie en de transactie kosten theorie samen.



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## Curriculum Vitae

Irene Troy was born in Bregenz, Austria in 1979. Between 2001 and 2007, she studied Sociology and Science of Education as major subjects, and Economics and Psychology as minor subjects at the University of Augsburg, Germany. In 2006, she graduated in Sociology as Magistra Artium (Master of Arts equivalent) and in 2007, she received a University Diploma in Education Sciences (Master of Arts equivalent) at the University of Augsburg. In 2007 and 2008, she was instructor and lecturer at the Neu-Ulm University of Applied Sciences, Economics Department, Neu-Ulm and at the Neubrandenburg University of Applied Sciences, Department of Health, Nursing and Management, Neubrandenburg, Germany.

From 2007 until 2010, she worked as junior researcher on the project “Trading Patents” with Raymund Werle at the Max Planck Institute for the Studies of Societies, Cologne. Between 2008 and 2010 she was also an affiliated doctoral fellow in the doctoral program IMPRS-SPCE. In fall 2009, she was granted a visiting scholarship at Northwestern University, Department of Sociology and Buffett Center for International and Comparative Studies, Evanston, USA.

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## Publications

- Troy, Irene/Raymund Werle, 2008: *Uncertainty and the Market for Patents*, MPIfG Working Paper 08/2. Cologne: Max Planck Institute for the Study of Societies.
- Troy, Irene, 2010: Ein Markt für Patente? Unsicherheiten im Handel mit geistigem Eigentum. In: *Kongressband zum 34. DGS Kongress. CD-Rom*.
- Troy, Irene/Raymund Werle, Forthcoming: Wissen handelbar gemacht? Politik und Patente. In: Andreas Busch/Jeanette Hofmann (eds.), *Politik und die Regulierung von Information. PVS Sonderband 46*. Baden-Baden: Nomos Verlag.

