

The international preliminary examination of patent applications filed under the Patent Cooperation Treaty – a proxy for patent value?

CHRISTIAN STERNITZKE<sup>1,2</sup>

<sup>1</sup>Technische Universität Ilmenau, PATON – Patentzentrum Thüringen, Ilmenau (Germany)

<sup>2</sup>Universität Bremen, Forschungsgruppe Innovation und Kompetenztransfer, Bremen (Germany)

Abstract:

One way to achieve international patent protection is to file patents via the Patent Cooperation Treaty (PCT). The application process therein can be divided into two phases, those represented by chapters I and II of the PCT. According to the literature, patent applications filed via chapter II of the Treaty tend to be more valuable. The results presented in this paper suggest that in general this assumption is not justified. The analyses further revealed that for practitioners seeking fast patent protection at the European Patent Office (EPO) via the PCT, the choice should be chapter II of the PCT, with the EPO as preliminary examination authority.

*Address for correspondence:*

CHRISTIAN STERNITZKE

Technische Universität Ilmenau

PATON – Patentzentrum Thüringen

PF 100 565, D-98684 Ilmenau, Germany

E-mail: [christian.sternitzke@tu-ilmenau.de](mailto:christian.sternitzke@tu-ilmenau.de)

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## 1. Introduction

One popular way of achieving international patent protection for an invention in a variety of countries is to file the application via the Patent Cooperation Treaty (PCT). This article investigates the impact of different stages of the PCT on the patent application process at the European Patent Office (EPO) and the impact of those different stages on patent quality and subsequent patent value. GUELLEC & VAN POTTELSBERGHE DE LA POTTERIE (2000, 2002) and REITZIG (2004a, 2004b) discuss whether requesting an international preliminary examination for a patent application under chapter II of the PCT can be taken as a proxy for valuable patents. By doing so, the applicant extends the time limit within which he needs to make the final (and costly) decision to request the final examination from 20 to 30 months after the application's priority date. However, the observations in the publications cited above are ambiguous. In practice, applicants value the extension of the international phase since it enables them to postpone their costly decision to file at certain national or regional offices (GRUPP & SCHMOCH, 1999). The prolongation in this case should reflect uncertainty about the market potential of the invention rather than its particular value. The findings presented in this paper show that there is no evidence that patent applications filed according to stage II of the PCT are more valuable. In addition, they reveal examination practices at the EPO which may help firms to choose an adequate filing strategy in order to achieve fast patent protection within Europe.

The article is structured as follows: in section 2, the background of the PCT application process is presented. Section 3 outlines the research

methodology; section 4 illustrates and discusses the results. Conclusions follow in section 5.

## 2. Background and research questions

Under chapter I of the PCT, applicants are free to seek patent protection in 132 member states or regions worldwide. Until recently, applicants could name certain designated states and – within 20 months after the priority date – decide in which of these states then finally to pursue the granting procedure. Since 2004, all PCT member states have automatically been considered as designated states. The eight additional months for for the final choice of designated states because the time limit is extended from twelve (according to the Paris Convention) to 20 months under the PCT give the applicant a better chance of evaluating the invention's commercial potential. A patent office serving as International Search Authority (ISA) for the World Intellectual Property Organization (WIPO) creates a preliminary international search report. When the applicant receives this report, he or she can use it as a basis for the decision to continue with the application or to abandon the procedure if the report indicates that the invention might not be new,. The decision on continuing with the final designated states means that it is the corresponding (national) patent offices who examine the application and charge an examination fee, which in consequence is to be paid at the point of the decision to continue in these states (called entry into national phase). Chapter II of the PCT (especially Art. 31/39 PCT) extends the international phase from 20 to 30 months (31 if the EPO is a designated office). During this time, the international preliminary examination

authority<sup>1</sup> chosen by the applicant performs the international preliminary examination which in consequence is not binding for the different national offices where protection is sought (Art. 33 of the PCT). After 30 or 31 months and having received the result of the international preliminary examination, the applicant can either withdraw his application or decide to continue with the patenting procedure, paying the national (or regional) examination fees. Continuing will mean the national or regional offices will perform the examination of the patent. As a result of the examination process, the patent is either granted, rejected by the office, or withdrawn by the applicant, which is frequently the case when the office had communicated that the invention is not patentable, for instance because it lacks novelty.

Several scholars have considered the decision to use chapter II of the PCT for their patent application as an indicator of patent value: REITZIG (2004a), who analyzed approximately 800 European patents issued between 1992 and 1994 on combinatorial chemistry, noticed that those patents that were extended under PCT chapter II had a significantly higher chance of being opposed. Oppositions of patents are widely used as a proxy for patent value (LANJOUW & SCHANKERMAN, 2001; REITZIG, 2002, 2004a, 2004b; ALLISON ET AL., 2003; CREMERS, 2004; HARHOFF & REITZIG, 2004). REITZIG (2004a) argues that the international preliminary examination accelerates the final examination at the national or regional offices and hence, allows the patent holder to enforce his intellectual property rights earlier, augmenting the

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<sup>1</sup> According to the WIPO, the patent offices of the following countries currently act as international preliminary examination authorities: Austria, Australia, Canada, China, Spain, Finland, Japan, Korea, Russia, Sweden, USA; and the European Patent Office.

patent's value. He also speculates that in recent years the steady increase of PCT applications has caused the indicator to lose its explanatory power.

For those patents filed under chapter II of the PCT, GUELLEC & VAN POTTELSBERGHE DE LA POTTERIE (2000, 2002) find a higher granting rate at the EPO, which is also taken as an indicator of patent value (ERNST, 1996, p. 208, 1998, 1999). They see the additional gain in time and information as arguments for a higher patent value, while they admit that it can be the other way round: PCT II is exploited in order to gather more information and better evaluate the still unclear market potential of the invention.

Neither line of thought explains sufficiently why patents filed under chapter II of the PCT are more valuable. The arguments of REITZIG (2004a) regarding a faster examination at the national or regional office are unproven assumptions. The examination at the national or regional office after having chosen PCT II would have to be very much shorter to compensate for the time spent on the international preliminary examination of PCT II. In a further survey REITZIG (2004b) investigated approximately 16,000 European patents in polymer chemistry with the likelihood of opposition as the dependent variable. Here he could not find a statistically significant relationship between applications filed after PCT II and the dependent variable. He concludes that the explanatory power of the indicator rather seems to indicate uncertainty. This line of argument is also supported by SCHMOCH (1999).

The present article sheds more light on patent applications under chapter II of the PCT and investigates whether patents filed after these rules are more valuable than patents filed under PCT I. The investigation is based on three

different analyses. First, the time-lags in the case of chapter I and chapter II applications are compared. This is to test the argumentation of REITZIG (2004a). At the same time a check is made for an effect on the granting lag that might be caused by the different patent offices serving as WIPO examination authorities and performing the international preliminary examination. Second, the differences in the granting rate of the applications are tested as in GUELLEC & VAN POTTELSBERGHE DE LA POTTERIE (2000, 2002), but taking into account also those patent applications that were withdrawn during the patent application process. Third, the number of patent citations received, a widely accepted measure of patent value (NUNN & OPPENHEIM, 1980; CARPENTER ET AL., 1981; ALBERT ET AL., 1991; HARHOFF ET AL., 1999, 2003), is taken into account, since it is.

### 3. Methodology

We focused, as earlier studies did, on patent applications targeting the EPO. The analyses presented in this paper included all patent applications filed via the PCT between December 1 and 15, 1996 which did not name the EPO as priority office. In order to minimize the potential bias from still pending patent applications, an observation period since which about ten years have elapsed was chosen. This period reflects on the assumption of 31 months from PCT II plus twice the average current granting time (44 months) at the EPO. Data was retrieved from the INPADOC, Derwent Patent Citation Index (DPCI) and EPFULL databases provided by STN International, plus EPOLINE from the EPO.

The Department of Trade and Industry (DTI) and the Office of Science and Technology (OST) of the United Kingdom provide a definition of technology classes linked to classifications of the International Patent Classification (IPC) (DTI/OST). To reflect technology specific characteristics of the applications, particularly in the context of citation data, the analysis was split into six broader technology classes selected from the DTI/OST definition.

### *3.1 Measuring granting time*

The speed of the patent granting procedure was obtained by measuring the time difference between the priority date of the PCT application and the date when an application was finally granted at the EPO, comparing applications filed after chapter I and II of the PCT. Patent family information from the DPCI database was used to match EPO patents to their PCT applications. When there was more than one European patent associated with the PCT application, the granting date of the earliest European patent was chosen. Since the EPO offers a 50 percent discount on its examination fee if it has previously processed the international preliminary examination (BRANDI-DOHRN ET AL., 1998, p. 101), it can be expected that the EPO will rely on the previous results speeding up the final granting procedure in this case. Therefore it was controlled for the office that had performed the international preliminary examination. The analysis was carried out by means of ordinary least squares regression, with the granting time in days as dependent variable, and dummies for international preliminary examination authorities. To check for differences in granting rates at the EPO among applications that had been pre-examined by

different international preliminary examination authorities, a chi-square test was applied.

### *3.2 Measuring granting and total success rate*

The proportion of the patent applications that were subsequently granted was compared for chapters I and II. Here two measures were applied: the granting rate and the “total success rate” (for an illustration see figure 1).

*{insert figure 1 about here}*

These measures are somewhat similar to those applied by GRUPP & SCHMOCH (1999) on granting rates of US-based PCT applications at the EPO. They computed two types of granting rates (also described as success rates): one measure was based on all PCT applications that had the EPO as designated office, and the other measure only took into account those which were not withdrawn during the PCT application process. The measures applied in this study are more detailed, distinguishing between PCT I and II: The granting rate relates in this case to the ratio of “patents granted” to “patent applications not granted”, only taking into account patent applications that previously had entered the national phase. Thus the granting rate is a direct computation of the applicants’ success in terms of the examination procedure at the EPO. In contrast, the total success rate measures the ratio of granted patents to patent applications that were not granted. These include not only those patent applications rejected by the office or withdrawn after entering the national phase (as in the calculation of the granting rate), but also those that had been withdrawn. Patent applications that had been withdrawn after they had entered phase II of the PCT but before they had entered the national phase were included in the calculation of the total success rate for PCT II applications. Patent



applications that had been withdrawn during the first 20 months (between priority date and the decision to enter PCT I or II) were distributed among PCT I and II according to conditional probabilities to reflect how the remaining patent applications were distributed among these two paths (see table 7 in the appendix). Tests for significance were conducted by means of chi-square tests. To sum up the process, the granting rate primarily reflects the applicant's success in the examination procedure at the patent office, i.e. that the invention fulfils the criteria of patentability, the total success rate is computed from the applicants' overall success in receiving a granted patent and takes into account both uncertainty about the examination procedure and market-oriented uncertainty, i.e. the uncertainty whether the invention described in the patent application will yield a positive net present value.

### *3.3 Measuring citation frequency*

The number of citations received per patent family up to December 2006 was calculated controlling for patent applications filed after chapter I and II of the PCT. The analysis was performed for the six different technology areas defined by DTI/OST: Electricity–Electronics, Instruments, Chemicals–Pharmaceuticals, Process Engineering, Mechanical Engineering, and Others. A two-tailed t-test was carried out for logged citation values to assess the significance of the findings.

## 4. Results and Discussion

In total, 2,719 PCT patent applications that did not have the EPO as priority office were identified for the observation period. Among these, 2,600 had targeted the EPO as designated office. The citation data and the data on the

authority that had performed the international preliminary examination were available for 2,563 patent applications. Figure 2 provides an overview of the distribution of different events associated with these 2,563 applications. 6.7% of all patent applications were withdrawn within the first 20 months of the PCT procedure. The majority, 83% of all applications, entered PCT II. Thus, among all PCT applications, entering stage II seems to be the rule rather than the exception. After entering PCT II, another 24.3% were withdrawn by the applicant, the majority as a result of the preliminary examination. 7.2% of the applications are still pending.

*{insert figure 2 about here}*

#### *4.1 Granting time of PCT I and II patent applications*

The regression analysis in table 1 gives a figure for the expected granting time of a European patent after filing a PCT I application of 2,456 days. The granting time for a patent filed under PCT II is highly dependent on the authority which had performed the international preliminary examination. Surprisingly, at the EPO the granting time is even shorter than if the patent application had followed PCT I. Since the EPO performs the majority of all international preliminary examinations, as can be derived from table 2, and the majority of all PCT applications are in fact PCT II applications, it becomes obvious that the overall granting time for PCT II applications is shorter than that for PCT I applications. On average, a patent filed via PCT I was granted after 2,456 days, while a PCT II patent on average was granted after 2,307 days. When the EPO had performed the international preliminary examination, granting took only 2,173 days, and when, for instance, it was the United States Patent and Trademark Office (USPTO) which had performed the international preliminary examination, the period

*{insert table 1-3 about here}*

was 2,702 days, about one and a half years longer. However, the difference in this case results from examination policies at the EPO. Obviously, the office relies highly on the results its earlier preliminary examination, not trusting the results of other examination authorities. This mistrust is rooted in significantly lower granting rates of patent applications where an international examination report has been prepared by other examination authorities such as the USPTO (see table 3), an indication that the EPO performs comprehensive searches for prior art, and a finding which is also of value for practitioners who seek fast patent protection in Europe. They would clearly be well advised to request the EPO to conduct the international preliminary examination.

#### *4.2 Granting rate and total success rate of PCT I and II patent applications*

Could it be possible that applicants who are aware that PCT II results in faster granting times use PCT II to achieve a faster protection of their more valuable inventions? Then patents would not be granted faster because they were per se more valuable, but only because their owners thought that they were, and hence, had selected the faster granting path. In order to answer this question, a closer examination of the granting rate, total success rate and citation analysis was made.

*{insert table 4-5 about here}*

The results of this examination indicate that the granting rate of patents at the EPO was slightly higher for PCT I than PCT II applications (67.4% vs. 64.8%). The numbers are not significant (see table 4). Looking at the total success rate (table 5), one sees it is the other way round: when uncertainty is included in the computations, the ratio of granted patents is significantly

lower for those patent applications under PCT II than for those under PCT I (54.5% vs. 62.4%). The difference is also significant at the 5 percent level, which contradicts the conclusions of GUELLEC & VAN POTTELSBERGHE DE LA POTTERIE (2000, 2002). If the granting rate is taken as a proxy for patent value, it can be concluded that patent applications taking the PCT II route are not of higher value.

Are results found above supported by citation analysis? The answer is: only partially. Citation data on all patent applications revealed that those filed under PCT II received significantly more citations (see table 6). By technology field, the significance diminishes, except for Electricity-Electronics. If the sample is limited to granted patents, for all technology fields the significance also vanishes, again the exception is Electricity-Electronics. However, in other technology fields such as in Mechanical Engineering, PCT I applications receive significantly more citations. Therefore, it can hardly be said that PCT II patents or patent applications are more valuable across the board. For applicants who know about the different speed of the patent application process via PCT I and PCT II at the EPO, it would be feasible in particular to use such knowledge strategically for valuable inventions in Electricity-Electronics. Since innovation cycles are relatively short here, fast patent protection (via PCT II) provides a strategic advantage in the prosecution of the patent holders' rights.

*{insert table 6 about here}*

## 5. Conclusion

This paper presents findings with a two-fold message: First, filing patents under PCT II tends to be the rule rather than the exception. Second, for PCT

patent applications (and patents granted) it cannot generally be concluded whether a patent is more valuable if it has been filed under PCT I or PCT II. Caution is required in drawing conclusions from granting data. The granting time and rate at the EPO appear to depend on internal working policies, and the office does not seem to rely on examination results of other examination authorities. Practitioners who want to achieve speedy patent protection in Europe via the PCT should choose PCT II and the EPO as international examination authority. Citation data as a proxy for patent value reveal a divergent picture: patent applications in general seem to be more valuable when filed according to PCT II, but when controlling for technology fields the significance of this finding diminishes in all fields except in Electricity-Electronics. To conclude, it makes little sense to differentiate between PCT I and II in order to assess a patent's value. The fact that a patent has been filed according to the PCT at all could probably be better used as a general proxy for patent family size and thus, patent value.

#### Acknowledgements

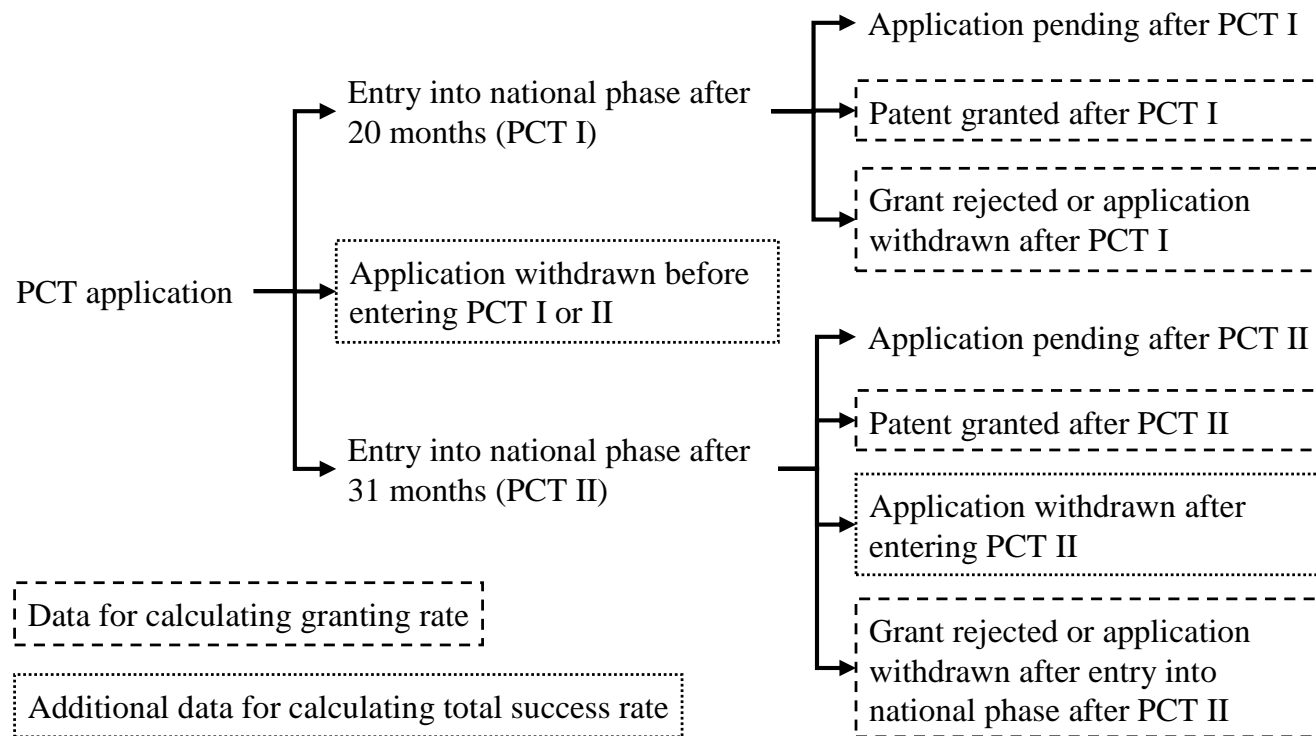
The author would like to thank his colleagues at PATON for support in data retrieval and processing and for their valuable discussions with him.

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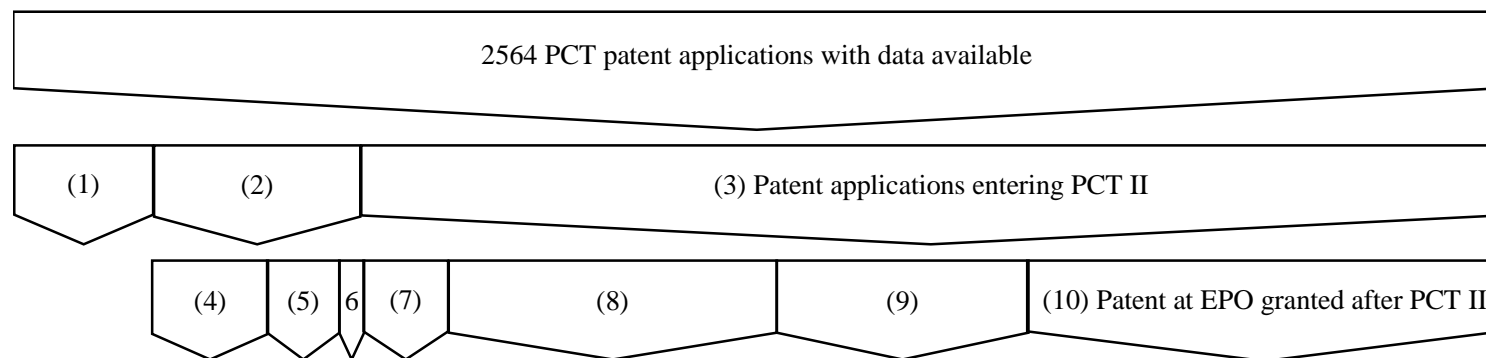
Figure 1: Distribution of the outcome of the PCT patenting procedure and the relationship to granting and total success rate.



(Source: own illustration)



Figure 2: Distribution of the outcome of patent applications in the sample.



*{Insert captions (see next page) close to Figure 2}*

Caption for figure 2

Item	Number of patent applications	Description
(1)	171 (6.7%)	PCT applications withdrawn or extension to EPO withdrawn before entering PCT I OR PCT II
(2)	264 (10.3%)	Entry into national phase after 20 months (PCT I)
(3)	2128 (83.0%)	Patent applications entering PCT II after 31 months
(4)	161 (6.3%)	Patent at EPO granted after PCT I
(5)	78 (3.0%)	Grant rejected by EPO or application withdrawn at EPO after entry into national phase after PCT I
(6)	25 (1.0%)	Application pending after PCT I
(7)	160 (6.2%)	Application pending after PCT II
(8)	623 (24.3%)	PCT application withdrawn or extension to EPO withdrawn after entry in PCT II
(9)	871 (34.0%)	Patent at EPO granted after PCT II
(10)	474 (18.5%)	Grant rejected by EPO or application withdrawn at EPO after entry into national phase after PCT II
	2563 (100.0%)	Total patent applications with data available

(Source: INPADOC, DPCI, EPOLINE; timeframe: December 1-15, 1996; application status as of January 2007).

Table 1: Regression results

Intercept (PCT I application)	2455.565 ***	(42.329)
PCT II & EPO as preliminary examination authority	-282.095 ***	(47.469)
PCT II & USPTO as preliminary examination authority	246.089 ***	(62.552)
PCT II & JPO as preliminary examination authority	258.685 **	(88.326)
PCT II & SPRO as preliminary examination authority	-52.965	(86.954)
PCT II & Other patent offices as preliminary examination authorities	327-518 *	(160.719)
Adjusted R <sup>2</sup>	0.131	
F-Statistic	32.206	
Significance of F	0.000	
N	1.032	

Dependent variable: granting time in days; Standard errors in parenthesis

\*p < 0.05; \*\*p < 0.01; \*\*\*p < 0.001

EPO (European Patent Office); USPTO (United States Patent and Trademark Office); JPO (Japanese Patent Office); SPRO (Swedish Patent and Registration Office).

(Source: INPADOC, DPCI, EPOLINE; timeframe: December 1-15, 1996).

Table 2: Distribution of preliminary examinations by authority

Preliminary examination authority	Number of examinations	
	All applications	
EPO	1245	(58.5%)
USPTO	540	(25.4%)
JPO	140	(6.6%)
SPRO	133	(6.3%)
Other:	70	(3.3%)
IP Australia	45	(2.1%)
APO	10	(0.5%)
Rospatent	10	(0.5%)
SIPO	5	(0.2%)
Total	1972	(100.0%)

EPO (European Patent Office); USPTO (United States Patent and Trademark Office); JPO (Japanese Patent Office); SPRO (Swedish Patent and Registration Office); IP Australia (Australian Patent Office); APO (Austrian Patent Office); Rospatent (Russian Patent Office); SIPO (Chinese State Intellectual Property Office).

(Source: INPADOC, DPCI, EPOLINE; timeframe: December 1-15, 1996).

Table 3: Observed and expected values for patents granted at the EPO after completion of preliminary examination reports from the EPO, USPTO, JPO, SPRO, and other authorities.

Preliminary Examination	Number of patent applications		
		Not granted	Granted
EPO	Observed	254	625
	Expected	309.8	569.2
USPTO	Observed	150	136
	Expected	100.8	185.2
JPO	Observed	29	48
	Expected	27.1	49.9
SPRO	Observed	29	50
	Expected	27.8	51.2
Other patent offices	Observed	12	12
	Expected	8.5	15.5
Total		474	871

$p < 0.001$

EPO (European Patent Office); USPTO (United States Patent and Trademark Office); JPO (Japanese Patent Office); SPRO (Swedish Patent and Registration Office) (Source: INPADOC, DPCI, EPOLINE; timeframe: December 1-15, 1996)

Table 4: Observed and expected values for patents filed under PCT I and PCT II.

	Number of patent applications	PCT I PCT II	
		PCT I	PCT II
Granted	Observed	161	871
	Expected	155.7	876.3
Not granted	Observed	78	474
	Expected	83.3	468.7
Total		239	1345

$p=0.468$

(Source: INPADOC, DPCI, EPOLINE; timeframe: December 1-15, 1996)

Table 5: Observed and expected values for the total success rate for patents filed under PCT I and II.

	Number of patent applications	PCT I	PCT II
Granted	Observed	161	871
	Expected	143.5	888.5
Not granted	Observed	97	726
	Expected	114.5	708.6
Total		258	1597

$p < 0.05$

Patent applications withdrawn before entering phase I or II of the PCT were assigned according to conditional probabilities in table 7 (Appendix).

(Source: INPADOC, DPCI, EPOLINE; timeframe: December 1-15, 1996)

Table 6: Citation frequency of patents filed at the EPO according to technology field. Mean values computed for citations received.

	Complete sample		Electricity– electronics		Instruments		Chemicals– pharmaceuticals		Process engineering		Mechanical engineering		Others	
	N	Mean [log]	N	Mean [log]	N	Mean [log]	N	Mean [log]	N	Mean [log]	N	Mean [log]	N	Mean [log]
All patent applications														
PCT I	410	0.5816*** <sup>v</sup>	92	0.6209*** <sup>v</sup>	54	0.6745	76	0.5274 <sup>v</sup>	65	0.5419	95	0.5927	27	0.4922
PCT II	1968	0.6468*** <sup>v</sup>	361	0.8353*** <sup>v</sup>	323	0.7694	579	0.5845 <sup>v</sup>	274	0.5654	300	0.5403	128	0.5174
Granted patents														
PCT I	161	0.7754 <sup>v</sup>	34	0.6941** <sup>v</sup>	19	1.0152	31	0.6982 <sup>v</sup>	28	0.7509	39	0.8100**	9	0.7918
PCT II	871	0.7217 <sup>v</sup>	154	0.8641** <sup>v</sup>	143	0.8090	247	0.7164 <sup>v</sup>	138	0.6508	135	0.6429**	53	0.5815

\* Significant at the 10% level. \*\* Significant at the 5% level. \*\*\* Significant at the 1% level

<sup>v</sup> unequal variance according to Levene test (p<0.05)

(Source: INPADOC, DPCI; timeframe patent documents: December 1-15, 1996; citations received as of December 12, 2006)

## Appendix

Table 7: Conditional probabilities for table 5 as a basis to calculate the total success rate. Those PCT applications withdrawn or extensions to the EPO withdrawn before entering any stage of the PCT are estimated to match PCT I and II depending on the overall distribution to PCT I and II of the remaining patent applications.

Description	Number of patent applications	Percentage (probability)	Description	Number of patent applications	Conditional probabilities	Previously withdrawn patent applications for calculating the total success rates
Entry into national phase after 20 months (PCT I)	264	11.0 %	PCT applications withdrawn or extension to EPO withdrawn before entering PCT I OR PCT II	171	11.0 %	19
Patent applications entering PCT II	2,128	89.0 %			89.0 %	252
Sum	2,392	100.0 %		171	100.0 %	171

(Source: INPADOC, DPCI, EPOLINE; timeframe: December 1-15, 1996)