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The timing of trademark application in innovation processes

Marcel Seip

VU University Amsterdam
FEWEB
m.seip@vu.nl

Carolina Castaldi

Eindhoven University of Technology
School of Innovation Sciences
C.Castaldi@tue.nl

Meindert Flikkema

VU University Amsterdam
Management and Organization
m.j.flikkema@vu.nl

Ard-Pieter De Man

VU University Amsterdam
Management and Organization
a.p.de.man@vu.nl

Abstract

An emerging stream of literature studies the extent to which trademarks can be used to measure innovation. Trademarks may capture forms of innovation that are not yet adequately captured by other innovation measures. The picture of trademarks' usefulness in innovation studies is far from complete. One area that has not yet been covered relates to the timing of trademark applications, even though research into other IPRs found timing to be relevant. This article is a first attempt to fill this gap. We find that trademarks can indeed be used to study late stage innovation, as the literature predicts, but interestingly enough early stage innovation as well. Especially startups file trademarks referring to innovations in an early stage of development. Large firms tend to file trademarks later in the innovation process. Hence, combining trademark data with information about firm age and size might enable us to predict the type of innovation the trademark refers to. This would allow further uses of trademark data in innovation research.

Jelcodes:O34,O39

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Abstract

An emerging stream of literature studies the extent to which trademarks can be used to measure innovation. Trademarks may capture forms of innovation that are not yet adequately captured by other innovation measures. The picture of trademarks' usefulness in innovation studies is far from complete. One area that has not yet been covered relates to the timing of trademark applications. This article is a first attempt to fill this gap. We find that trademarks can indeed be used to study late stage innovation, as the literature predicts, but interestingly enough early stage innovation as well. Especially startups file trademarks referring to innovations in an early stage of development. Large firms tend to file trademarks later in the innovation process. Hence, combining trademark data with information about firm age and size might enable us to predict the stage of development of the innovation the trademark refers to. This would allow further uses of trademark data in innovation research. Another dimension is the innovation the trademarks refers to. Trademarks referring to service innovations are filed during all phases of the innovation process. Trademarks referring to new products however show a significant tendency towards early filing during the innovation process (especially during the development phase) indicating that trademarks can also be used as an early indicator for new product development.

JEL codes: O34, O39

Keywords: trademarks, innovation, timing, IP strategy, start-ups

1. INTRODUCTION

An emerging empirical literature has pointed out how trademark statistics bear potential for measuring innovation (Schautschick and Greenhalgh, 2013; Greenhalgh and Rogers, 2012).

The basic idea behind the trademark-innovation linkage is twofold. First, new trademarks are filed to signal the introduction of new products or services (Mendonca et al., 2004). Second, the literature assumes trademarks are filed close to the market introduction of new products, and much closer than patents (Hipp and Grupp, 2005). Trademark statistics can therefore be considered as an output indicator, while patent statistics should be used preferably as a throughput indicator. Moreover, a large share of all granted patents cannot be exploited and the time-to-market of many other patents is long (Sichelman, 2010).

The validity of the first claim has been tested in a few firm-level and case-level studies (Allegrezza and Guarda-Rauchs, 1999; Schmoch, 2003). The results of these studies confirm the correlation of firm-level innovation and trademark filing (Allegrezza and Guarda-Rauchs, 1999; Schmoch, 2003) and the reference to innovation of new trademark filings, particularly for start-ups (Flikkema et al., 2014). The second claim has been tested, with mixed results. In the sample considered in Flikkema et al. (2014) half of the innovation related trademarks were filed close to the market introduction, while the other half were filed in the front-end of the innovation value chain or in its tail. The timing of trademark application for innovation purposes has not yet been studied in depth. In the related field of patent studies, timing is found to be an essential element when using patents to appropriate the rents from innovation. Therefore, we study why the timing of trademark application might differ along the innovation process. We hypothesize that early or late trademark filing can be explained by

three factors: i) the joint use of patents and trademarks, ii) process level innovation modes referring to major characteristics and the organization of the innovation project and iii) start-up versus mature firms. We consider two process level innovation modes that may affect timing: a) product or service innovation, b) ad-hoc versus continuous innovation. In doing so, we provide a first effort to study the link between timing of trademark applications and the innovation process. In section 2 we review the literature about the timing of patent application to understand the joint use of patents and trademarks and timing of trademark filing. In section 3 we review the literature on innovation modes. In section 4 we present the research design and the data collection. Section 5 is dedicated to data analysis, while the final section includes conclusions, a discussion of the results and suggestions for future research.

2. THE TIMING OF PATENT AND TRADEMARK APPLICATION

2.1 The timing of patent versus trademark application

Firms benefit from various intellectual property rights (IPRs) to appropriate rents from innovation (Teece, 1986; Davis, 2006). The actual timing of engagement in different IP rights requires great precision. Imprecision may have both cost and revenue consequences.

Empirical studies into the timing of IPR application are limited and most of them focus on the timing of patenting (Johnson and Popp 2001; Harhoff and Reitzig 2001; Hipp and Grupp, 2005). In that case, the reasons for being early are obvious and embedded in patent system rules: the first one to file a patent, which is granted ultimately, is the one who gets the monopoly right.

Because of their nature and relatively short handling times at IPR offices the literature assumes that trademarks are registered close to the market introduction of a new product or service (Rujas, 1999; Hipp and Grupp, 2005). Flikkema et al. (2014) however show that this

is correct for about 60% of the trademarks referring to innovation. The rest of the trademarks are already registered during early innovation phases, while also a significant part of the trademarks are filed after the market introduction of new products and services. As the literature has not yet studied reasons behind early or late filing of trademarks, we first review whether the patent literature provides reasons that may apply to trademarks as well.

Studies have highlighted at least three reasons why inventors would delay their patent application. A first reason for delaying patent application is to delay information disclosure. Information disclosure is a prerequisite for patent application but also provides competitors with useful information facilitating imitation (Leiponen and Byma, 2009). Secondly by delaying patent application the length of patent protection can be extended in order to earn back development costs (especially in the pharmaceutical sector). A third reason is to cut costs of patent taxes. Patent protection in multiple countries can become very costly (Berrier, 1995; Lanjouw et al., 1998). Firms therefore delay patent filing until they are sure that they will earn back all costs involved with patent filing and renewal. Yet, all studies also stress that inventors run the risk of waiting too long. Choosing the right time to file is therefore essential for patent applicants. For various reasons this also seems to hold for trademark application. Like patents, trademarks are also based on priority. This means that the first to file a trademark for certain goods or services in a certain country or region acquires the legal right to prevent others from using similar trademarks in the same market(s). Therefore it is essential not to be too late when applying for a trademark. The literature on small firms and resources (Katila and Shane, 2005) and the valuations of venture capitalists (Block et al., 2014) provide other reasons for early trademark registration. Block et al. (2014) found that the value of trademark applications decreases when start-ups enter more advanced development stages. Attracting venture capitalists might therefore be an important reason for resource-lacking start-ups to file trademarks in the front end of the innovation process. Desyllas and Sako

(2013) suggest that in the case of intangible service innovation, early registration of formal IP rights, including trademarks, may buy firms time and allow them to build complementary specialized assets.

There are also reasons not to apply for trademarks too early, though the three reasons mentioned before for delaying patent application do not seem to apply to trademarks. First, information disclosure only partly applies to trademarks since a trademark reveals some characteristics of the product and/or the firm market strategy. Different from patents, when applying for a trademark the applicant only has to disclose a minimal amount of information about the goods or services covered by the trademark. Secondly, unlike patents the validity of a trademark can be prolonged indefinitely (in many countries after every 20 year period). This is the reason why trademarks are popular in the pharmaceutical sector (Chudnovsky, 1983), to foster customer loyalty. Finally, the costs of maintaining a trademark are much lower than the costs of patent protection. Hence the reasons for late filing of patents only partially apply to trademarks.

There are however other reasons for delaying trademark application. A first reason is that many countries require that a trademark will be used in commerce within a certain period of time after its filing. A Community Trademark (CTM) registered at OHIM (Office for Harmonization in the Internal Market) must be put to genuine use in the European Union in the five years following its registration (OHIM, 2015). Moreover, use must not be interrupted for at least five years. Therefore in case of long innovation processes it is not rational to register a trademark long before entering the market. A second reason concerns the description of a trademark. Unlike patents a trademark does not require full disclosure of the goods or services to which the trademark applies. Trademark law does require a clear identification of the nature of the goods and services involved. In case a trademark refers to innovation there is a possibility that in case of early trademark registration, when it is not

clear yet what the results of the innovation process will be, the trademark registered does not cover the innovation correctly (Klink, 2003). A final reason to register late is that early trademark registration signals innovation and change to competitors enabling them to develop a competitive reaction early. Early trademark registration therefore can cause the applicant to lose part of its lead time advantage. Leiponen and Byma (2009) confirm this for small firms facing the choice of maintaining secrecy or filing patents.

We are interested in what determines either early or late filing of trademarks. If we are able to answer that question, we may get a better picture of the innovations and innovators covered by trademark data. For instance, we could establish the extent to which trademarks do refer to commercialized innovation or the extent to which they can measure early innovation activities of start-ups. We propose here to look at three main determinants of early or late filing of trademarks: the combined use of patents and trademarks, innovation in start-ups versus established firms and type of innovation process.

2.2. The timing of trademark application in case of the combined use with patents

In the previous section we have separately reviewed motives for early or late engagement in patent or trademark application for innovation purposes. However, in many cases firms apply both for patents and trademarks, for reasons of complementarity (Llerena and Millot, 2013). Trademarks and patents may strengthen each other for example by prolonging the time during which an innovation can be exploited in the market. Sometimes trademarks are substitutes for patents (Llerena and Millot, 2013). For example, when an innovation cannot be legally patented or when it is too expensive, firms may still create an alternative form of protection for their innovation by using a trademark. In case of substitution we expect a trademark to be filed earlier to ensure at least some form of protection. This is not necessary in case of the

combined use of patents and trademarks since the patent provides better protection than a trademark. We therefore hypothesize that

Hypothesis 1: TM applications that are not combined with patents are filed earlier in the innovation process than TM applications used in combination with patents.

3. MODES OF INNOVATION AND THE TIMING OF TRADEMARK FILING

IPRs can be filed during different stages of an innovation process. Properties of the innovation process such as its length and internal organization depend on characteristics of both the innovator and innovation. At the two extremes, the innovation trajectory of complex products developed within large firms is different from the innovation by small firms in the services sector. We expect these differences to lead to different modes of innovation and differences in the process of decision making when applying for IP. In section 3.1 we elaborate on the differences between the development of new products and new services. In 3.2 we focus on innovator characteristics, in particular the difference between start-ups and established firms.

3.1. Innovation processes: new product development versus new service development

During the past decades different process schemes have been introduced for the development of both new products and processes inspired by defining different phases or stages. Cooper (1983) introduced the stage-gate product development process consisting of a predetermined set of stages which have to be passed or evaluated positively before entering the next one.

During the eighties and nineties of the past century these simple models have evolved to include more complexity and interaction such as customer demand and the chaotic reality of most innovation processes (Cooper, 1994; Rothwell, 1994). Third generation stage-gate product development models include overlapping, fluid stages with conditional or “fuzzy”

decision making between stages. Also the interaction between different stages and feedback loops between stages were included. Especially in case of innovation processes which are short in duration and where decision making is quick and informal (for example in case of small firms) stages will overlap. Next to the development of new product development, new service development (NSD) models which describe innovation in the services sector have appeared as well (Booz, Allen and Hamilton, 1982; de Brentani, 1989 ; de Brentani and Cooper, 1992; Sundbo, 1997; Alam and Perry, 2002). Because of its intangible character service innovation is difficult to capture and therefore its typical innovation process is also more challenging to describe (Sundbo, 1997). Both Sundbo (1997) and Alam and Perry (2002) state that the idea generation phase is an important phase in the development of new services. However they also state that the generation of new ideas in most cases is not formalized. It is a creative and fortuitous process. New ideas are mostly generated on a bottom-up basis and often in response to specific clients' needs. Therefore very often service innovation cannot be planned but is initiated triggered by external influences. Because of the interactive nature of services, customer orientation and interaction is very important in the further development of these new ideas. The service innovation is only recognized as such after proven success in the market. Triggered by this success IP protection becomes necessary when the innovation is already implemented, which might explain later trademark filing in case of new service development as compared to product innovation.

Another reason why services innovation is difficult to recognize and the IP connected to it is filed during the back end of the process is the short duration of service innovation processes. Alam and Perry (2002) indicated that service firms have a lot of parallel activities in their service innovation process. For example in their process model the test and marketing phases are combined. Sundbo (1997) presents a model with just four phases in which testing is considered to be part of the service development phase. This development phase is followed

by an implementation phase (which can be described as a combination of market introduction and commercialization). Sundbo (1997) also states that especially in the services sector it is easy for competitors to imitate service products. Moreover in the case of services imitation can already take place in a very short period of time after its first introduction. Innovation speed is therefore necessary in order to maintain a competitive advantage. These differences are shown in figure 1 which is an adaptation of Cooper's basis stage gate model (Cooper, 1983).

FIGURE 1 about here

Based on the above discussion, we propose Hypothesis 2a:

Hypothesis 2a: TM applications referring to new service development are filed during the later stages of the innovation process, especially during the introduction or commercialization phases.

Many innovations are not planned. They do not follow a structured process but arise on the job in order to fulfill new customer needs, or to deal effectively with the unique problem a customer faces. Gallouj and Weinstein (1997) defined ad hoc innovation as “the interactive (social) construction of a solution to a particular problem posed by a given client”. When applied to innovation processes this implies that the development and commercialization phases in ad hoc innovation strongly overlap. Ad hoc innovation has been studied mainly in connection with service innovation (Sundbo and Gallouj, 2000; Gallouj, 2002; Drejer, 2004). After a new service is developed in a customer organization, firms fine tune and commoditize new service practices, to capitalize on it in other client assignments. This process of

knowledge codification is at the basis of the development of new service and product offerings (Castaldi and Giarratana, 2015). If they succeed in doing this trademarks are filed afterwards, triggered by market success and to counter attacks of competitors in the same area (Semadeni, 2006). Hypothesis 2b therefore states:

Hypothesis 2b: Ad hoc innovators file trademarks in later stages of the innovation process.

Ad hoc innovation has been used predominantly in studies of service innovation but its definition also applies to product innovation. Examples given in case studies (Windahl et al., 2004) however are limited to business-to-business manufacturing firms providing integrated solutions to customers

3.2 Start-ups versus mature firms

When it comes to IPR, the literature clearly finds that how large established firms deal with protecting their intellectual property is very different from how young start-ups do that (Mann and Sager, 2007). For our purposes here, research on the use of IPRs by (innovative) start-ups provides three main reasons why start-ups may use trademarks. First, start-ups can use trademarks to flag invention, to claim revolution, to be able to attract licensees or to attract investors. Research by Block et al. (2014) on the use of trademarks by high-tech start-up firms indicates that early trademark filing may enhance their value potential for venture capitalists. Schneider and Veugelers (2013) also find that innovative start-ups use significantly more trademarks than innovative firms in general. Second, start-ups embody innovation. Trade names are filed to mark the start of a new, innovative company. Finally, as start-ups have limited resources, trademarks may also function as substitutes for patents, especially in consumer-oriented markets (de Vries et al, 2013). This might entail applying for trademarks relatively early on in the innovation process. Of course, a lack of familiarity with IPR and IPR law may have the opposite effect of delaying trademark application, most likely in case of

start-ups in low-tech industries, such as many service sectors. However, we expect that start-ups will typically tend to apply for trademarks relatively early.

Hypothesis 3: Start-ups apply for trademarks in the innovation process earlier than mature firms.

4. RESEARCH METHOD

The empirical evidence in this paper is based upon data collected from a survey of trademark applicants. This survey considers as the units of observations individual trademarks, thereby providing case-level evidence on the relation between trademarks and innovation. In cooperation with both BOIP (Benelux Bureau for Intellectual Property), OHIM (European Trademark Office) an online questionnaire was distributed among applicants who filed at least one trademark at one of both offices in 2009 and which had been granted within two years. Novagraaf, a large international IP agency based in the Netherlands, helped in recovering contact information for large firm applicants, who typically only report the IP agency contact in their trademark application. The survey set out several questions, varying from respondent characteristics – such as firm size and sector, market orientation, branding strategy and maturity of the IP rights strategy to aspects of the trademark registration process, such as motivation, involvement of trademark attorneys, timing of the trademark filing and the bundling of trademarks with other IP rights. The final sample contains 1015 applicants who have applied for a Benelux Trademark (n=456) or a Community Trademark (n=559) in 2009. Besides applicant and trademark characteristics the questionnaire contained questions on the motives of the applicant, the trademark reference to innovation, the use of other IPRs (both formal and informal). In case the trademark was referring to an innovation, trademark applicants were asked during which phase in the innovation process the trademark was filed

according to the seven phases defined in Cooper’s (1983) new product development process. Out of in total 1015 respondents 716 declared that the trademark referred to something new (a new or improved product, service, design or process). 677 of these 716 respondents also answered the question with respect to the timing of trademark application. More descriptive statistics are shown in table 1.

In our sample about 45% of all trademarks are filed before the marketing phase. There are clear differences visible in the timing of trademark application in case of service innovation as compared to product innovation. The trademark registration patterns for product and service innovation are different as can be seen in figure 2.

FIGURE 2 about here

Trademarks referring to services are registered more frequently in the first two phases of the innovation process or during the last phases (introduction & commercialization phases) as compared to product innovations, whereas trademarks referring to product innovation dominate the middle stages of the innovation process. The biggest difference is found in the marketing phase: 35% of trademarks referring to product innovation are filed in this phase as compared to 11% in the case of service innovation.

5. DEFINITION OF VARIABLES

Table 1 also shows the descriptive statistics for the variables used in this study, and the dummies created when needed. 585 out of 677 respondents answered all the necessary questions needed to enter our final analysis

TABLE 1 about here

Our dependent variable is late trademark filing (filing from the marketing phase on) as opposed to earlier trademark filing (filing earlier than the marketing phase). Because of their purpose it is expected that trademarks are filed during the marketing phase in innovation processes or later. This is also the reason why trademarks filed before the marketing phase can be considered to be filed early. Given the dichotomous nature of the dependent timing variable in the formulated hypotheses binary logistic regression was used for estimating the significance of the relation with the different covariates. Apart from the main descriptives of our sample table 1 shows the operationalization of the observational characteristics into dummy variables which enter the final analysis. Dummies were introduced as independent variables representing firm, innovation and trademark characteristics.

To check the robustness of this method the same analysis has been applied for a different definition of the dependent variable where timing is defined as (very) late when application happens after the marketing phase and early when the trademark is filed during the idea or research phase of the innovation process. A reason for recoding the timing variable into binary variables is that not all of Cooper's seven innovation are equally represented in our sample. Especially the research and test phases are underrepresented while the development and marketing phase represent almost 50% of the cases in our sample. Possible reasons are that the underrepresented phases are either short in time or less applicable for some kind of innovations (for example the test phase in case of service innovation).

Our independent variables are measured with several dummies. To test Hp1, we consider the joint use of one or more patents to protect the innovation referred to by the trademark. 18% of

the respondents indicated that the trademark was combined with one or more patents. To test Hp2a we distinguish between product and service innovation. For Hp2b a dummy is introduced representing respondents who (fully or mainly) agreed with the statement “I would classify our firm as an ad-hoc innovator as opposed to a serial innovator.” This applies to 30% of the cases in our sample. For Hp3 a dummy was introduced to represent the maturity of the firm whose trademark is referring to innovation. This dummy is 1 if the respondent indicated to be a start-up or a future start-up. This applies to almost half of the cases in our sample.

We also control for general firm variables which are not innovation variables but which might also influence the timing of trademark application. As control variables we use: firm size and sector, whether the applicant has filed a trademark before and whether the application is done with the help of an attorney. Descriptive statistics show that these variables indeed influence the timing of trademark filing. Medium sized and large firms tend to file trademarks during the marketing phase of the innovation process. For the large firms in our sample this amount is especially large: about 40%. This also holds when an IPR agency/attorney is involved. In these cases more than 30% of the trademarks are filed during the marketing phase. For pro se filers this is less than 20%. Pro se filers seem to prefer the very early stages of innovation. Almost 15% of the trademarks are filed during the idea phase. For the trademarks where an IPR agency/attorney was involved this share is less than 5%. Pro se filers are in most cases start-ups and small firms. Applicants with previous trademark experience show a more mixed result (see figure 3). Trademark applicants who have filed a trademark before either favor the development phase or the marketing phase (almost 25% in both cases) while first time applicants file very early (idea and research phases) or very late (introduction phase).

FIGURE 3 about here

6. RESULTS

We first checked of the correlation among our independent variables (table 2).

TABLE 2 about here

Some correlations are evident. For example patent protection is linked to product innovation and not to service innovation which explains the large negative correlation between the combined use with patents and service innovation dummies. There is also a significant negative correlation between start-up and product innovation and start-up and large firm size indicating that most start-ups are small firms in the services sector. However there is no correlation between the ad-hoc innovator dummy and other variables, not even the factor representing a firm's focus on continuous innovation.

A binary logistic regression was used in order to examine the effect of the combined use with patents, the effect of the two modes of innovation on the timing of trademark application and the effect of the innovator being a start-up company. Four models were introduced to test these effects. Results for the binary recodings of the dependent timing variable are shown in table 3. The estimated coefficients represent the log odds of filing later in the innovation process as represented by the binary timing variables. A negative coefficient indicates the

effect of earlier filing while a positive coefficient indicates that when the represented factor applies the likelihood is increased that a trademark will be filed during the last phases of the innovation process. In case the dependent timing variable is 1 in case of trademark filing during the idea or research phase in the innovation process this is opposite. In this case a negative coefficient indicates a tendency towards later filing.

TABLE 3 about here

Characteristics such as the combined use of patent(s), start-up and previous trademark experience show significant negative coefficients if the dependent timing variable is late trademark filing indicating that these characteristics are connected with earlier filing. Large firm size, the use of an IP agency and the ad hoc innovator dummy are variables with significant positive coefficients indicating late trademark application (marketing phase or later). This result is partly confirmed by the robustness check. Large firm size however is not significant in case of the robustness check where late filing is defined as being after the marketing phase indicating that most large firms file their trademarks during the marketing phase of innovation. Contrary to hypothesis 1 trademarks that are combined with patents are filed earlier in the innovation process. Closer examination shows that more than 30% of the trademarks filed jointly with patents are registered during the development phase of the innovation process. Therefore hypothesis 1 is rejected. Start-ups show the most significant tendency towards earlier trademark filing which is also confirmed by the robustness check. Therefore hypothesis 3 is confirmed. The estimations show a mixed result when testing for hypotheses 2a and 2b. The service innovation dummy does not show a significant tendency towards both early and late trademark filing. Hypothesis 2a therefore does not hold. The

product innovation reference dummy however does show a significant tendency towards early filing. This result is confirmed by the robustness check but not confirmed when we take very early filing (trademark application during the idea or research phase) as a dependent variable indicating that trademarks tend to be filed during the development phase in case it refers to product innovation. The ad-hoc innovator dummy indicates a significant tendency towards later trademark filing but this result is not confirmed by the robustness check indicating that ad-hoc innovators apply for trademarks during the market phase instead of even later phases (introduction and commercialization phase) which is expected when they innovate “on the job”. Hypothesis 2b therefore only partly holds.

7. DISCUSSION AND IMPLICATIONS

This study contributes to the emerging literature on the use of trademarks as indicator of innovation and firm-level IP strategies. There is a substantial amount of papers studying patent strategy and management (see the review by Somaya (2012)). There is also a growing amount of papers on the use of trademarks as an indicator for innovation (Mendonca et al, 2004; Greenhalgh and Rogers, 2012) and on branding strategy in general (Aaker, 2007). The aim of this paper is to provide further insight into trademark strategy as a means to protect innovation. An important insight is that trademarks are not only filed late in the innovation process, but that a substantial share of trademarks are filed early on. Early filing takes place by smaller firms, in conjunction with patents, and by start-ups. This has implications for the use of trademarks to measure innovation. Trademarks can indicate innovations in different stages of development. When trademark data can be combined with data about firm age and size, it may be possible to predict whether a trademark refers to an early or a late stage

innovation. This result is however preliminary as other factors may influence this link between firm age, size and trademarking.

This study also shows that large firms prefer to file their trademarks during the back-end phases of the innovation process. During the early stages of innovation there is still a lot of uncertainty about its possible success. The confidence in the success of an innovation grows when it enters the later stages of innovation. Therefore trademarks referring to innovation filed by large firms can be a useful indicator for potentially successful innovation especially in patent-intensive sectors. Relatedly, it could be useful to extend this research by looking at the timing of application of different IPRs such as patents, design rights and model rights. By collecting data on complete firm IPR portfolios more insights can be obtained on the joint use of different forms of IPR to profit from innovation.

Furthermore, one could take a closer look at differences across sectors. Our data reveals that the most early trademark filers are firms with R&D or advertising and market research as a main economic activity. About 25% of these firms file their trademarks already during the idea phase. They seem to market ideas. The size of the data sample used in this paper is not large enough to make any reliable conclusions about the differences between specific sub-sectors, but further (qualitative) research on specific groups of early trademark filers could shed further light on their strategies.

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TABLES

Table 1: Sample descriptives

Variable		Categories	n (original sample)	Original sample share	Operationalization	value	n (analysis)	final analysis sample share
dependent								
1.	Timing	Idea phase	75	11%	Filing during idea or research phase	1	63	11%
		Research phase	42	6%	Filing during idea or research phase	1	36	6%
		Development phase	150	22%		0	130	22%
		Test phase	46	7%		0	38	7%
		Marketing phase	142	21%	Filing during marketing phase or later	1	130	22%
		Introduction phase	124	18%	Filing during introduction phase or later	1	104	18%
		Commercial phase	98	15%		1	84	14%
HP1								
2.	Patent(s)	Yes	123	18%	Patent dummy	1	110	19%
		No	554	82%		0	475	81%
HP2								
3.	Reference to product innov.	Applicable	371	55%	Product innovation reference dummy	1	326	56%
		Not applicable	306	45%		0	259	44%
	Reference to service innov.	Applicable	196	29%	Services innov. reference dummy.	1	160	27%
		Not applicable	481	71%		0	425	73%
4.	ad hoc innovator	Fully disagree	90	13%	ad hoc innovator dummy	0	81	14%
		Mainly disagree	112	17%		0	95	16%
		Neutral	205	30%		0	175	30%
		Mainly agree	181	27%		1	159	27%
		Fully agree	89	13%		1	75	13%
HP3								
5.	Firm maturity	Future start-ups	26	4%	Startup dummy	1	26	4%
		Start-ups	246	36%		1	246	42%
		Mature firms	313	46%		0	313	54%
		Not applicable	92	14%		0	0	0%
controls								
6.	Firm size	1 "a one man business "	128	19%		0	116	20%
		2 to 4	154	23%		0	140	24%
		5 to 9	92	14%		0	74	12%
		10 to 49	125	18%	Medium firmsize dummy	1	111	19%
		50 to 249	66	10%		1	52	9%
		250 to 499	14	2%	Large firmsize dummy	1	11	2%
		≥ 500	77	11%		1	65	11%
		not applicable	21	3%		0	16	3%
7.	Industry	Services	308	50%	Services sector dummy	1	253	43%
		Manufacturing	272	44%		0	294	50%
		Agriculture, forestry and fishing	38	6%		0	36	6%
		Extraction of minerals	2	0%		0	2	1%
8.	Trademark experience	first-time applicants	289	43%	trademark experience dummy	0	256	44%
		frequent users	388	57%		1	329	56%
9.	Use of IP agency	No	522	77%	Use of IP agency	0	455	78%
		Yes	155	23%		1	130	22%

Table 2: Correlation between independent variables

				Correlations										
				1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	
Hp1	1.	patent	Pearson Correlation Sig. (2-tailed) N	1,000 677										
	Hp2	2.	product innovation	Pearson Correlation Sig. (2-tailed) N	,251** ,000 677	1,000 677								
3.		services innovation	Pearson Correlation Sig. (2-tailed) N	-,166** ,000 677	-,336** ,000 677	1,000 677								
4.		ad hoc innovator	Pearson Correlation Sig. (2-tailed) N	-,008 ,830 677	-,006 ,880 677	-,048 ,215 677	1,000 677							
Hp3	5.	start-up	Pearson Correlation Sig. (2-tailed) N	,007 ,856 585	-,080 ,054 585	,174** ,000 585	,029 ,478 585	1,000 585						
controls	6.	medium firmsize	Pearson Correlation Sig. (2-tailed) N	,037 ,342 677	,081* ,034 677	-,096* ,012 677	,012 ,751 677	-,297** ,000 585	1,000 677					
	7.	large firmsize	Pearson Correlation Sig. (2-tailed) N	,129** ,001 677	,088* ,022 677	-,070 ,068 677	-,020 ,598 677	-,340** ,000 585	-,247** ,000 677	1,000 677				
	8.	services sector	Pearson Correlation Sig. (2-tailed) N	-,211** ,000 620	-,402** ,000 620	,374** ,000 620	,002 ,961 620	,242** ,000 585	-,068 ,090 620	-,184** ,000 620	1,000 620			
	9.	previous trademark experience	Pearson Correlation Sig. (2-tailed) N	,066 ,087 677	,062 ,106 677	-,081* ,035 677	,008 ,842 677	-,373** ,000 585	,203** ,000 677	,270** ,000 677	-,123** ,002 620	1,000 677		
	10.	IP agency	Pearson Correlation Sig. (2-tailed) N	,035 ,363 677	-,014 ,722 677	-,022 ,563 677	,008 ,825 677	-,144** ,000 585	,166** ,000 677	,125** ,001 677	-,070 ,080 620	,150** ,000 677	1,000 677	

** . Correlation is significant at the 0.01 level (2-tailed).

* . Correlation is significant at the 0.05 level (2-tailed).

Table 3: Regression results

DV: TM filing during marketing phase of innovation or later

mode	Variables	model 1		model 2		model 3		model 4	
		B	Sig.	B	Sig.	B	Sig.	B	Sig.
patents	bundled with patents	-0,581***	0,008	-0,524**	0,019	-0,523**	0,020	-0,489**	0,037
innovation modes	product innovation			-0,444**	0,021	-0,442**	0,022	-0,481**	0,017
	services innovation			-0,303	0,143	-0,281	0,176	-0,251	0,243
	ad hoc innovator					0,300*	0,079	0,300*	0,092
startup	startup							-0,563***	0,008
Controls	medium firm	0,521**	0,011	0,537***	0,009	0,541***	0,009	0,339	0,138
	large firm	1,094***	0,000	1,110***	0,000	1,120***	0,000	0,779**	0,017
	services sector	-0,239	0,166	-0,310	0,108	-0,318	0,100	-0,256	0,206
	previous TM	-0,324*	0,075	-0,350*	0,056	-0,355*	0,053	-0,500**	0,012
	use of IP agency	0,459**	0,030	0,444**	0,037	0,442**	0,038	0,500**	0,024
	Constant	0,177	0,304	0,546**	0,017	0,425*	0,075	0,865***	0,002
	N		620		620		620		585
Prediction rate		56,8		59,8		60,5		62,1	
Nagelkerke R square		0,070		0,083		0,089		0,106	

DV: TM filing during introduction phase of innovation or later

mode	Variables	model 1		model 2		model 3		model 4	
		B	Sig.	B	Sig.	B	Sig.	B	Sig.
patents	bundled with patents	-0,647**	0,011	-0,527**	0,042	-0,526**	0,042	-0,444*	0,099
innovation modes	product innovation			-0,675***	0,001	-0,675***	0,001	-0,697***	0,001
	services innovation			-0,117	0,591	-0,104	0,633	-0,049	0,825
	ad hoc innovator					0,168	0,352	0,113	0,541
startup	startup							-0,526**	0,018
Controls	medium firm	0,248	0,246	0,291	0,181	0,290	0,182	0,080	0,737
	large firm	0,024	0,938	0,070	0,821	0,074	0,811	-0,221	0,514
	services sector	0,199	0,272	-0,012	0,952	-0,016	0,937	0,006	0,977
	previous TM	-0,275	0,151	-0,301	0,121	-0,302	0,119	-0,383*	0,063
	use of IP agency	0,037	0,866	-0,001	0,995	-0,002	0,992	0,031	0,893
	Constant	-0,702***	0,000	-0,219	0,350	-0,288	0,242	0,105	0,713
	N		620		620		620		585
Prediction rate		68,5		68,7		68,2		68,4	
Nagelkerke R square		0,030		0,056		0,057		0,070	

DV: TM filing during idea or research phase

mode	Variables	model 1		model 2		model 3		model 4	
		B	Sig.	B	Sig.	B	Sig.	B	Sig.
patents	bundled with patents	0,082	0,785	0,044	0,888	0,054	0,863	-0,042	0,896
innovation modes	product innovation			0,272	0,270	0,266	0,281	0,249	0,337
	services innovation			0,226	0,368	0,205	0,416	0,079	0,769
	ad hoc innovator					-0,309	0,176	-0,283	0,234
startup	startup							0,821***	0,003
Controls	medium firm	-0,742**	0,010	-0,745**	0,010	-0,751***	0,010	-0,338	0,286
	large firm	-1,220**	0,015	-1,222**	0,015	-1,224**	0,015	-0,643	0,235
	services sector	0,718***	0,002	0,743***	0,004	0,754***	0,003	0,641**	0,018
	previous TM experience	0,020	0,929	0,032	0,888	0,034	0,884	0,226	0,364
	use of IP agency	-0,482	0,128	-0,474	0,134	-0,467	0,142	-0,478	0,149
	Constant	-1,609***	0,000	-1,840***	0,000	-1,723***	0,000	-2,352***	0,000
	N		620		620		620		585
Prediction rate		82,4		82,4		82,4		83,1	
Nagelkerke R square		0,090		0,099		0,104		0,120	

Significant at the ***0.01 level, **0.05 level, *0.1 level

FIGURES

Figure 1: Sequencing of stages in the innovation process and the duration of the innovation process: two examples

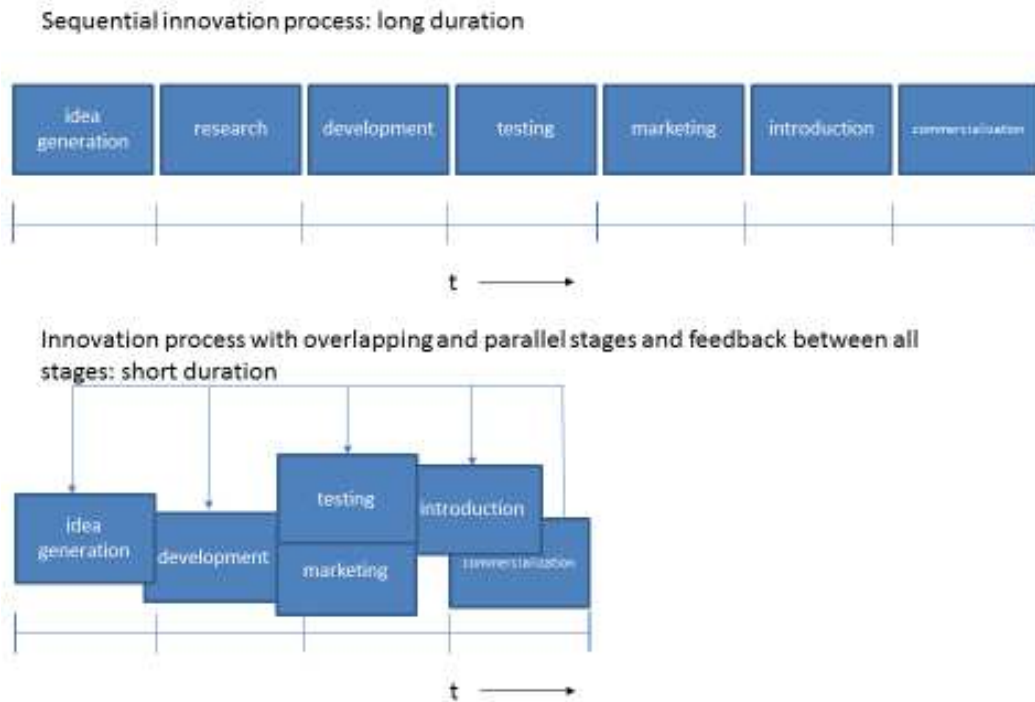


Figure 2: The timing of trademark application for product and service innovation

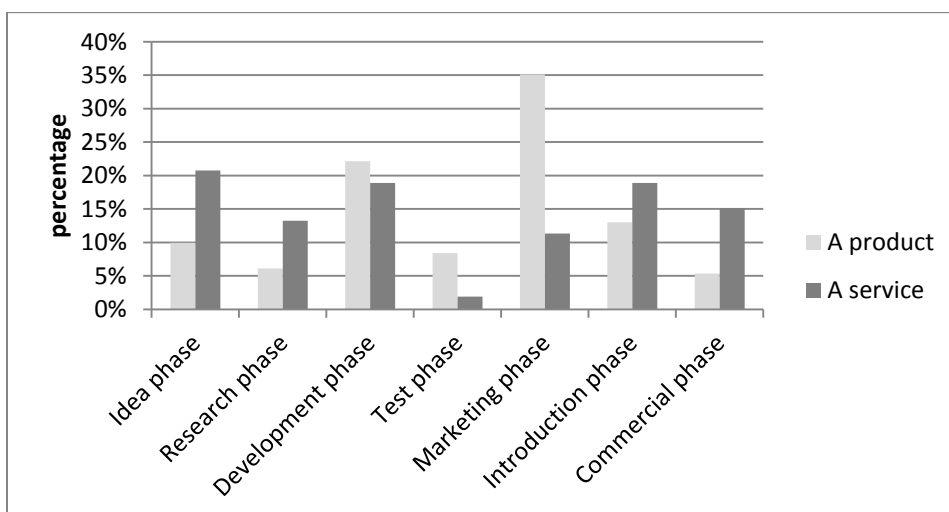


Figure 3: The effect of trademark experience on the timing of trademark application during the innovation process

