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Intermediaries and Innovation: Why they emerge and how they facilitate IP transactions on the markets for technology

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- Why they emerge and how they facilitate IP Transactions on the Markets for Technology

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Intermediaries and Innovation

- Why they emerge and how they facilitate IP Transactions on the Markets for Technology

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Abstract

With this paper we aim to contribute to the discussion about the difficulties that occur when trading technical knowledge and particularly patents. Currently one can observe that markets for technology have been sizable growing, transaction obstacles are still immanent and technology market intermediaries (TMI) emerge that develop new models aiming to facilitate Intellectual Property (IP) transactions. Why TMIs emerge and how they attempt to facilitate IP transactions however is not yet sufficiently understood. We propose theoretical explanations for these two questions building primarily on the contributions of Stigler (1951) and Williamson (1979). We argue that the growing markets for technologies on the one hand and immanent transaction obstacles on the other hand lead to further division of labor and thus foster the emergence of TMIs. Following Williamson (1979) we propose that the new transaction models developed by TMIs attempt to implement more standardized governance structures in order to diminish transaction costs. However it remains to be seen which of the newly developed models (or those to come) will survive and actually deliver more economic transactions.

Please note: The reader may excuse the extensive use of footnotes.

How IP Transactions support Innovation

Following the introduction of the 'innovation concept' in the economic literature by Schumpeter (2006) in 1911, nowadays firms have widely recognized that innovation is substantial not only to create and sustain a competitive advantage.[1] In order to create continuous growth firms have adopted innovation strategies and developed sophisticated management approaches to systematically and efficiently create innovation.[2]

[1] It is widely accepted that innovation has a substantial impact on economic growth. According to Carlsson and Eliasson (2003, p.1) "…economic growth results from the interaction of a variety of actors who create and use technology and demanding customers." Various countries (including the EU) have adopted innovation policies to support the interaction of the actors in their innovation systems. In the economics literature this trend is reflected particularly by the 'evolutionary economics' that follow the idea of Schumpeter treating innovation as an endogenous growth variable according to Gilbert and Katz (2007). On the contrary, as well the neo-classical economics accepted innovation although as exogenous growth variable. For a detailed elaboration of innovation in neo-classical economic growth models see e.g. Baumol (2002).

[2] While various definitions for innovation exist we understand innovation as defined by OECD (2005, p.46) as the "implementation of a new or significantly improved product (good or service), or process, a new marketing method, or a new organisational method in business practices, workplace organisation or external relations." Different typologies for

When firms have recognized the increased importance to continuously innovate, at the same time they are pressed by shortening development and product life cycles while products are characterized by increasing technical complexity.[3] These developments make it merely economically impossible for a single firm to internally develop all technologies necessary for a product and particularly the IPRs required to enable freedom-to-operate in order to prevent costly litigation.[4]

At the same time, various firms often undertake redundant research. If firms could assess technologies they need that were already developed by other market actors they could innovate more economically, wherefore an increasing number of firms is opening up their innovation processes[5] beyond the own firm boundaries. Particularly if innovation is understood as a cumulative, dynamic process[6] where firms assemble 'pieces' of complementary technical know-how (tacit and explicit) as well as IP assets[7], it becomes obvious that firms can innovate more economically if these 'pieces' could be acquired from different sources no matter whether they come from insight the own firm (including other business units) or from other market actors outside the own firm's boundaries (e.g. other firms, universities, independent inventors).[8] To limit the effect ever increasing product development costs firms have recognized that one might quicker and / or cheaper in-license technologies than developing them on its own.

An example are technologies that are actively used by their inventors but need to be embedded into other firms' products because they have been established as an industry standard. Those technologies can be acquired e.g. in-licensed or purchased to avoid redundant R&D. Even SMEs and start-ups might be acquired by large technology based firms and integrated into the own operations more economically than developing their technologies again.

At the same time certain technologies of the firm's own technology portfolio might be beneficial for other firms. Although a firm's 'willingness-to-exploit' (e.g. license or sale) might differ across technologies in the portfolio due to the fact that each technology could serve a different (strategic) purpose.[9] To

innovation exist, e.g. Granstrand (2000). Aside the existence of innovation in variety of domains (e.g. process, financial, social, service) we focus particular on technical product innovation, particularly those that can be protected by patents. For a review of the development of research on innovation and particularly on innovation processes during the last decades see e.g. Fagerberg and Verspagen (2009), Xu, Chen et al. (2007), Herstatt and Verworn (2004), Rothwell (1994).

[3] Lichtenthaler (2005), referring to Cesaroni, Gambardella et al. (2004), Granstrand (2004), Chesbrough (2003) and Grindley and Teece (1997) argued that the increasing technological content of products accompanied by shorter product and technology life cycles and more intense competition have encouraged stronger external knowledge exploitation. He argued that this 'knowledge push effect' has been intensified by a growing knowledge convergence and fusion, which have led to higher numbers of knowledge components from different areas being incorporated into a single product. According to Granstrand (2000, p.9) "products and services become not only increasingly based on new technologies, but increasingly based on many different technologies. That is, products and services become more multi-technological, or 'mul-tech'."

[4] This issue is known and discussed in the literature under the notion 'IP assembly problem' e.g. by Granstrand (2003, p.59), who argued that "intellectual property rights to sustain a business become increasingly fragmented among players."

[5] Parker et al (1996) noted that the high cost of internal R&D had encouraged companies to turn to independent inventors. Moreover, companies who intentionally or unintentionally find that their internal R&D efforts are limited to line extensions and marketing can gain access to the breakthrough ideas created by inventors who are not confined to the corporate context. More recently, Quinn (2000) highlighted the wisdom of outsourcing innovation. Rigby and Zook (2002) also argued for taking an 'open market' approach to innovation, which includes actively seeking inventions from external sources.

[6] According to Powell and Snellman (2004) our economy is increasingly reliant on the production, refinement, and accumulation of ideas. Murray and O'Mahony (2007, p.1008) argued that "for innovation to occur…innovators must have the ability to actually combine or accumulate knowledge." Green and Scotchmer (1995, p.20) noted that "knowledge and technical progress are cumulative in the sense that products are often the result of several steps of invention, modification, and improvement." Aghion, Harris et al. (2001, p.470) argued along the lines of Harris and Vickers (1987) and Budd, Harris et al. (1993) that "technological progress as emerging from a dynamic process of "step-by-step" innovation" and noted that in Schumpeterian (i.e. evolutionary) economics growth models innovation is often modelled as a "step-by-step" concept. According to Pénin (2008) similar concepts discussed in the literature are 'step-by-step innovation', 'multi-invention products', 'sequential innovation' and 'collective mode of innovation'. Already Schmookler (1966, p.vii) indicated the cumulative nature of technical knowledge for inventions as "the 'bits' that are added to the existing stock of knowledge." The cumulative nature of innovation has further been subject to research in relation to the policy debate concerning optimal patent breadth e.g. by Scotchmer (1991), Green and Scotchmer (1995), Chang (1995), O'Donoghue (1998) and Mazzoleni and Nelson (1998).

[7] When understand 'technology' as an assembly of those three elements to enable a technical purpose. The dichotomy of tacit and explicit knowledge has been introduced by Polanyi (1966). Rather more generically technology can be understood as defined by Schmookler (1966), i.e. as "the social pool of knowledge of the industrial arts. Any piece of technological knowledge available to someone anywhere is included in this pool by definition."

[8] This understanding of innovation through external technology sourcing is not particular new. Already Teece (1989, p.35) argued that "the institutional structure of innovation in capitalist economies is extremely variegated and involves a complex network of backward, forward, horizontal, lateral relationships and linkages within, among and between firms and other organizations…" Somaya and Teece (2001) argued that "inventions may be combined in such multi-invention products using three alternative organizational modes – viz., licensing of inventions, trade in components that embody inventions, or by integrated production."

[9] While technologies directly related to a firm's core competences and competitive advantage might not be allowed for ETE - or at least not to direct competitors - other technologies might not be

develop certain technologies firms might have spent resources although these technologies are not used at all by their inventors.[10] At least for those technologies firms can generate additional revenues to increase its R&D return ratio[11] through external exploitation.

However, when an increasing number of firms[12] started to become increasingly outward oriented and to adapt what is often labelled the 'open innovation' approach those firms feel the need to establish competences for an effective and efficient IP management particularly focused outside the own firm, i.e. on the management of IP transactions and external relationships with other market actors.[13] Firms thus face the need to acquire dedicated knowledge and competences about the management of external exploitation[14] (as well as acquisition) of technologies and particularly patents.[15]

According to Lichtenthaler and Ernst (2006) the management approaches developed so far are still in its 'infancy'. Firms face many obstacles when managing IP transactions. Aside from internal obstacles related to management processes and firms' innovation cultures (e.g. not-invented-here-syndrome)[16], valuation difficulties to assess market prices, identifying buyers, etc.) further obstacles relate to the management of inter-firm relations, the nature of technologies (and patents) as traded assets and the institutional structures of the markets for technologies[17] on which transactions commonly take place. The many obstacles ultimately result in high transaction costs lowering the firms' incentives to engage into technology trade thus preventing the efficient creation of innovation.[18]

To conclude, nowadays in industrial practice senior management has realized the importance of innovation. In order to maintain competitiveness in the innovation game and generate sustainable firm growth, an increasing number of firms attempts to exchange technologies within collaborations and networks outside the own firm's boundaries, i.e. opens up their innovation processes. While on the one hand firms increasingly source technologies from other market actors through 'external technology acquisition' on the other hand firms increasingly exploit own technologies outside the own firm's boundaries to other markets actors in need for

critical to the firm's competitive advantage and very well suit for external exploitation. For different strategic purposes of technologies within technology portfolios the reader might refer to e.g. Tschirky and Koruna (1998, chapter 4.2.10) who presented different typologies and approaches to classify technologies.

[10] It is a common assumption that along the innovation process the market actor who files for patent protection of a technical invention is the same who ultimately exploits the patented invention on the market turning it into an innovation. Empirical evidence proves that this is not the case. A dominant share of patents is not used directly by its inventors. Gambardella, Giuri et al. (2006) reported that 36% of the patents in there 'huge' sample of EU patents are not used internally or for licensing. While about one half of these patents (18.7%) may even assume a potentially high value as they help block competitors, the other half (17.4%) labelled 'sleeping patents' are left virtually unexploited. The Institut der deutschen Wirtschaft Köln (2006) proved that in Germany each fourth patent (24.6%) is not used at all. Chesbrough (2006, p.5) reported that in the "US over 95% of issued patents are unlicensed, and over 97% never generate any royalties."

[11] Bessy and Brousseau (1998, p.452) argued that "when an innovator is allowed to license his technology, he spreads it in the economic system, while at the same time he increases his return on innovation investments and efforts."

[12] Among the most cited cases is IBM. According to Shulman (2003) and Lang (2001) IBM's licensing revenues accounted for 20% of their total profits in 1999 and in the last decade in total for almost 8.2 b€. As another example Dow Chemicals is often cited. According to Roos, Edvinsson et al. (1997), the company set up an 'Intellectual Asset Function' in 1993 and obtained licensing revenues of 110 M€ in 2000 compared to 22 M€ in 1994. Another example is the Denmark-based healthcare firm Novo Nordisk A/S. According to Reitzig (2004) the firm built a dominant market position in Europe with diabetes drugs as the result of its license on a technology for manufacturing insulin from animal sources.

[13] In the 1990s and early 21st century many firms had realized the value of IP as corporate assets and their contribution to innovation. From 197 survey responses and 30 interviews with senior executives in the five principal regions across the world PWC (2007) reported that above 80% of all surveyed top manager agreed or strongly agreed with the statement that IP management is important to the success of the company. By today various firms have already shifted from a purely legally focused approach to administer patents towards an active IP management perceiving patents as economic assets and various IP management approaches have been developed, although primarily focused on internal processes (e.g. by Edvinsson and Sullivan (1996), Sullivan (2000), Teece (2000) and Reitzig (2004).

[14] In the literature various terms are used for essentially similar processes. These include 'deployment' e.g. by Escher (2005) and 'commercialization' e.g. by Lichtenthaler (2006).

[15] For example, Sheehan, Martinez et al. (2004) showed that compared with 10 years ago, the importance of out-licensing has grown in 51.4% of their surveyed companies. Furthermore, 63% of the respondents in their study expect this trend to continue and anticipate that out-licensing of patented inventions become more important for their companies in the next five years. This expectation is confirmed as well by the survey of PWC (2007) who reported that 54% or their respondents expect a growing importance of out-licensing in the next three to five years.

[16] For further reading about the NIH-syndrome see e.g. Lichtenthaler and Ernst (2006).

[17] Various terms are used by different scholars often in an almost similar meaning. Chesbrough (2006) used the term 'markets for IP', Gambardella, Giuri et al. (2007) used the term 'market for patents', Lichtenthaler and Ernst (2006) used the term 'market for knowledge', and Gu and Lev (2000) used the term 'markets in intangibles'. The use of different terminology further indicates the absence of clear and commonly accepted definitions in this field. Although we specifically focus on 'markets for patents' few solid research can be found on this specific term with one exception being Troy and Werle (2008). Thus we apply the term 'markets for technology' as used by most scholars in this field including A. Gambardella, O. Granstrand and D. Harhoff.

[18] According to Escher (2005, p.75) "companies often fail to initiate such an exploitation program due to market imperfections and high initial financial commitments."

them.[19] With firms' increasing activities to source and exploit technologies outside the own boundaries, the importance of IP in general and of its efficient trade on the markets for technologies is gaining importance. Firms feel the need to manage the transactions and relationships with different market actors particular along the later stages of the innovation process.[20] However, those transactions are still characterized by various obstacles prohibiting efficient market clearing through high transaction costs.

Thus, in order to develop innovation more economically IP transactions need to ensure a better resource allocation to efficiently match those market actors owning technologies and patents with the actors who possess the necessary complementary resources to exploit the patented inventions into innovation.

Growing Markets for Technology, Transaction Obstacles and the Emergence of Intermediaries

Although markets to exchange technologies and IP have existed for decades[21] empirical data from various sources indicates that they have grown sizably just recently since the 1990s[22], especially in some high-technology areas.[23] Arora, Fosfuri et al. (2001, p.40) compared estimates at an aggregated level from three different data sources, which were "subject to numerous caveats" but rather led to consistent results. Limiting their analysis to technological knowledge, their estimates indicated annual worldwide markets for technology in the range of US$ 35-50 billion in 2000. In addition, Elton, Shah et al. (2002) and Kline (2003) estimated that the overall US patenting licensing revenues have 'skyrocketed' from below US$ 15 billion per year at the beginning of the 1990s to around US$ 100 billion a year in 2002. Results from a survey by Sheehan, Martinez et al. (2004) indicated that the majority of 81% or the responding companies expected an increasing number of out-licensing transactions from 2005 to 2010, while 54% of the respondents have experienced a growth of out-licensing since 1995. A recent study by Institut der deutschen Wirtschaft Köln (2006) estimated that the German market for technology has a potential size of € 8 billion. Gambardella, Giuri et al. (2006) estimated that the market for the EU-8 countries was € 9.4 billion in 1994-1996, 12.7 in 1997-1999, and 15.6 in 2000-2002, which corresponds to 0.16%, 0.19%, and 0.20% of the GDP, and a total growth between the third and the first period of 65%. According to Gambardella, Giuri et al. (2006, p.V) "the total value of patents licensed has increased considerably in these industries in the 1990s, suggesting that the markets for technology in these sectors are growing at a significant pace." Athreye and Cantwell (2007) have compared the growth of non-US patens and worldwide licensing receipts and came to conclude that the growth of patenting coincided with the growth of markets for technology after 1980s.

Moreover, the growth can be expected to continue in the future. Gambardella, Giuri et al. (2006) estimated that the market for technology in Europe could be larger by 50%, i.e. the potential has grown from US$ 14.8 to US$ 24.4 billion. The potential market suggests that there are notable untapped opportunities for enhancing the market for patents in Europe, and correspondingly for using this means in order to increase the rate of utilization of patents.

Other scattered evidence indicates further the growing importance of intangible assets, IP and patents in particular. The evidence includes reports of extensive licensing revenues of few large companies, on the forefront IBM as often quoted example.[24]

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[19] As early as Granstrand and Sjölander (1990) suggested a typology for technology acquisition and exploitation strategies, followed by a period of intense academic writings on IP acquisition throughout the 1990s (e.g. Granstrand (2004)), it took until 2003 when Chesbrough (2003) labelled the concept 'open innovation' any a wider range of firms realized the importance to open up innovation processes. Following few successful firms like P&G nowadays firms act in wide networks trying to source ideas and IP for new products and newly developed technologies from external parties including universities, other firms (including start-ups), leading clients and individual 'lead users' (see e.g. Herstatt and E.v.Hippel (1998)). According to Murray and O'Mahony (2007, p.1008) "with a shift toward 'open innovation' … contributors to innovations are more likely to come from different types of organizations (e.g. Powell, Koput et al. (1996), Owen-Smith and Powell (2003)) and across individual and firm units of analysis (Rosenkopf, Metiu et al. (2001))."

[20] In the early stages of the innovation process rather ideas are exchanged than technologies. Cf. e.g. Herstatt (2007).

[21] Even at the beginning of the 20th century organized markets for technology have existed according to the extensive study by Lamoreaux and Sokoloff (1998). Just when Arora, Fosfuri et al. (2001) published their comprehensive data compilation on this topic, the phenomena started to attract attention from a wider range of scholars as well as policy makers likewise.

[22] To explain the reasons behind the growth effect is out of the focus of our study and remains an open question so far.

[23] E.g. pharma firms rely extensively on outside knowledge for their products according to Ceccagnoli, Graham et al. (2009). However, we like to note that the size of the markets for technology, respectively for intangible assets, patents and licensing remains difficult to determine. Besides the absence of solid measures to systematically collect data, few studies have tried to approximate the market size and so far only few official statistics are collected by international authorities e.g. EUROSTAT on a regular basis.

[24] While among the top patent holders in the world, its licensing revenues until 1993 amounted to approximately $300 million a year. This changed drastically in 1993 when under the newly appointed CEO Lou Gerstner, IBM embarked on an aggressive licensing programme that he expected to yield US$1.4 to US$ 1.5 billion in 2000 according to (Salomon Smith Barney report on

Furthermore, the dynamics in the market for technology are illustrated by the controversial discussions about the abuse of the patent system appearing from enormously huge litigation cases particularly in the US[25] but to some extent as well in Europe were 'patent trolls' recently have filed infringement cases against large firms pressing for damages and licensing royalties.[26]

However most of the studies that were conducted to better understand technology trade on firm level either from the seller (e.g. Lichtenthaler (2006), Escher (2005)) or the buyer perspective (e.g. Granstrand, Bohlin et al. (1992)) or on national level (e.g. Gambardella (2002), Granstrand (2004)) came to similar conclusions. The market constellation, including the traded good and the institutional structure are today far from optimal. Many obstacles are still present that inhibit markets to clear efficiently.

According to Troy and Werle (2008, p.3) the "well-functioning market for patented new technological knowledge is confronted with several obstacles knowledge" and the "markets are far from functioning smoothly." Teece (1998, p.545), referring to his early work Teece (1981) noted that already almost 20 years earlier he had recognized the "first signs for an emerging market for know-how", however at the same time had stated that "much technology does not enter it … either because the firm is unwilling to sell or because of difficulties in transacting in the market for know-how." Teece (1998, p.62) still noted similar circumstances, i.e. that "the market for know-how is riddled with imperfections…" and "one class of assets that is especially difficult, although not impossible, to trade involves knowledge assets."

Furthermore, recently on the markets for technology the emergence of a new type of specialized market actors, which we label technology market intermediaries (TMI) could have been observed.[27]

OECD, BMWI et al. (2005, p.10) pointed out that recently "market intermediaries have become more numerous and diverse as demand for technology transfer and patent valuation have grown." According to the EPO, OECD et al. (2006, p.1) "the IP marketplace is nowadays in a probe and learn period where the number of intermediaries is rising." EPO, OECD et al. (2006) drew further attention to the raise of new business models which those intermediaries apply. Examples of TMI models mentioned in that study include partnerships or technology pools to special purpose investments vehicles, auctions, publicly traded IP indexes as well as patent value funds which aim at taking care of IP logistics issues (e.g. finding and negotiating with potential licensees) whilst filling in the financial gap needed to allow the necessary managerial efforts preceding the commercialization of new products, i.e. identifying potential licensors, establishing contacts and negotiating with them up to the closing of a transaction. According to EPO, OECD et al. (2006, p.1) these new models "make one step forward towards the development of a market for IP transfers …[and]… contribute to the maturation of the IP market."

Aside from governmental organizations, scholars from this field have as well recognized this trend. Koruna (2001) observed that with new services and instruments on the market the process of externally exploiting technologies is getting easier and thus will probably also gain more acceptance among companies. Chesbrough (2006, p.3) reported "that a small number of intermediary firms have arisen in recent years to assist in the process of identification, negotiation, and transfer of patents from one firm to another." Troy and Werle (2008, p.20) noted that "the number of intermediaries is growing, as is the propensity of firms to employ specialized intellectual property professionals. These and other actors potentially involved in patent transactions gain trading experience, experiment with different modes of trade, and invent ways to cope with uncertainty."[28]

IBM, June 22, 1999). Given the substantially higher gross margin on licensing revenues than on other kinds of IBM revenues, the contribution to the bottom line of patent royalties can be regarded as considerably larger than those of other revenue sources. Thus, while IBM's royalty revenues represent about 1.5% of its 2000 total revenues, royalty income accounts for about 13% of IBM's pretax net income. Cf. Gu and Lev (2001)

[25] Various examples exist, e.g. in late 2001, Research in Motion (RIM), the Blackberry manufacturer was sued by the 'non-manufacturing entity' NTP for infringing on its patents "covering the use of radio frequency wireless communications in e-mail systems." In 2006, the case was settled RIM paying US$ 612.5 million to NTP. In another high profile patent case, Intel reached a US$ 525 million settlement of a suit alleging that Intel's Pentium family of microprocessors infringed Intergraph's patents. Cf. Gilbert and Katz (2007).

[26] In 2008 one of the first high-number infringement cases started in Europe when IP-Com sued Nokia at the German patent court in Mannheim for infringing about 1,000 patents of about 150 patent families. IP-Com, who bought the patents in 2006 from Robert Bosch GmbH and claims € 12 billion damages.

[27] We define TMIs based on an extensive literature review as "private firms specialized in intellectual property that provide services to primarily technology based firms in order to facilitate the external exchange of intangible assets, predominantly without adding value or holding property of the asset, excluding services provided typically by patent law firms (e.g. all services related to the patent application procedures and patent litigation court cases)." Thus, our definition focuses on private firms and excludes government support vehicles and TTOs set up by universities as well as patent law firms offering their 'classical' legal services (e.g. patent filing, prosecution and litigation).

[28] We like to note that the emergence of intermediaries is not special to markets for technology when markets do not clear

However, few statistics were available to us documenting this trend by strengthening the anecdotal evidence. Therefore we collected own data throughout a pre-study in December 2006. Based on interviews with a range of industry experts we identified about 70 TMIs with the growth rate of those firms measured by the year of their foundation. Our results confirm the trend. An approximated exponential curve fit indicates an annual 'birth rate' of 8% of TMIs appearing on the markets for technology starting from 1980.[29]

An example for a recently developed model to facilitate IP transactions is the public patent auction model. After in spring 2006 the first widely recognized public multilot patent auction took place in San Francisco, US This model has gained particular interest[30] not only in the community of IP experts. Since then at least twice a year those auctions were held not only in the US but also in Europe and Asia. Sales generated through six auctions between spring 2005 and autumn 2007 accumulated to more than € 30 million.

Explaining recent Trends

Having observed the recent growth of the markets for technology, the still persisting transaction obstacles and the emergence of TMIs we were interested to understand why TMIs actually emerge and how they impact IP transactions. In the following we propose an explanation attempting to explain the emergence of TMIs on the one hand and propose an explanation of how TMIs attempt to facilitate IP transactions and thus contribute to more economical creation of innovation.

Why TMIs Emerge

In order to explain the emergence of TMIs, we believe that the notion of Stigler (1951) provides a valuable argumentation. Stigler (1951) formalized the Smithian notion that the specialization depends on the size of the market and thus provided a widely applied[31] theoretical foundation with roots back to Smith (1776). Accordingly market growth can lead to further specialization of the division of labor, i.e. to the emergence of new market actors, e.g. intermediaries that specialize on certain dedicated tasks.[32]

Within his seminal paper, Stigler (1951, p.142) defined the firm "not among the markets in which it buys inputs but among the functions or processes which constitute the scope of its activity." Stigler (1951) argued that the different processes are characterized by different average cost functions, i.e. he differentiated among three types ('falling continuously', 'rising continuously' and 'conventionally U-shaped'). Similar processes are characterized by increasing or diminishing returns. Based on the respective cost and return structure, Stigler (1951, p.143) suggested that firms abandon "functions subject to diminishing returns… [where the]… cost of the final product does not diminish with output… allowing another firm (and industry) to specialize in them to take full advantage of increasing returns."[33] However, at any given time these functions, i.e. the sales of the product/service may be too small to support a specialized merchant; the output of a by-product may be too small to support a specialized fabricator; the demand for market information may be too small to support a trade journal. In these cases, the firm must then perform these functions for itself. However, Stigler (1951, p.188) argued that "with the expansion of the

efficiently. E.g. in agricultural markets Klerkx and Leeuwis (2008, p.260) reported that "due to market and systemic failures, both supply side and demand side parties in this market have experienced constraints in effecting transactions and establishing the necessary relationships to engage in demand-driven innovation processes. To mitigate these constraints, a field of intermediary organizations has emerged to assist agricultural entrepreneurs to articulate demand, forge linkages with those that can provide innovation support services, and manage innovation processes.

[29] Counting for 80% of the TMIs, by for the majority of the TMIs seem to be based in the US clustering around two centres at the west and east coasts. While a considerable number of them are concentrated around Silicon Valley at the west coast, another cluster is concentrated at the east cost including New York and Massachusetts. The TMIs that are not based in the US are mainly European and Canadian firms. In Europe the British and Germans encounter the majority. Several TMIs hold regional offices in Europe, Japan, China and East Asia. A description of the sample can be found in Tietze and Barreto (2007). Founding dates could be identified for only 60 TMIs of the whole sample.

[30] Auctions, as one of the oldest negotiation mechanisms, appear suitable to trade assets in various fields and in multiple contexts. Traditionally, among the most prominent assets traded via auctions are art, antiques and wines. However, in recent years auctions have been applied for an increasing range of tangible (e.g. second hand industrial machinery to third world countries, real estate properties, see e.g. Azasu (2006), Shenkar and Arikan (2006)) but as well for intangible assets, including e.g. various types of services (e.g. craftsmen services for house repair, travel services, software developer services, problem solving services) or IP assets (e.g. patents, 3G licences, see e.g. Klemperer (2004), Milgrom (2005)). Furthermore, McClure (2008, p.102) argued that "the current wave of activity in the IPR market. IPR auctions have attempted to commoditize IPRs."

[31] On 26.08.2009, Google Scholar reported 1.118 citations of this paper.

[32] Coase (1937) had argued that firms emerge when transaction costs, a firm exists if the transaction costs are reduced compared to pure market coordination. Accordingly, an intermediary exists if its activities induce a reduction of transaction costs between the market actors, thus enhance the outcome of the market.

[33] This argumentation, i.e. a forward disintegration of certain processes to specialized firms appears to be the basic argument of what is known today as the concept of 'outsourcing'. Cf. e.g. Akehurst (2008), Holcomb and Hitt (2007), Mahnke (2001).

industry, the magnitude of the function subject to increasing returns may become sufficient to permit a firm to specialize in performing it." The firm will then abandon the process (disintegrate), and a new firm will take it over. Thus, throughout an industry development disintegration might appear during a growth phase and reintegration most likely during a decline phase.[34]

We believe that we can apply the general theoretical argumentation provided by Stigler (1951) to explain the recent emergence of TMIs on the markets for technology.

We have seen that currently three phenomena can be observed on the markets for technology where IP transactions are commonly conducted. Firstly, empirical evidence proves that currently, respectively since the last decade the markets for technology have been sizably growing. Secondly, evidence proves that firms encounter various obstacles within IP transactions. Among others uncertainty and asymmetric information lead to high transaction costs for IP transactions. Thirdly, we have observed the emergence of TMIs, as a new type of market actor that offer new services on the markets for technology.

Following the notion of Stigler (1951) and the previously presented evidence we argue that the emergence of TMIs should be interpreted as a result of the first two phenomena.[35]

The growth of the markets for technology is the basis for the argumentation. Following Stigler (1951, p.189) "vertical disintegration is the typical development in growing industries" so that "specialism of firms may take the form of transactioning with a narrower range of products as well as performing fewer functions of the same range of products." Thus, we argue that recently the trade of IP and technical knowledge on the markets for technology appears to have reached a sufficient size to open up business opportunities for specialized firms. Those business opportunities constitute an incentive large enough for TMIs to develop specialized business models for certain parts of IP transactions. This institutional change can thus be understood as vertical forward disintegration (outsourcing) of certain tasks of IP transactions, i.e. contracting with TMIs might be cheaper for the firms owning IP than performing those IP transactions completely with in-house resources.

We argue further that this impact has a cyclical impact on the obstacles within IP transactions. Hopefully, depending on any specific 'new' transaction model, this impact will be positive in sum (i.e. lower overall obstacles) in order to facilitate IP transaction efficiency, having in mind that the nature of the 'new' transaction models might impose additional obstacles into IP transaction processes (e.g. particularly due to increased complexity and coordination efforts). Increasingly efficient transactions would then support firms to exchange IP assets more frequently and ultimately contribute to more efficient creation of innovation through a more economical exchange of technologies.

However, it appears unlikely that firms will be able to abandon all process tasks they previously performed in-house. Referring to Stigler (1951), firms will preferably outsource those tasks that do not represent increasing returns or diminishing costs, but retain tasks which might include further the governance (coordination and communication) of the transaction process and tasks where the IP owner needs to deliver technical, economic and legal information about the technology (e.g. as input to the due diligence to potential buyer). The firm will only agree to the forward disintegration if either the earnings from successful transactions are significantly higher, the transaction success rate increases significantly or the transaction costs (including fees charged by TMIs) are significantly reduced. According to Stigler (1951, p.143) specialized firms "cannot charge a price for the process higher than the average cost of the process to the firms which are abandoning it." Only if TMIs manage to prove a sustainable business case, their business model can survive in the long run.

How TMIs impact IP Transactions

Having proposed a possible explanation for the emergence of TMIs, we continue to propose an explanation of how TMIs attempt to make IP transactions more economically on the micro level of the firm. To explain the impact we believe that the argumentation provided by Williamson (1979, p.234) can be applied.

Williamson (1979, p.239) argued that "governance structures - the institutional matrix within which transactions are negotiated and executed - vary with

[34] Since the early 1950s, the discussion of disintegration has carried on until today. Particularly since the mid 1990s with the increased performance of ICT and the globalisation in many industries "services previously undertaken in-house within organisations are outsourced to specialist firms" according to Akehurst (2008, p.6). Although today outsourcing is considered by many scholars to have driven the growth of business services (e.g. Martinelli (1991), Rajan and Pearson (1986)) the theory is not without critics and doubts. Some empirical studies have reaches inconsistent results (e.g. Bryson, Keeble et al. (1993), Levy (1984), Stuckey (1983), Tucker and Wilder (1977)) and e.g. Perry (1989) questioned the way Stigler had defined 'specialization'.

[35] Although probability the relationship should not be understood as a unidirectional causal relationship. A more meaningful assumption would rather be that the causal relationship between these phenomena must be seen as mutual reinforcing.

the nature of the transaction." According to Williamson (1979) the choice of the governance structure depends mainly on the asset specificity and the frequency of transaction of a traded asset. According to Williamson (1979) the crucial investment distinction is to what degree transaction-specific (nonmarketable) expenses are incurred. Assets that are unspecialized among users pose few hazards, since buyers in these circumstances can easily turn to alternative sources, and suppliers can sell output intended for one order to other buyers without difficulty. Nonmarketability problems arise when the specific identity of the parties has important cost-bearing consequences. Williamson (1979) referred to transactions of this kind as 'idiosyncratic'. Occasionally even the identity of the parties is important from the outset, as when a buyer induces a supplier to invest in specialized physical capital of a transaction-specific kind. Inasmuch as the value of this capital in other uses is, by definition, much smaller than the specialized use for which it has been intended, the supplier is effectively 'locked into' the transaction to a significant degree.

Williamson (1979, p.239) then concluded that that while "simple governance structures should be used in conjunction with simple contractual relations and complex governance structures reserved for complex relations seems generally sensible. Use of a complex structure to govern a simple relation is apt to incur unneeded costs, and use of a simple structure for a complex transaction invites strain." Williamson (1979, p.247) then proposed a typology of governance structures. He considered three broad types of governance structures: non-transaction-specific, semi-specific, and highly specific. The market is the classic non-specific governance structure within which "faceless buyers and sellers . . . meet ... for an instant to exchange standardized goods at equilibrium prices." By contrast, highly specific structures are tailored to the special needs of the transaction. Identity here clearly matters. Semi-specific structures, naturally, fall in between. Thus, to a large extent the choice of any governance structure depends on the asset specificity, i.e. whether an asset is a commodity of highly specific. [36]

We argue that the emergence of TMIs, i.e. the institutional change on the markets for technology has an impact on the governance structures of IP transactions, i.e. that TMIs develop "alternative institutional modes for organizing transactions" according to Williamson (1979, p.234).

Following the notion of Williamson (1979) patents must be understood as assets with a high specificity. Firstly, patents constitute an intangible asset, which are usually harder to value than tangible assets. In addition their unique nature (i.e. patents must be novel to the world) make it even more difficult to value them what relates to the question of what can be patented, i.e. in order to be patentable a technical invention has to be novel, applicable and non obvious[37] where patents can be granted on products (parts, applications, chemical substances, etc.) or processes (production processes, etc.)[38]. Thus, Reitzig (2003, p.18) noted that "it is known that the value of a patent is highly idiosyncratic." These patent characteristics are furthermore reflected by the characteristics reflected in the governance structures commonly employed when trading patents.

Particularly due to the nature of patents, prior to the emergence of TMIs, following the notion of Williamson (1979) governance structures of IP transactions need to be understood as of idiosyncratic nature. Due to the various obstacles discussed earlier that permit efficient IP transactions over long time idiosyncratic governance structures had emerged to trade IP as economically as possible. Due to the high asset specificity of patents, most IP transactions were conducted in private, bilateral settings. These bilateral transactions allow for contracts to be individually adjusted to specific needs and requirements of the involved actors, i.e. as idiosyncratic transactions take the nature of relational contracts.

We argue that the 'new' transaction models developed by TMIs attempt to facilitate IP transaction efficiency by shifting the governance towards more standardized non-specific or at least semi-specific structures. Taking patent auctions as one particular example for a new model developed by TMIs to facilitate IP transactions, we argue that two changes impact the nature of IP transactions when TMIs become involved. Firstly, the sellers and buyers of IP are not anymore directly connected. Thus the nature of the transaction becomes 'indirect' and in the case of auctions rather multilateral (involving various bidders) than bilateral. Secondly, auctions implement more standardized governance structures of IP transactions through the use of standardized legal frameworks (including standardized contracts with lump sump payments). Thus, patent auctions can be

[36] For a recent discussion of asset specificity see Ruzzier (2009).

[37] In the US the invention has to be novel, non-trivial and has to have commercial application.

[38] Since the emergence of new matters as integral part of today's GDP in many countries e.g. software, biotechnology on governmental level a discussion is currently ongoing whether other matters should be patentable as well. However, this issue is still controversial. In the U.S. software can be patented since 1981 and methods-of-doing-business (MDB) since 1998. In Europe however, software could not be patented until fall 2003 and MDB business patents are not accepted so far according to e.g. (Granstrand 2000) and Pitkethly (2001).

interpreted to employ at least semi-specific governance structures where highly specific assets are traded as 'spot market transactions' according to Williamson (1979).

Part IV : Conclusions

To summarize, recent market developments force technology based firms to continuously innovate. However, innovation is a cumulative process that increasingly requires the combination of internally developed technologies with externally acquired ones, particularly for increasingly complex products. Firms increasingly innovate openly to maximize their returns of R&D investments, wherefore efficient technology acquisition and external exploitation is becoming increasingly important.

Although growing markets for technology indicate increasing technology trade activities, various obstacles still prohibit efficient transactions. The current status can therefore hardly be considered to be supportive to innovation and firm growth. Currently TMIs emerge as a new type of markets actors.

For patent auctions we have argued that in spite of the obstacles inherent from the nature of patents and the protected technical inventions, the auction model attempts to shift the governance structures of 'classical' IP transactions from highly specialized, individually designed 'idiosyncratic' transactions towards more standardized, 'transactional' governance structures in order to decrease transaction costs.

How TMIs, and patent auctions as a particular model impact IP transactions and whether those contribute to more efficient market transactions remains to be seen and is further subject to our ongoing research where we attempt to derive implications for whom we believe are the main stakeholders, i.e. particularly top level management positions concerned with IP and innovation strategy of technology based firms, TMIs themselves, but further policy makers concerned with innovation policy and the academic community.

Whether all types of patents can be traded though any of the newly developed transaction models - with the governance structures including transaction processes and contract designs - remains an open question. Indications at least exist that this might not be the case, but that some models, e.g. auctions are suitable only for certain types of patents. Thus, we will continue to investigate how patent auctions can support to develop inventions into innovation more economically.

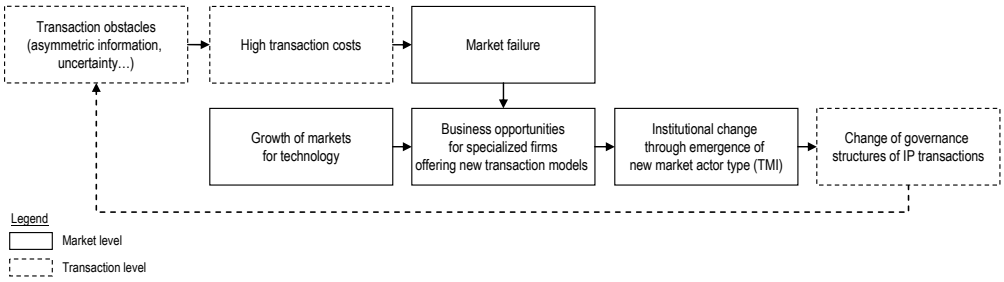

Figure 1 - Why TMIs emerge and how they impact IP transactions

The involvement of TMIs in IP transactions changes the nature of the transactions from 'direct' to 'indirect'. Furthermore, the new transaction models developed and offered by TMIs to technology based firms attempting to facilitate IP transactions by circumventing or diminishing the present transaction obstacles.

The emergence of TMIs can be interpreted as institutional change, i.e. a forward disintegration of the IP owners who 'outsource' certain tasks to TMIs. This 'new' division of labor between IP owners, buyers and TMIs on market level has an impact on the governance structures of IP transactions on the micro level of the firm, i.e. how firms manage IP transactions. The argumentation of this paper comprising both these elements is illustrated in Figure 1.

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