HOW TO ENHANCE PATENT COMMERCIALISATION? AN ANALYSIS OF PATENT AGGREGATORS IN EUROPE

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In this study, we investigate the phenomenon of patent aggregators, entities that license or acquire patents from third parties with the goal of commercialising them through sale, licensing, enforcement, or the creation of new patent-based companies. We classify patent aggregators into four distinct types according to the following two main dimensions: the level of value added to a technology and the aggressiveness of their commercialisation strategy. We then construct a comprehensive map of patent aggregators established in Europe and analyse four case studies in greater depth. We discuss and compare characteristics of patent aggregators, their patent aggregation and commercialisation strategies, their main barriers and key success factors. Our findings lead to several policy and managerial recommendations.

Keywords: Technology commercialisation; technology transfer; intellectual property; patents; patent aggregators.

Introduction

Recent decades have been characterised by an increasing awareness of the strategic importance of intellectual property (IP) (Rivette and Kline, 2000). The

use of IP within firms has developed from primarily an internal use and defensive application (e.g., securing in-house exploitation and production by limiting infringement and imitation) to an external use and more strategic role (e.g., IP licensing, sale or obtaining an external source of finance).

The development of new markets for technologies has generated a variety of arrangements for the use and exchange of IP-based technologies (Arora *et al.*, 2001; Munari *et al.* 2015). New types of players with different roles have appeared in the technology marketplace. Among them, patent aggregators have played an innovative and prominent role. They include companies that generally do not develop and produce technologies and goods themselves, but instead aggregate large portfolios of patents developed by other companies and then exploit them by means of licensing, selling, or asserting their ownership (Kelley, 2010; Ruther, 2012; Holden, 2011). These types of patent aggregators could potentially act as technology transfer intermediaries and create liquidity in the technology marketplace (Yurkerwich, 2008).

Despite an emerging discussion both in the academic and business literature, it is still poorly understood whether these patent aggregators are effective and beneficial to the economy. Understanding this type of economic actor in greater depth is particularly important for both practical and theoretical reasons. On the one hand, there is ample evidence that the vast majority of patents remain unused and do not produce economic returns for their owners (Gambardella *et al.*, 2007; Gambardella *et al.*, 2008; Giuri *et al.*, 2013). This problem is particularly relevant to some specific actors, such as SMEs, universities, and public research institutes, which could benefit substantially from their financial and managerial support. Moreover, an analysis of patent aggregators could shed light on a series of specific limitations of the markets for technology, such as issues of fragmentation, uncertain ownership, and difficult valuation and assertion (Shapiro, 2001; Arora and Gambardella, 2010; Gallini and Wright, 1990; Gans *et al.*, 2008; Gans and Stern, 2010; Munari and Toschi, 2014). On the other hand, there are several concerns that some of these patent aggregators could ultimately lead to unintended consequences concerning innovation and economic and social welfare (Duff *et al.*, 2008; Henkel and Reitzig, 2008; Wang, 2010; Bessen *et al.*, 2012).

There is still limited knowledge about the functioning, characteristics, and success of the variety of patent aggregators who have emerged in recent years. In addition, empirical insights into these types of patent aggregators, especially in the European context, are still scarce. In particular, only a few studies have attempted to identify and analyse patent aggregators (e.g., Buchtela *et al.*, 2010; Gassmann *et al.*, 2011). However, these studies generally provide only scattered examples or anecdotal evidence. To our knowledge, there is no study that attempts to systematically map and classify all patent aggregators in Europe.

The paper aims to shed light on the phenomenon of patent aggregators and contribute to the existing literature in several dimensions. We first introduce a classification of patent aggregators using two main dimensions, namely, the level of value added they provide in the development of a technology and the aggressiveness of their patent commercialisation strategy. Using such dimensions, we classify patent aggregators into the following four distinct types: technology development patent aggregators (TDPAs), technology trading patent aggregators (TTPAs), offensive patent aggregators (OPAs), and defensive patent aggregators (DPAs). We then map patent aggregators established in Europe, selecting four of them to develop qualitative in-depth case studies that allow us to compare their characteristics, patent aggregation strategies, and patent commercialisation strategies, main barriers, and key success factors. We argue that our study will contribute to better understanding the patent aggregator businesses and in assessing their role in fostering technology markets in Europe. The findings of this study lead to several policy and practical recommendations.

The paper is structured as follows. First, we review the literature and provide the classification of patent aggregators used for our analysis. Secondly, we describe our methodology to map patent aggregators established in Europe and to develop case studies. Thirdly, we report a mapping of patent aggregators in Europe and discuss their characteristics. Finally, we present four case studies to better illustrate and compare differences in patent aggregator strategies. We conclude by discussing policy and practical implications derived from our analysis.

Literature Review

Patent aggregators are relatively new players in the technology market. For the purposes of this study, we define patent aggregators as organisations that invest in the acquisition of externally developed patents (i.e., third party patents) with the aim of leveraging and monetising them by means of sale, licensing, assertion/enforcement of ownership, or the creation of new patent-based companies.[1] The literature relevant to studying patent aggregators is fragmented and lies at

[1]In this definition, acquisition of patents is used as a general term for both acquiring the ownership rights and acquiring the commercialisation rights for a patent through means such as an exclusive licensing agreement. When the patent aggregator acquires the original IP ownership rights, those rights are reassigned from the original patent owner to the patent aggregator. However, when the patent aggregator acquires only the commercialisation rights, the ownership rights remain with the original patent holder, and the patent aggregator usually concludes an exclusive licensing agreement to exploit, commercialise, or enforce a patent (Ruther, 2012).

the intersection of various domains such as IP management, IP law, markets for technologies, and patent marketplace intermediaries. It can be divided into three groups. The first group of studies has a relatively broad scope and considers various types of patent marketplace intermediaries, including patent aggregators, patent pools, brokers, auctions, online patent exchange platforms, etc. (Millien and Laurie, 2008; Benassi and Di Minin, 2009; Yanagisawa and Guellec, 2009; Kelley, 2010). The second group of studies that focuses on multiple types of patent aggregators is the most relevant for our research (Buchtela *et al.*, 2010; Gassmann *et al.*, 2011; Ruther, 2012). For instance, Gassmann *et al.* (2011) provide a classification of patent intermediaries aggregating patent portfolios that includes patent pools, defensive patent funds, patent enforcement companies, trading patent funds, and incubating patent funds. In turn, Ruther (2012) classifies patent aggregating firms into eight categories: patent trading funds, patent acquisition company, royalty monetisation company, patent incubating fund, patent enforcement company, DPA, patent pooling company, and non-commercial patent aggregator. Buchtela *et al.* (2010) classify for-profit patent funds into technology development funds and technology trading funds and non-profit patent funds into patent funds with and without returns. Finally, the third group of studies (Rubin, 2007; Henkel and Reitzig, 2008; Geradin *et al.*, 2011; Bessen *et al.*, 2012; Pohlmann and Opitz, 2013; Fisher and Henkel, 2010; Papst, 2013) focuses on a specific type of patent aggregators known in the literature as patent enforcement companies (or patent assertion entities, patent litigation companies, patent sharks, and patent trolls).

However, such literature still presents several gaps. First, the majority of the studies focus on patent aggregators in the United States. Although the literature provides some scattered examples of patent aggregators in Europe (e.g., Buchtela *et al.*, 2010; Gassmann, 2011; Ruther, 2012), there is no comprehensive list or mapping of them. Therefore, another important contribution of this study is in developing a map of patent aggregators established in Europe. Secondly, because only a few recent studies adopt a case study approach in their analyses of patent aggregators (e.g., Ruther, 2012; Pohlmann and Opitz, 2013), we do not know much about their characteristics, functioning, strategies, or performances. In this study, by conducting interviews and developing in-depth case studies, we describe and compare the basic characteristics of four types of patent aggregators, their patent aggregation and commercialisation strategies, their main barriers, and their key factors for success.

A Classification of Patent Aggregators

As discussed earlier, in this paper, we would like to focus on different types of patent aggregator business models without expanding to other types of patent

marketplace intermediaries or narrowing to only a few specific types of patent aggregators. Therefore, our classification of patent aggregators is similar to some extent and draws significantly upon the classification of patent aggregating companies proposed by Ruther (2012) and the classification of patent intermediaries aggregating patent portfolios proposed by Gassmann *et al.* (2011). However, unlike Ruther (2012) and Gassmann (2011), we do not include patent pools that aggregate patents owned by pool participants in our classification of patent aggregators. Moreover, we propose a novel classification based on the following two main criteria: the extent to which value is added to the patents and the level of aggressiveness in patent commercialisation activities undertaken by the patent aggregator. The first dimension refers to how much the patent aggregator invests in the development and maturation of the patents in its portfolio to increase the value of that technology for potential buyers and licensors. The second dimension refers to whether the patent aggregator opts for "stick licensing" approach and threatens to sue the potential licensee for patent infringement if that potential licensee does not take a license.

Although patent aggregators differ in many aspects of their patent aggregation and commercialisation strategies, these two dimensions allow them to be clearly distinguished and classified. Extending the previous review of the literature, we thus propose a classification that includes the following four categories, as highlighted in Fig. 1.[2]

TDPAs, also known as incubating patent funds, acquire patented technologies, invest in their incubation to make them more attractive to industry players and commercialise them through sale, licensing, or the creation of new ventures. In other words, the business model of TDPAs can be characterised as "acquire, develop, and commercialise". They undertake all necessary steps such as technology development and the implementation of monetising and exploitation strategies (Buchtela *et al.*, 2010). TDPAs pursue an "asset picking" approach with the intention of concentrating on few, but high quality and promising patents and technologies.

To some extent, TDPAs attempt to close the gap between a technical invention and its market recognition and commercial exploitation, also known as the "valley of death" (Markham, 2002). The "valley of death" can also be defined as a fatal

[2]We should note that it can sometimes be difficult to specifically assign an organisation to a particular patent aggregator type because some of them may pursue multiple business models and strategies over time. However, for the purpose of our analysis, we classify each organisation within a single category based on the prevailing business model at the time of its establishment. For instance, some patent aggregators that were initially established as TTPAs may later start behaving as OPAs, but in this paper, they are classified as TTPAs.

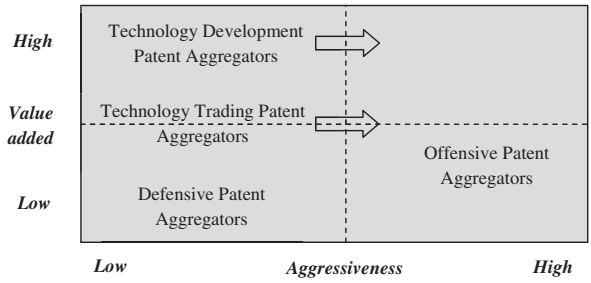

Fig. 1. Characteristics of patent aggregators.

gap between proof of concept and the start of mass production, especially for science-based inventions (Buchtela *et al.*, 2010). The financial endowments of TDPAs make it possible for them to invest in the development and maturation of the patented technologies in their portfolio (for instance, by supporting technical validation, prototyping and testing, demonstration activities). Once a patent or a patent portfolio is acquired, it goes into development, which means that before and during any commercialisation, there is an incubation process to develop the technology. Some TDPAs commercialise acquired patents only by selling or licensing them to third parties, whereas others are more entrepreneurial and acquire patents to commercialise and monetise them through the creation of new firms. After selecting strategically valuable patents and undertaking technology maturation activities, these patent aggregators create portfolio companies. Similar to traditional VC or private equity firms, in this case, the revenue comes either through the sale of a portfolio company or an IPO exit strategy (Millien and Laurie, 2008).

TTPAs invest in the acquisition of underexploited patents, organise these patents into coherent technology clusters, search for the right counterparty (possibly in a different industrial sector), and license or sell the patents or patent clusters. The business model of TTPAs can be described as an "acquire and commercialise". TTPAs raise money either from private investors, large technology companies, or capital markets by promising an above-average return on investment (ROI) from targeted patent purchases with the aim of instituting licensing programmes and/or using other arbitrage strategies (Millien and Laurie, 2008).

Similar to financial arbitrage, the activity of TTPAs primarily builds on their ability to screen a large number of patents to select those that have an undervalued potential. TTPAs focus on a large number of patents from which perhaps a few hundred can be chosen for exploitation and licensed. This means that TTPAs buy many patents in a broad range of markets with a probability that a certain percentage can be commercialised. Although TTPAs do not undertake any technology maturation activity, they are potentially interesting instruments in reducing

transaction costs in the markets for technology through specialisation and economies of scale.

OPAs are patent aggregators who exploit patents as liability rights primarily for offensive purposes. OPAs can be described as the "acquire and assert" business model. OPAs have different names through the literature, such as patent enforcement companies, patent assertion entities, patent litigation companies, patent sharks, and patent trolls (Millien and Laurie, 2007; Henkel and Reitzig, 2008; Benassi and Di Minin, 2009; Wang, 2010; Bessen *et al.*, 2012).

OPAs acquire patents or patent portfolios and attempt to monetise them by enforcing and asserting legal rights over them. The offensive behaviour of these patent aggregators consists of acquiring patents, typically from individual inventors or small or bankrupt firms, with an aim of licensing or enforcing them against large firms that are bringing actual products or services to the market. OPAs often purposefully acquire patents that are already being infringed and are in use by manufacturing firms. OPAs give priority to the patents acquired based more on their enforceability against other firms than the quality of technology behind them. The licensing method used by OPAs is the so-called "stick licensing" method, i.e., licensing when the patent holder threatens to sue the potential licensee for patent infringement if that potential licensee does not take a license (Neuenschwander, 2004; Lipfert and von Scheffer, 2006; Duff *et al.*, 2008).

Previously, OPAs have mostly operated in the US, where the patent litigation system makes it easier to use legal threats for profitable settlement or to seek high infringement damages. There are fewer OPAs in Europe, probably because the litigation system in Europe does not provide the same strategic opportunities that the US system does (Harhoff, 2009). However, there is some evidence that OPAs are also active in Europe (Kollner, 2008a,b).

OPAs have the most controversial business model. There is a discussion in the literature on the role of such OPAs. Proponents argue that these types of companies help individual inventors and small companies to assert their patent rights against large companies and groups to obtain returns from their inventions (McDonough, 2006; Rubin, 2007; Geradin *et al.*, 2012). However, opponents argue that such OPAs have a disruptive effect on the market and create private and social costs, rather than promoting innovation (Duff *et al.*, 2008; Henkel and Reitzig, 2008; Chien, 2009; Wang, 2010; Bessen *et al.*, 2012).

DPAs seek to acquire portfolios of patents selectively for defensive reasons (Millien and Laurie, 2008). These patent aggregators can be described by an "acquire and defend" business model. DPAs are companies that purchase patents on behalf of investors (founders and members) to mitigate risks of being threatened by competitors or OPAs (Buchtela *et al.*, 2010). An annual fee allows the patent acquisition costs to be spread across investors/members. In turn, investors

receive a license to use the patented technology. DPAs purchase patent rights, remove them from the open market, and place them in their "patent library" (Millien and Laurie, 2008; Brassell and King, 2013).

Although DPAs are usually initiated by several large companies that join their efforts and finances together, other companies may sign on later as members. Membership in a DPA protects companies against rent-seeking OPAs discussed above at a cost that is lower than litigation and settlement. Thus, DPAs may assist their members in defending against OPAs (Wang, 2010) and navigating through patent thickets (Shapiro, 2001). Although DPAs primarily acquire patents to protect their members from OPAs, these aggregators may still use their patent portfolio as a weapon to counterattack third parties that sue their members for infringement.

DPAs seem to have a beneficial effect on technology markets by driving demand for and raising market values of patents. Moreover, DPAs provide some protection to their members against potential assertions from competitors or OPAs. Although some DPAs are profit-seeking businesses that try to achieve a certain rate of return, there are a number of non-profit DPAs that are motivated by a sense of social responsibility and public duty. The objective of the latter is to create macroeconomic and social benefits by enhancing technological innovation (Buchtela *et al.*, 2010).

The four types of patent aggregators and their business models differ substantially with respect to the two analytical dimensions included in our framework — the level of aggressiveness in patent commercialisation activities undertaken by the patent aggregator and the extent of value added to patents — as summarised in the two-dimensional matrix reported in Fig. 1. We believe that these two dimensions are particularly important in distinguishing between patent aggregator business models because they demonstrate how collaboratively or aggressively each of them interacts with other participants in the technology markets (i.e., creators and users of technologies) and how much each of them contributes to the process of bringing new ideas to market.

As discussed earlier, the extent of value added to patents by patent aggregators varies. At the one extreme, TDPAs undertake substantial value-adding activities by investing in the development and maturation of the patents in their portfolio. At the other extreme, OPAs and DPAs generally do not undertake any value-adding activities with respect to the development of the patented technologies. They only acquire patents to use them for offensive or defensive purposes. TTPAs lie in the middle of these two extremes. Although TTPAs generally do not invest in R&D for the development of technologies, they may undertake technology enrichment or bundling activities to increase the value of that technology for potential buyers and licensors.

The second variable that can be used to differentiate business models of patent aggregators is the level of aggressiveness in patent commercialisation. At the lower end, there are DPAs that primarily acquire patents to license them to their members for defensive purposes. Although DPAs may still use their patent portfolio as a weapon to counterattack third parties that sue their members for infringement, in general, they do not initiate aggressive patent commercialisation activity. At the higher end are OPAs that acquire patents and attempt to aggressively monetise them by enforcing and asserting patent rights. As noted earlier, OPAs use a so-called "stick licensing" approach, in which they threaten to sue the potential licensee. TDPAs and TTPAs generally commercialise their patents by means of "carrot licensing", i.e., licensing when the potential licensee is willing to agree to the deal because the patent has a strategic value. Therefore, TDPAs and TTPAs are generally characterised by a low level of aggressiveness. However, empirical evidence suggests that some TDPAs and TTPAs that fail to "carrot license" their patents may opt for a more aggressive "stick licensing" strategy to commercialise their patents and gain quick returns on their investments.

Given these two variables, we can locate the four types of patent aggregators on the two-dimensional matrix, as expressed in Fig. 1. The aim of our empirical analyses reported in the following sections is to identify patent aggregators in Europe, to understand how they are distributed with respect to the four types, and to discuss differences in their characteristics and strategies. We are particularly interested in understanding whether different types of patent aggregators vary in terms of objectives, patent selection, aggregation, and commercialisation strategies.

Methods

The two important objectives of our empirical analysis are to create a map of patent aggregators established in Europe and to develop four qualitative in-depth case studies that are representative of the different classes discussed in the previous section, describing their basic characteristics, patent aggregation and exploitation strategies, and their main barriers and key success factors. The present section describes the methodology used to accomplish these two objectives.

Mapping of patent aggregators in Europe

To identify patent aggregators in Europe, we have followed a structured process. In the first step of the search process, patent aggregators in Europe were identified

through extensive Internet-based desktop research and searches in databases (e.g., LexisNexis) using keywords in English and other European languages.[3] Other important sources of information about European patent aggregators were related to existing studies and scholarly publications. As noted earlier, most of these studies have primarily focused on patent aggregators established outside Europe, primarily in the US. However, several EU co-financed studies (e.g., Buchtela *et al.*, 2010) investigating IP rights and technology transfer activities in Europe were useful as an information source.

In addition to the aforementioned sources, patent aggregators were also identified through a survey conducted among university Technology Transfer Office (TTO) managers in Europe, within the FinKT project.[4] The survey was sent to 348 managers at European universities in 2013, and it included a set of questions related to the existence of patent aggregators in the respective countries. More precisely, we asked whether the university has ever sold or licensed university patents to external "IP and patent funds", and if the answer was "Yes", we asked the name of these funds. We received 145 responses to the questionnaire, and 21 TTOs quoted specific patent aggregators, which was useful in validating and extending our list. In addition, we conducted 41 interviews with key informants from different European countries to learn about financial instruments that supported technology transfer activities in these countries, including patent aggregators. These key informants were selected among university TTO managers, VC managers, scholars, IP lawyers, and other practitioners and experts involved in the field of technology transfer and innovation financing.

First, the selection of organisations to be included in our final sample was based on our definition of patent aggregators, developed after reviewing the relevant literature. Secondly, for our mapping, we referred only to patent aggregators established in European countries. Finally, it is important to note that our mapping includes also patent aggregators that were liquidated or ceased their operations when the study was conducted in 2014.

[3]The primary keywords used for such a search were "patent aggregator", "patent aggregating company", "intellectual property fund", "IP fund", "patent fund", "IP investment fund", "licensing fund", "patent value fund", "technology development fund", "technology trading fund", "technology acquisition fund", "patent enforcing company", and "patent monetizing company".

[4]The "Financing Knowledge Transfer in Europe" (FinKT) project was implemented in the period 2012–2015 by the Department of Management of the University of Bologna with the financial support of the European Investment Bank University Research Sponsorship (EIBURS) programme. The project aimed to analyse the institutional context and financial instruments that facilitate technology transfer in Europe.

Following the identification phase, more detailed information on patent aggregators was collected by means of further Internet-based desktop searches in which the websites of patent aggregators were searched, as were the websites of consultant firms responsible for managing their patents, and various media publications. In our analyses, we specifically describe the characteristics of patent aggregators in terms of type, country of origin, establishment date, technological focus, and geographical focus. Moreover, we classified all identified patent aggregators based on the four different classes according to the typology previously described.

Case studies

The second objective of our empirical analysis is to analyse the characteristics and business models of patent aggregators by developing qualitative in-depth case studies. The use of qualitative case studies is an appropriate research approach to explore and gain deeper insights into novel phenomena that do not yet have clear boundaries (Creswell, 1994; Yin, 2009). Through the case studies, we try to answer the following research questions: How are patent aggregators structured? How do they differ by class? What are their business models? How do they actually operate? What determines their performance? Therefore, we adopted the following main criteria to analyse the case studies: basic characteristics of patent aggregators, patent selection and aggregation strategies, patent exploitation strategies, and main barriers and key success factors.

We have chosen four patent aggregators to be analysed through in-depth case studies. The cases were chosen based on our proposed definition and classification of patent aggregators. The objective was to describe four different types of patent aggregators from different European countries. Such a heterogeneous research sample of cases allows us to compare and contrast multiple patent aggregator business models, their characteristics, and strategies. We analysed the following four patent aggregators through in-depth case studies: CRT Pioneer Fund, France Brevets, Papst Licensing, and Easy Access IP.

For the patent aggregators selected for the case-study analyses, we developed interview guidelines to conduct face-to-face or phone interviews with patent aggregator representatives based on a semi-structured questionnaire. The main targets for interviews were founders, CEOs, managing directors, and partners. The standardised open-ended interviews were used to collect information on the origin and structure of patent aggregators, their investment activities, and their performances. Whenever possible, the interview guidelines were sent to the interviewees in advance. The interviews with patent aggregator representatives lasted between 1 and 2 h.

Analyses and Findings

Patent aggregators in Europe

Based on the methodology described earlier, we have identified 33 companies and funds in Europe, which can be classified as patent aggregators. As noted earlier, it is possible that small, less well-known patent aggregators may have fallen off our search radar, and we may have been unable to detect them. Nevertheless, given the lack of a complete list or mapping of European patent aggregators, our mapping represents a first valuable contribution to the literature.

The mapping includes companies established from 1981 to 2013. Moreover, for the purpose of our research, our mapping also includes patent aggregators that were liquidated or ceased their operations when the study was conducted in 2014. In this section, we describe the characteristics of different patent aggregators in terms of geographical distribution, year of establishment, technological focus, and geographical focus.

Figure 2 shows the distribution of patent aggregators by type and country of origin. The most diffused types of patent aggregator in Europe are TDPAs and TDPAs. Despite the general perception that OPAs have been mostly operating in the US where the patent litigation system makes it easier to use legal threats for profitable settlement or to seek high infringement damages, our results suggest that there are also OPAs operating in Europe. Finally, DPAs in Europe are represented by non-profit aggregators that are motivated by a sense of social responsibility and free license patents that they aggregate.

Considering the distribution of different patent aggregators across European countries, the largest numbers are in Germany and in the UK, where all types of patent aggregators are represented. Other European countries are represented by a single type of patent aggregator. Table 1 shows the date of establishment of patent aggregators. Most of the patent aggregators including in our map were established

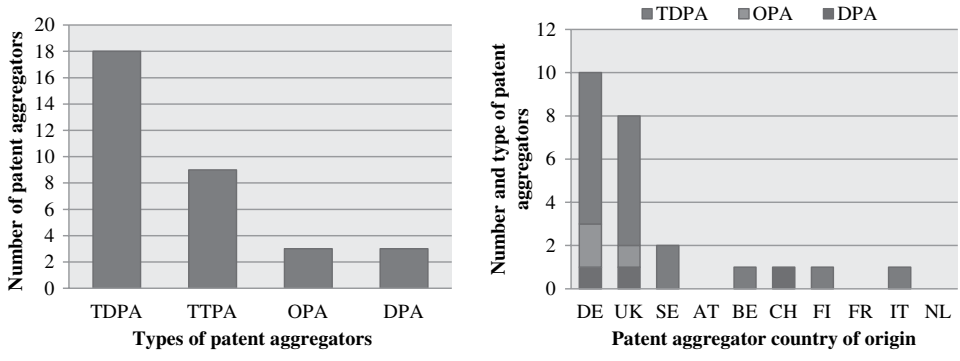

Fig. 2. Distribution of patent aggregators by type and country of origin.

Table 1. Distribution of patent aggregators by establishment dates.

Establishment date	2013	2012	2011	2008	2007	2006	2005	2004	2003	2002	2001	2000	1999	1996	1992	1982	1981
TDPA	1	1	1	—	3	2	1	2	1	—	1	1	1	1	—	1	1
TTPA	—	—	2	4	1	—	1	—	—	1	—	—	—	—	—	—	—
OPA	—	—	—	1	1	—	—	—	—	—	—	—	—	—	1	—	—
DPA	—	—	1	1	—	—	—	—	—	—	—	1	—	—	—	—	—
Total	1	1	4	6	5	2	2	2	1	1	1	2	1	1	1	1	1

during the last decade. The evidence confirms our argument that patent aggregators are a relatively new and underexplored phenomenon in Europe.

The degree of technological focus varies among patent aggregators. Roughly half of them are primarily focused on patents in one or two technological areas. Others invest in patents from more technological areas. In terms of geographical focus, about one-third of patent aggregators have only invested in patents originating from their respective countries and regions. These patent aggregators are often created with the objective of supporting local inventors and SMEs in their technology transfer and commercialisation activities. About half of patent aggregators do not have any geographical focus and are open to the acquisition and commercialisation of patents from any country. The remaining patent aggregators have been investing in patents originating from a limited number of European countries.

Case Study Analysis

From the sample of patent aggregators in Europe described in the previous section, we have chosen the following four patent aggregators to be analysed through in-depth case studies: CRT Pioneer Fund, France Brevets, Papst Licensing, and Easy Access IP. Using these case studies, we illustrate the characteristics and underlying business models of patent aggregators. In particular, we have analysed the patent aggregators according to the following main criteria: key characteristics, patent selection and aggregation strategies, and patent exploitation strategies. In this section, we first provide a description of the four case studies and then compare and discuss the four patent aggregators according to the main criteria.

Case study 1: CRT Pioneer Fund

The first case presents a UK-based fund called the Cancer Research Technology (CRT) Pioneer Fund, which can be characterised as a TDPA within our classification. The CRT Pioneer Fund was established in 2012 by CRT with financial support from Sixth Element Capital and the European Investment Fund (EIF). CRT is a specialist commercialisation and development company, which aims to develop new discoveries in cancer research for the benefit of cancer patients. The aim of the fund was to bridge the investment gap between cancer drug discovery and early development, also known as the "valley of death". The gap has increasingly emerged as an issue because investments in the pharma industry have moved from early stage discovery to later stage drug development, leaving less funding for small biotechnology companies. The goal of the CRT Pioneer Fund is to take potential cancer drugs, primarily discovered by Cancer Research UK,

from discovery to entry into Phase II clinical trials before partnering with large pharmaceutical companies.

The technological focus of the CRT Pioneer Fund is oncology, particularly cancer therapeutics, diagnostics, and devices. The CRT Pioneer Fund's goal is that two-thirds of its patents will come from CRT UK and one-third will come from UK universities or companies. The CRT Pioneer Fund plans to fund 1–2 projects per year, investing up to £7 million in their development.

Before acquiring a technology, the CRT Pioneer Fund conducts technical and legal due diligence. To conduct legal due diligence, the CRT Pioneer Fund uses external patent attorneys. For technical due diligence, the CRT Pioneer Fund has a scientific advisory board.

The CRT Pioneer Fund acquires selected patents by signing a worldwide exclusive licensing agreement with the original patent owner. Initial patent owners generally receive a small amount of up-front payment and then receive a percentage from future licensing revenues obtained from pharmaceutical companies. After acquiring the technology, the CRT Pioneer Fund undertakes several value-adding activities. First, because most projects acquired by the CRT Pioneer Fund are at the patent application stage, it undertakes all necessary IP management activities. Secondly, the CRT Pioneer Fund invests in the development of the drug to the entry of Phase II clinical trials to make them more attractive for large pharmaceutical companies. By conducting initial clinical trials, the CRT Pioneer Fund reduces the risk to pharmaceutical and biotechnology companies that may license more developed technology. Thirdly, the CRT Pioneer Fund adds value in terms of development speed. By providing sufficient capital and resources, the CRT Pioneer Fund ensures that once a compound goes through pre-clinical development, it then goes straight into clinical development. This helps to avoid the usual 1- or 2-year delay in finding a financial partner. Fourth, in terms of commercialisation, after developing a technology to the entry of Phase II clinical trials, the CRT Pioneer Fund plans to find a partner to license the technology.

Case study 2: France Brevets

The next case study describes a France-based company, France Brevets, that can be classified as a TTPA. France Brevets was established in 2011 within the framework of the French public initiative "Programme d'Investissements d'Avenir", which aimed to build value for research activities and to foster increased technology transfers from laboratory to industry. France Brevets was initially capitalised with a total of €100 million equally contributed by the French

government and Caisse des Dépôts et Consignations (CDC), a publicly managed investor in French economic development.

The creation of France Brevets was dedicated to the needs of SMEs and research centres, helping them build patent commercialisation strategies, enforce their IP rights, and secure fair and reasonable compensation for their patents or innovations. At the time of the interview, France Brevets has a team of approximately 15 people. The France Brevets team consists of people with substantial industry background in corporate R&D, IP management, technology licensing, negotiation, market analysis, and finance. In addition to its in-house team, France Brevets has strategic partnerships with firms in Europe and the US that provide support with patent mapping, management, and commercialisation.

The investment focus of France Brevets is not limited to French patents and technologies; nevertheless, it tries to focus on the industries in which it knows there are French players. The main technological focus of France Brevets is information technology and communication, aeronautics and space, alternative energy, chemistry, materials, and life sciences.

During its selection and due diligence processes, France Brevets looks for high-quality patents with economic and strategic value. First, it identifies and analyses industry segments in which innovations are important, disruptive, and may significantly change existing markets. It also looks for industries where SMEs or research centres possess good patents and where the market will allow a level of investments that can provide sufficient returns. Once an industry segment is identified, France Brevets conducts worldwide IP search to understand the patent landscape and dynamics.

Whenever France Brevets strikes a patent acquisition deal, it signs an exclusive licensing agreement. When signing an exclusive licensing agreement, France Brevets usually does not provide any upfront payments to patent owners. The original patent owner receives their compensation from licensing revenues when technology reaches the maturity phase and is commercialised.

After signing a licensing agreement, France Brevets covers all the costs associated with further patenting and commercialisation of the technology. France Brevets' distinctive edge also lies in its ability to aggregate patent portfolios from laboratories, research organisations, and private companies. Moreover, by pooling patents into coherent technological clusters, France Brevets leverages their market potential. As some patents can be exploited outside the original patent owner's core business, France Brevets explores new opportunities for acquired patents in other fields of use and licenses them to companies in other sectors. To estimate the amount of fair compensation, France Brevets considers the characteristics of the technology, the size of future product markets, the intensity of competition, and the characteristics of potential licensees.

Case study 3: Papst Licensing

The third case describes Papst Licensing, a German-based company that represents the OPA business model according to our classification. Papst Licensing was formed in 1992 as a result of the bankruptcy of a family-owned manufacturing company, Papst Motoren, which had financial problems in the early 1990s, partly due to a massive infringement on the company's patents by competitors. Papst Licensing acquired approximately 600 patents and patent applications from the dissolved Papst Motoren and started an enterprise of commercialising those patents. Papst Licensing was attempting to regain something from the infringers, who were predominantly located in Japan, Korea, and Taiwan, by asserting its ownership rights and licensing the infringed patents. Given a successful experience enforcing its own patents, in the early 2000s, Papst Licensing started to acquire and monetise third party patents. Papst Licensing is an example of a manufacturer that turned into a patent monetisation entity.

Papst Licensing is a family business, created and run by Papst family for over 20 years. Papst Licensing is different from other similar companies because it uses its own resources to fully finance the patent acquisition and monetisation activities. Therefore, Papst Licensing is able to pursue long-term patent monetisation projects without having pressure from outside investors. Papst Licensing has a team of 12 people with diverse backgrounds, including engineers, lawyers, patent attorneys, and financial experts. Moreover, Papst Licensing outsources necessary legal and technical expertise.

Papst Licensing acquires patents from different technological areas. Due diligence, undertaken before patent acquisition, is an important procedure that involves legal, technical, and economic analyses in order to select patents with the higher monetisation potential. After the evaluation, Papst Licensing usually acquires patent rights from the original patent owner and reassigns them to monetise and enforce the patent under the Papst Licensing name. For acquired patents, the goal of Papst Licensing is always to obtain a license from the infringer. According to its risk-sharing model, Papst Licensing provides part of the compensation to the original patent owners and then encourages them to participate in the monetisation project by giving them a percentage of future licensing revenues.

The largest share (approximately 70%) of licensing agreements signed by Papst Licensing was closed through a settlement with the infringers. Papst Licensing first tries to engage in a dialogue with patent user-infringers to negotiate licensing agreements. However, when infringers refuse to negotiate or do not respond, court litigation may remain the only option for Papst Licensing. In some cases, infringers themselves file a declaratory judgement action and basically initiate a litigation process.

Case study 4: Easy Access IP

Finally, the case study of UK-based Easy Access IP Initiative can be used to describe some characteristics of DPAs. The Easy Access IP Initiative is a collaborative project lead by the University of Glasgow, King's College London and the University of Bristol that started in 2010. By licensing technologies in its portfolio for free, the Easy Access IP Initiative provides a fast-track method of transferring university technology to industry for further development to benefit the economy and society. Universities participating in the Easy Access IP Initiative by pledging their patents gain an opportunity to establish long-term relationships with industry partners and to disseminate their knowledge and expertise to the wider community.

The Easy Access IP Initiative is a consortium of more than 20 universities and research organisations from the UK, Denmark, Sweden, Switzerland, Canada, and Australia. Most of the people involved in the Easy Access IP Initiative are usually employed in universities or TTOs. People involved in the initiative have different backgrounds, including legal, technical, and academic.

The Easy Access IP Initiative centres on technologies that come from universities and research organisations. In its portfolio, the Easy Access IP Initiative has technologies that include medicine, life sciences, science, and engineering. In terms of geographical range, the portfolio contains technologies from British, Dutch, Swedish, Swiss, Canadian, and Australian universities.

When considering which patents to contribute to the Easy Access IP portfolio, every member university makes its own independent decision on what to include. In general, universities and research institutes pledge patents that are considered more difficult to commercialise through traditional licensing routes. By putting patents into the Easy Access IP portfolio, universities may reach new industry partners that probably would not collaborate under traditional technology commercialisation schemes.

The Easy Access IP patents are free licensed to companies using a simple one-page agreement that avoids costly negotiations. The Easy Access IP Initiative has developed different types of exclusive and non-exclusive licensing agreements. The patent ownership rights for technologies in the Easy Access IP portfolio remain with the original patent owner, i.e., the inventor or university. Even in the case of an exclusive license, the university retains the right to continue further research in the field and to publish. If the technology, which was free licensed to a company under the Easy Access IP scheme, has substantial success in the future, the university that owns the IP rights for the technology cannot claim any financial returns. However, under the licensing terms, the company has to publicly recognise the contributions of the university and the Easy Access IP Initiative.

For universities participating in the Easy Access IP Initiative, this reputational component is very important in demonstrating that their technologies are making a difference in the business world.

Discussion

In the section below, we compare and discuss the four cases of patent aggregators to highlight similarities and differences in their characteristics and strategies, based on insight from the interviews. The discussion is organised according to the following three main analytical criteria: basic characteristics of patent aggregators, their patent selection and aggregation strategies, and patent commercialisation strategies.

Main characteristics of patent aggregators

The case studies describe the four types of patent aggregators from three European countries, namely, Germany, France, and the UK. Table 2 summarises the main characteristics of the different patent aggregators. The four cases show a high variety in terms of ownership arrangements of patent aggregators (privately owned, established by public organisations, or jointly created by private and public entities). The staff size of patent aggregators depends on the decision of whether to outsource the required engineering, legal, and economic expertise or keep it in-house. For example, France Brevet and Papst Licensing have a considerable level of competencies in-house and outsource necessary *ad hoc* competencies.

Moreover, patent aggregators differ in terms of their objectives and return-on-investment orientations, which are largely related to the type of main stakeholders involved. For instance, OPAs that tend to be promoted mainly by private actors are primarily concerned with commercial returns and, therefore, aggressive in enforcing their patents. On the other hand, TDPAs that often have public co-ownership are also interested in favouring the diffusion of technologies and addressing specific market failures such as the funding gap. For instance, Papst Licensing enforces patents with the specific objective of obtaining monetary compensation. In contrast, Easy Access IP has a primary goal of disseminating university technology to create macroeconomic and social benefits. Both the CRT Pioneer Fund and France Brevets consider the return on their investments, but also pursue objectives of bridging the investment gap and help SMEs and research centres to develop patent monetisation strategies.

Table 2. Comparison of case study results: characteristics.

	CRT Pioneer Fund	France Brevet	Papst Licensing	Easy Access IP
Type	TDPA	TTPA	OPA	DPA
Country	UK	France	Germany	UK
Main investors	CRT, EIF, and Sixth Element Capital	Stakeholders: French government and Caisse des Depots et Consignations (CDC)	Papst family business	More than 20 universities and research centres from around the world led by UK universities
Establishment date	2012	2011	1992	2011
Number of full time employees at the time of the interview	3	15	12	None
What are the main objectives of the aggregator?	Bridge the investment gap between cancer drug discovery and early development	Help SMEs and research centres to build patent monetisation strategy, enforce their IP rights, and secure reasonable and fair compensation for their inventions	Enforce own and third party patents to negotiate licensing agreement and obtain compensation	Transfer to industry university technologies that are difficult to commercialise through traditional licensing schemes
Does it have a return on investment objective?	Yes, it seeks to provide returns on investment to investors, but fostering cancer drug discovery is the main objective	Yes, it seeks to provide returns on investment to investors	Yes, it seeks to provide returns on investment to owners	No, the objective is to disseminate knowledge to create macroeconomic and social benefits

Table 3. Comparison of case study results: Selection and aggregation strategies.

	CRT Pioneer Fund	France Brevet	Papst Licensing	Easy Access IP
Technological focus for patent selection	Cancer Drugs, Diagnostics, and Devices	Electronics, Telecom, IT, Aerospace, Life Sciences, Chemicals, Materials, Energy	No technological focus	No technological focus
Geographical focus for patent selection	UK	Worldwide	Worldwide	Worldwide
Target organisations for patent selection	2/3 of patents come from CR UK and 1/3 from UK universities and companies	Individuals, universities, PROs, SMEs, and other organisations	Individuals, SMEs, and other organisations	Universities and PROs
Patent aggregation method	Worldwide exclusive license agreement with original patent owner	Exclusive license agreement for a whole or a part of patent scope with original patent owner	Acquires and reassigns patent rights from original patent owner	Patents are freely pledged by universities, but ownership rights remain with original patent owner
Size of patent portfolio	Small	Medium	Large	Medium
Value added to aggregated technology	High	Low/medium	Low	Low

Patent selection and aggregation strategies

As shown in Table 3, the degree of technological and geographical focus varies among patent aggregators. As a TDPA, the CRT Pioneer Fund has a narrow technological focus, which is necessary to establish specific competencies to incubate and develop certain types of technologies. Therefore, this type of business model is likely to require a strong level of technological specialisation to enhance the implementation of technology maturation and value-adding activities. It also acquires patents originating from UK companies and universities to support local organisations. The other three patent aggregator models tend to acquire patents from a broader range of technological fields and geographical areas. The patents are usually acquired by signing an exclusive licensing agreement with the original patent owner. Unlike the other cases, Papst Licensing, as an example of an OPA, prefers to reassign ownership rights and commercialise patents from their name. This strategy, in the case of an OPA, can be attractive to original patent owners that do not want to be negatively portrayed as patent enforcers and litigators. Easy Access IP patents are pledged by universities and research centres that sign a letter of intent to free license their patents to interested industry players.

Finally, the size of the patent portfolio and value added to aggregated technologies are determined by the type of patent aggregator model as well. For instance, the CRT Pioneer Fund acquires a small number of highly promising patents and invests in their development. Due to the higher commitment of time and financial resources required by the TDPA model, it should necessarily be focused on a limited set of potentially high-return projects. Extensive due diligence and a careful selection process are, therefore, necessary prerequisites of such a model. On the contrary, the case of a TTPO model, such as that of France Brevets, rests on a larger accumulation of patent portfolio based on aggregating patents from different sources and bundling them into coherent patent clusters that will be more attractive to potential licensees. Papst Licensing, in turn, acquires a large number of patents and enforces them with limited value-adding activities. Therefore, in the case of an OPA model, technological specialisation plays a more limited role, whereas the process of patent selection is largely based on the assessment of the potential for enforcement and subsequent monetisation.

Patent exploitation strategies

As displayed in Table 4, patent aggregators generally commercialise their patents through licensing agreements. In this sense, the difference between the various models is largely dependent on how these licensing agreements are reached and the aggressiveness of the commercialisation process. As would be expected with

Table 4. Comparison of case study results: Commercialisation strategies.

	CRT Pioneer Fund	France Brevet	Papst Licensing	Easy Access IP
Commercialisation approach	Exclusive licensing to large pharmaceutical companies	License and sale of patents to large companies	Licensing or sale of patents through agreement or litigation	Free licensing using one-page agreement
Aggressiveness of patent commercialisation	Low	Medium	High	Low
Does it provide financial support to patent holder?	Yes, small up-front payment and percentage of future licensing revenues	Yes, only percentage from licensing revenues	Yes, some up-front payment and percentage from licensing revenue	No, patents are pledged by universities
Does it provide technical support to patent holder?	Yes, it develops a drug to the entry of Phase II clinical trials	No	No	No
Does it provide commercial and marketing support to patent holder?	Yes, it searches for a licensing partner for patents	No	No	Yes, it promotes patents by posting information on local and national technology transfer portals
Does it provide support in negotiating licensing/sale agreement of IP?	Yes, it negotiates exclusive licensing deals with pharmaceutical companies	Yes, it negotiates licensing deals with companies	Yes, it negotiates a licensing agreement with the infringer	Yes, licensing is supported through standard licensing models and royalty-free contracts
Does it provide support in monitoring licensing deals?	Yes, licensing deals are structured with milestone-based royalties	No	Yes, all licensing deals and respective royalty payments are monitored	Yes, if licensee does not use technology in 3 years after licensing the license is terminated
Does it provide support in asserting IP rights through litigations?	No	Yes, for infringed patents, if infringer does not agree to take a license, it may assert patent rights through litigation	Yes, if infringer does not agree to take a license, it asserts patent rights through litigation	No

the TDPA model, the CRT Pioneer Fund tends to use a "carrot licensing" approach by trying to find a licensee that is willing to strike a deal. On the contrary, in line with an OPA approach, Papst Licensing applies a "stick licensing" approach by first negotiating licensing deals with companies that already infringe on their patents. In turn, France Brevet was originally established to pursue the "carrot licensing" approach, but in some cases, it also later adopted a more aggressive "stick licensing" approach to favour the commercial exploitation of some of its patents. Finally, as an example of the DPA model, Easy Access IP seeks licensees that are interested in "free licensing" its patents to facilitate the diffusion of academic inventions and their further development.

If we look at the typical economic terms of licensing agreements, the CRT Pioneer Fund and Papst Licensing generally use a risk-sharing model with a small up-front payment to an original patent owner and a share of future licensing revenues. France Brevets provides compensation to the original patent owner only from licensing revenues when technology reaches the maturity phase and is commercialised. Easy Access IP does not provide any compensation to the original patent owner.

Barriers, Challenges, and Key Success Factors for Patent Aggregators

Patent aggregators in Europe are a relatively new phenomenon. Given that the commercialisation of inventions is a long and risky process, at this stage, it is difficult to access with certainty the results of their investment activities. The available evidence concerning the performance of patent aggregators in Europe suggests mixed success. This section discusses the main barriers and key success factors for patent aggregators derived from our interviews with their representatives. Table 5 summarises the main findings of our interviews in this respect, including the criteria for performance evaluation of the different models.

The interviews conducted with the representatives of patent aggregators have revealed some important challenges and key success factors that are relevant for the various kinds of patent aggregators. First, despite an increasing trend in patenting during recent decades, the interviewed patent aggregators struggled to find high-quality patents in which to invest. A large share of patents available for licensing or sale does not have any commercial value; therefore, it is extremely important for patent aggregators to be able to separate the wheat from the chaff and identify high-quality patents. High-quality patents are defined as innovative, enforceable, and economically valuable. Patent aggregators have to develop effective patent evaluation policies involving deep technical, legal, and economic due diligence. In turn, this requires a team of internal and/or external experts with a

Table 5. Comparison of case study results: Performance evaluation, challenges, and key success factors.

	CRT Pioneer Fund	France Brevet	Papst Licensing	Easy Access IP
Criteria for performance evaluation	Number of licensing deals closed Ability to further develop technology Commercial returns	Number of technologies evaluated Number of licensing deals closed Commercial returns	Number of licensing deals closed Commercial returns	Number of universities involved Number of patents pledged Establishing long-term relationships between university and industry
Main barriers and challenges	Long development periods in pharmaceutical sector Need to figure out a right commercial structure for the aggregator	Difficulty to find sufficient number of high-quality patents Pressure from patent owners to provide quick financial returns	Need for court litigation to enforce patents Difficulty to enforce patents in Europe due to the lack of Unitary European Patent Court	Universities overvalue patents and overnegotiate licensing deals Convincing universities to pledge patents for free licensing
Key success factors	Narrow technological focus Deep technical due diligence Developing or accessing specific expertise Experience in both scientific and commercial sectors Devoting sufficient funds for each project Readiness to cease non-performing projects	Sufficient financial resources for patent aggregation Deep technical and legal due diligence Quality and value of aggregated patents Devoting sufficient time and resources to patent enforcement Patience and alignment of interests with stakeholders	Deep technical, legal, and economic due diligence Quality of aggregated patents in legal terms Ability to finance activities from own revenues Devoting sufficient time and resources to patent enforcement Involving inventors in patent enforcement	Attracting university patents difficult to licence through traditional route Offering industry simple licensing procedure through one-page free licensing agreement Industry partner has to publicly recognise contribution by university

strong background in engineering, IP law, market analysis, and technology licensing.

Secondly, patent aggregation and commercialisation is a long and risky process requiring substantial initial investments. However, inventors entrusting their patents and investors committing their money to patent aggregators often expect to see immediate results. The pressure from investors and other stakeholders to obtain prompt financial results is a general challenge reported by the interviewees. To succeed, patent aggregators have to adopt a long-term technology commercialisation strategy without being pressured by short-term revenue considerations. For such a strategy to be implemented, it is crucial to have patient investors and stakeholders.

However, a major challenge for patent aggregators is in finding buyers and licensees for the patents in their portfolio. Patent aggregators failing to commercialise their patents through "carrot licensing" may opt for a short-term valorisation through patent enforcement or "stick licensing". To avoid this, the patent evaluation and acquisition process should be driven by market experts that are knowledgeable about the demand-side conditions in the particular technology market. Therefore, in general, patent aggregators with a narrow technological focus and profound expertise in the field can be more successful than those acquiring patents with no technological focus.

Conclusions

The development of markets for technology has increased the variety of arrangements for the use and exchange of technologies. New types of players with different roles and motivations have appeared in the technology marketplace in recent decades. This paper has explored the phenomenon of patent aggregators and entities that acquire third party patents with the objective of commercialising them by means of the sale, licensing, enforcement, or creation of new patent-based companies.

The contribution of our research reported in this paper is threefold. First, we have provided a classification of distinctive types of patent aggregators based on two relevant dimensions: the value added to patented technologies and the level of aggressiveness in patent commercialisation activities. Secondly, we have constructed a map of patent aggregators established in Europe. We have described the characteristics of different patent aggregators in terms of their type, country of origin, establishment dates, technological focus, and geographical focus. For instance, our results suggest that the most predominant types of patent aggregators in Europe are TDPAs and TTPAs. Our data also reveal that Germany and the UK are

the most active countries in terms of establishing patent aggregators. Thirdly, using four case studies, we have illustrated and compared various types of patent aggregator business models and their strategies. Moreover, our interviews with the representatives of patent aggregators allowed us to identify the main obstacles to their activities and key success factors.

The findings of this study lead to several policy and practical recommendations.[5] In recent years, there has been a hot debate regarding the merits and pitfalls of establishing state-supported (i.e., publicly financed) patent aggregators in Europe and other countries around the world as a way to facilitate the development of markets for technology. Our research suggests that patent aggregators vary in their objectives and business models. Certain types of patent aggregators, such as TDPAs, may have a beneficial effect on the markets for technology by fostering technology maturation and transfer. In contrast, other types of patent aggregators, such as OPAs, may have a disruptive effect on the market by creating private and social costs. Therefore, in general terms, policy-makers should not support the creation of patent aggregators with multiple objectives as a general policy to support innovation. Instead, they should consider supporting the establishment of TDPAs in specific fields that are strategically important to the development of national economies.

We also find that there is a risk that patent aggregators initially created as TDPAs and TTPAs due to an inability to commercialise their technologies may change their collaborative commercialisation strategy and turn into OPAs with a more hostile business model. We find several examples of such transformations among European patent aggregators. To avoid that, patent aggregators should adopt a demand-pull approach and acquire patents with a clear concept of potential buyers and licensees. With no demand in the markets for technology, patent aggregators will be destined for failure or will be forced to adopt an aggressive patent commercialisation strategy.

Patent aggregation and commercialisation is a very lengthy and risky business. It may take several years for a patent aggregator to find a suitable licensee and sign an agreement. Moreover, the licensing revenues are generally structured as a modest upfront payment followed by royalty payments based on the product sale revenues. Consequently, licensing royalties need to be accumulated and paid back to investors over the years, corresponding to a product lifecycle. Therefore, the patent aggregation business is not a suitable investment option for risk-averse and impatient investors looking for secure and quick returns on their investments.

[5]The findings of the analysis developed in this paper were taken into account in developing policy recommendations related to the creation of publicly financed patent aggregators in Europe (European Union, 2014).

Our study is subject to several limitations. The first limitation has to do with the fact that patent aggregators in Europe are a new and not well-studied empirical phenomenon. Therefore, to identify all these patent aggregators, we had to employ several qualitative research methods. The possible limitation of the methods used is that small and less well-known patent aggregators may have fallen off our search radar, and we may have not been able to detect them.

The second limitation is that our mapping and case studies were limited to patent aggregators in Europe. Nevertheless, we believe that Europe represents an important setting, and some of our research findings can be generalised to patent aggregators in North American and Asian regions. In the future, a comparative study between patent aggregators in Europe and other regions would be beneficial to understanding the differences in their characteristics, business strategies, and performances. Moreover, in the future, more extensive research in this field could provide a more definitive answer to both practitioners and policy-makers on the role of patent aggregators in technology markets.

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