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Crowdsourcing patent application review: leveraging new opportunities to capitalize on innovation?

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The knowledge-based economy requires new solutions to existing challenges

The economic value of the European market has shifted from relying on tangible to intangible assets as countries undergo the transformation to a *weightless* and *knowledge-based* economy and companies increasingly recognize the importance of *knowledge-related inputs* to competition (Quah 1998; Drucker 1994). Patent offices, as key institutions in the innovation system, are charged with the now colossal responsibility of regulating most of the intellectual property system. It is within this context of a burgeoning workload that new mechanisms to streamline prior art search, a critical element in the patent application process, are evolving. The growth of crowdsourced business models that harness the power of communication technologies to resolve complex problems and stimulate broad communities of contributors provide valuable lessons to learn from. Crowdsourcing could powerfully impact prior art search by enabling patent offices to reduce some of the strain on their institutional resources. The possible social and economic benefits are manifold. Enabling patent offices to overcome their sizeable patent backlogs by opening elements of review to the public, it is likely to enhance customer satisfaction while simultaneously improving institutional accountability. As low-quality patents are increasingly rejected, valuable resources will be diverted away from infringement litigation and towards research and development.

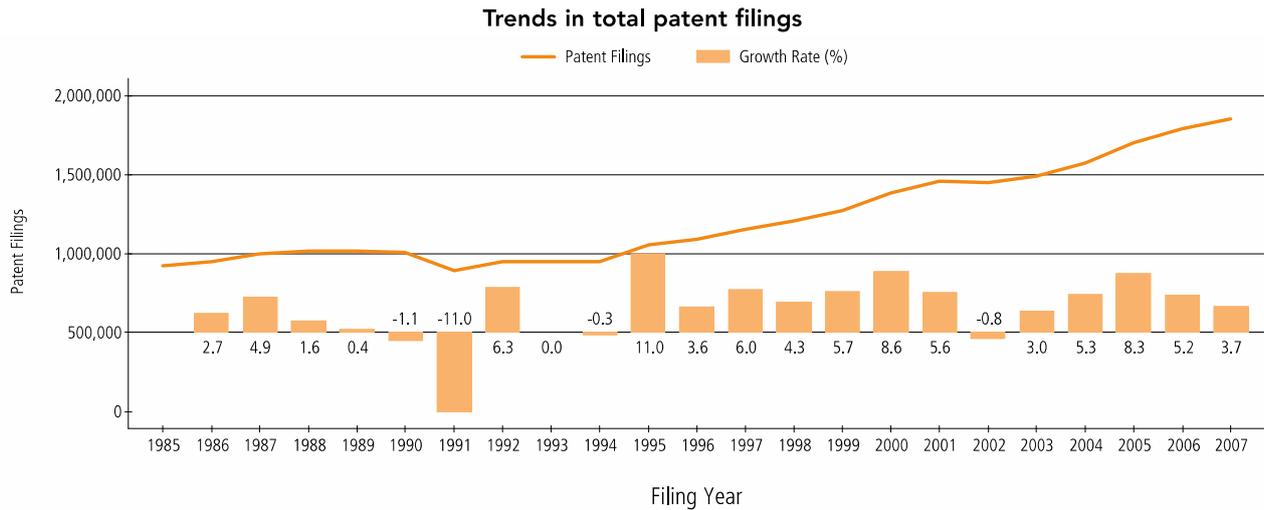
This paper evaluates the value proposition of public-private partnerships to patent review by analyzing the potential impact of crowdsourced prior art search on the European patent system. This first requires outlining the current challenges patent offices in Europe face due to their tremendous workload. The worst consequence of this for the innovation system – a drop in granted patent quality - is then described. Low standards in patent quality are believed to be the result of enormous strain on, and unreasonable expectations of, patent offices. Crowdsourcing offers a solution to many of these problems and presents a valuable resource for patent offices if the process is managed efficiently. The United States Patent and Trademark Office (USPTO) and Japanese Patent Office's (JPO) pilot projects in community patent review are presented as opportunities from which Europe can learn. Promoting public-private partnerships in the management of crowdsourced prior art search can be a valuable solution to mitigate current challenges.

Patent Offices in Europe face growing mounds of unprocessed applications

Demand in patent applications is systematically on the rise. (Center for Patent Innovations [CPI] 2008, 3; Danish Patent and Trademark Office [DKPTO] 2008, 5). While a drop in patent applications at the European Patent Office (EPO) in 2009 followed the economic recession, there were still around 134,500 applications filed under the European Patent Convention in a single year (EPO 2009a, 9). A five-year data review of EPO application and search requests along with patents granted provides a good macro-level perspective of the European system. Here, despite a recent (and likely temporary) fall in patents filed due to

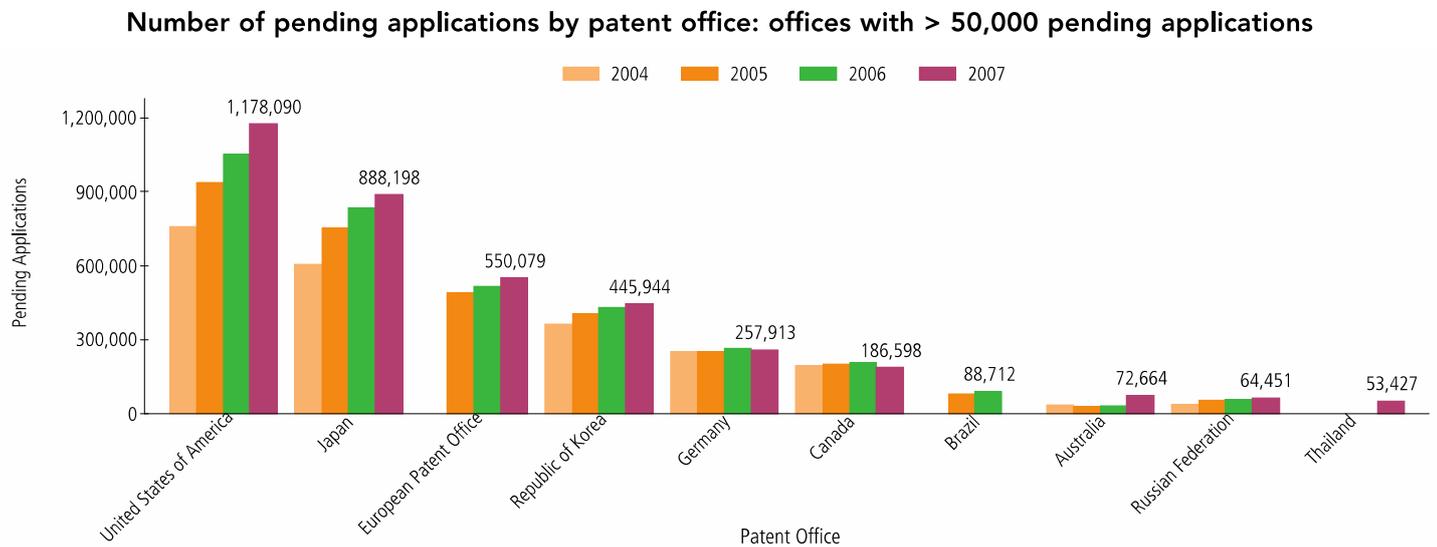
economic contraction, there has been a continuous rise in search requests and opposition proceedings (EPO 2009a, 34). At the national level, the ‘German Patent and Trademark Office’, a very active office in Europe, has exhibited a similar rise in examination and search requests despite a fall in total filings (DPMA 2008, 17).

Figure 1: Trends in total patent filings (World Intellectual Property Organization [WIPO] 2009, 14)



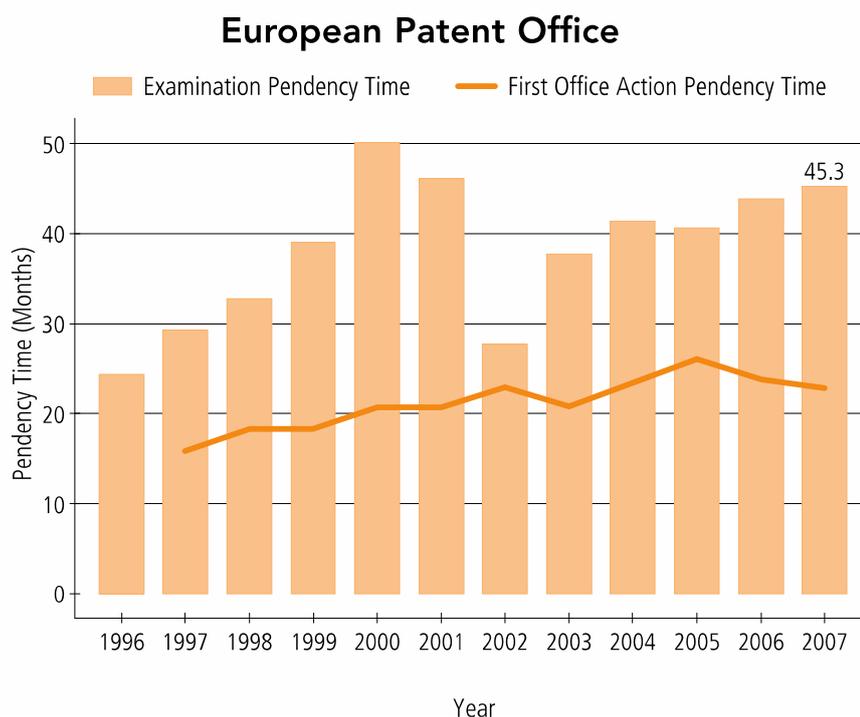
This, paired with the increasing amount of unfinished examinations, suggests that patent offices are overloaded with work in precisely the area where crowdsourced prior art search could be most beneficial. As patent examiners also spend a great deal of time reviewing unworthy applications, efforts are also being made to elevate standards (CPI 2008, 3; EPO 2008, 8). Though there has been a recent dip in patents filed, the general trend towards increased filings as well as increases in invalidation requests has put tremendous strain on the workload of patent offices. The EPO has commented on the ‘critical public reactions to issues such as the growing mounds of unprocessed applications’ (EPO 2008, 6) and patent backlogs worldwide are rising. Estimates place the total number of unprocessed applications at 4.2 million in 2007 as backlogs steadily increase across all geographic regions:

Figure 2: Number of pending applications by patent office (WIPO 2009, 44)



Potential to raise patent quality combined with growth in applications is frequently cited as a major reason for backlog (EPO 2008, 8-9). The EPO has repeatedly recognized the need for increased efficiency and streamlined governance in patent examination and admitted that resources should not be squandered on ‘systematically avoidable’ procedural matters (EPO 2008, 8-9).

Figure 3: Average pendency time of the European Patent Office (WIPO 2009, 45)



Moreover, the EPO and national patent offices increasingly acknowledge the role of technology in streamlining the patent review process (EPO 2009b, 12-13; DPMA 2008, 84-87; DKPTO 2009, 30). Harmonization across offices and regions is also frequently touted as a major solution: the suggestion is that common quality standards and avoidance of duplication efforts will encourage better quality patents and less backlog (NL Patent Office 2009, 15; EPO 2009a, 19). This is evidenced in initiatives such as the Patent Prosecution Highway, the IP5 multilateral project and various bilateral agreements between national offices. However, information sharing mechanisms often do not address some of the primary problems in issuing consistently reliable patents. Harmonization may shorten the average pendency time for a patent but is unlikely to significantly improve reliability. Thus, while collaboration is certainly valuable, it does not address some of the most important factors contributing to low quality patents. These factors include the lack of fundamental informational resources for prior art search - a problem compounded by inadequate time frames for individual examiner review - caused primarily by a highly centralized and accordingly inevitably limited prior art search format. Analysis of proposed reforms at the USPTO - lowering standards of judicial post-grant administrative review, statutory changes to examination procedures, implementing regulatory proposals requiring more thorough prior art searches and establishing peer review - concludes that none of the measures will solve the patent quality issue (Noveck 2006, 126).

Preserving the Public Interest by increasing Patent quality

Patent offices are critical in determining patent quality (Milone 2010, 6). The EPO remarks that 'patents are a pillar of the intellectual property system. The EPO is therefore always looking to improve the quality of its grant procedure, and quality management has been of the essence from the outset' (EPO 2009b, 21). This has been a consistent focus at the EPO and President Alison Brimelow stated that in 2008 the EPO was 'devoting particular attention to further enhancing patent quality' (EPO 2008, 6). The value of a patent to the private sector is largely dictated by patent offices that remain the ultimate arbiters of the validity of a given patent. This said, businesses are naturally implicated in the process as they attempt to optimize the allocation of resources based on the perceived quality of patent. Yet research suggests that there is a crisis in patent quality. Patents are frequently vague, sweeping in applicable scope and unoriginal. Adam Jaffe and Josh Lerner provide ample evidence of patents granted for obvious so-called 'innovations' in their book *Innovation and its Discontents* (Jaffe and Lerner 2006).

While multiple contending definitions exist for patent quality, in essence 'patent quality is synonymous with patent validity' (Milone 2010, 13). Ensuring the validity of granted patents is critical to maintain the public interest of promoting innovation and knowledge transfer. The patent system is justified because it creates incentives to stimulate innovation. Low quality patents create disincentives to downstream innovation, hamper scientific innovation and confer undeserved economic monopoly rewards on patent holders that negatively

impact the free market by constraining freedom to operate within it. In addition, low quality patents generate excessive litigation that is costly to firms and drains resources from federal courts. The costs of low quality patents are thus borne by federal courts, patentee's competitors, and the public (in terms of monopoly price on questionable patents and unnecessary litigation). Ensuring higher quality of patents will also counteract the growing power of Non-Practicing Entities (NPEs) who seek patents solely for the purposes of initiating infringement lawsuits against other businesses. These NPEs often extort licensing fees from competitors without producing any products or innovations. Enabling this type of *patent trolling* is totally antithetical to the rationale for a patent system and it is highly unfortunate that 'the field is fertile for companies to patent undeserving inventions and to profit from the threat of litigation rather than from productive research and development' (Noveck 2006, 131).

Effective prior art search requires adequate informational resources

If greater patent quality relies on stronger validity then the search for prior art is the critical stage at which to improve the current system. Prior art can be any relevant technology or published knowledge that preceded the technology that is currently being filed for patent application. It is of crucial importance that material considered prior art is not limited to *patent documents* (issued patents and filed applications) but includes *non-patent documents* such as articles, websites, and any other published material. The burden of examining all possible written resources that could be used as evidence to invalidate old or obvious ideas falls entirely onto patent examiners in the current system. Often overworked, patent examiners operate under extraordinary time and resource constraints. Yet they remain the integral variable in a working innovation system. Academic expertise has historically helped to maintain efficient patent issuance but this is increasingly replaced with highly centralized processes of administrative decision-making. There is now 'undue reliance on centralized structures of procedural expertise and decision-making' that contributes to a growing information deficit in patent offices due to the 'institutionalized isolation of expertise' (Noveck 2006, 125). The result is poor quality patents. The cause is inadequate information. Examiners are being charged with the responsibility to issue decisions that affect the next 20 years of an industry based on limited information. They cannot consult the public, experts or even the Internet in most cases (Noveck 2006, 126). This is believed to impede corruption of their decision-making by outside sources while insulating the process from security breaches (an internet search by an examiner could be quite easily tracked and the technology in question appropriated). Recognizing that information is critical to prior art searching, they continuously upgrade classification taxonomies and update their document databases (EPO 2009a, 14; DPMA, 65). While patent offices have substantial databases and advanced computer systems at their disposal, these certainly do not provide exhaustive search capabilities.

Further convoluting the process is the fact that applications are frequently unclear, improperly filed and often do not provide examiners with the information necessary to make informed decisions. This results in what has been

termed *The Goldilocks Problem* for examiners: there is 'too little information, too much information, and none of it is just right' (Noveck 2006, 136). With applicants having no legal requirement to submit information relating to the relevant technological antecedents of their filed patent, it is unreasonable to assume examiners can fill in all the gaps with their limited time and resources.

There are also significant language barriers involved in effective prior art searching. In the context of a globalized economy, where prior art can be from anywhere in any written language, the infrastructure required for effective searching is gargantuan (Milone 2010, 3). Compounding this problem is the fact that search technologies have yet to overcome hurdles in effectively recognizing and organizing non-western-language-based digital scripts (only the abstracts of foreign language publications are translated, rendering the full text unsearchable).

However, simply throwing more resources to resolve quality issues is insufficient and does not address the root cause of the problem. If the quality of issued patents is low, and operating firms know this, then litigation is the default tool employed to resolve infringement disputes. There is a flaw in the review process if users do not believe issued patents are valid. Litigation is a highly inefficient process to determine patent validity since it is disruptive, costly and time-consuming for both parties as well as public courts. Crowdsourcing prior art search (outlined below) addresses many of the issues of inadequate information and acknowledges that pouring more resources into a centralized review process is not the solution. The centralized information resources and procedures of review processes in patent offices means they cannot easily stay up to date with the complexity and pace of innovation without help from other actors.

Considering these obstacles to effective prior art search within patent offices, it is worth considering some of the traditional tools available to companies hoping to efficiently allocate resources towards high-quality patent products, since it is naturally in their interest to invest in R&D that will produce patents capable of withstanding infringement lawsuits. In-house prior art search that leverages accumulated expertise within a particular subject area is one tool that should certainly be used before filing a patent. Domestic and international prior art research firms that utilize high quality electronic database software-based searches are another useful tool. However, these encounter the same limitations as previously described: non-western-language-based digitized search engines can only search abstracts of foreign publications and the software engine remains the primary conduit between these agents and their research (Milone 2010, 10). Patent Quality Indices such as the IBM Patent Quality Index Tool, or Ocean Tomo's Patent Ratings are also valuable in determining patent quality. They index both patent applications and issued patents in order to provide statistical organization of validity and relevant facts such as the economic value of a given patent in the market. While these can be effective strategic tools for business, they do not address the fundamental problem of patent quality in the current European innovation system.

Understanding the crowdsourcing phenomenon

For better or worse, no one denies that globalization has significantly altered the way business is done today. Business models have accordingly evolved: first outsourcing, then open-sourcing and now crowdsourcing. With over 1,117,000,000 internet users today, there is a vast pool of skilled labour to draw from (Albors et al. 2008, 196). Howe first coined the term in 2006 and confidently claimed 'welcome to the age of the crowd' (Howe 2006, 1) as new technologies enabled business to harness the creative solutions of highly distributed groups of individuals:

'Crowdsourcing represents the act of a company or institution taking a function once performed by employees and outsourcing it to an undefined (and generally large) network of people in the form of an open call. This can take the form of peer-production (when the job is performed collaboratively), but is also often undertaken by sole individuals. The crucial prerequisite is the use of the open call format and the large network of potential laborers.' (Howe 2006; cited in Brabham 2008, 76)

Crucial to any crowdsourcing definition is the proprietary component. It is only crowdsourcing when the final product becomes the property of the business that initially made the open call. It is valuable in that it harnesses the benefits of open source while overcoming the problem of sufficient incentives. Providing financial returns that offset the overheads of running a business, 'a society that values the quality and innovation of open-sourced production, but is locked into a capitalist system of ownership, capital, and overhead, can have their cake and eat it too with crowdsourcing' (Brabham 2008, 83). The power of crowdsourcing lies in its ability to draw from a diverse intellectual background where networking technologies link the widest possible range of information, knowledge and expertise. Rather than the crowd providing solutions that tend towards the average intelligence of each individual, it provides solutions that aggregate the creativity of each one of the participants. Surowiecki's seminal analysis of the 'wisdom of the crowd' suggests that 'with most things, the average is mediocrity. With decision-making, it's often excellence. You could say it's as if we've been programmed to be collectively smart' (2004, 11).

Mobilizing and channeling the collective intelligence of the crowd for productive endeavours is made possible by web technologies. Advancements in internet technologies, particularly the advent of web 2.0 utilization architectures and social networking capabilities, are the crucial ingredient to effectively harness the wisdom of a mass crowd of users. The internet facilitates the exchange of ideas among culturally diverse, decentralized and geographically disparate individuals (Brabham 2008, 81). It is the enormous scale of the web combined with the instantaneous nature of user exchanges that enables the effective aggregation of disparate ideas into a single output (Terranova 2004). Communication technologies permit participative, multidirectional and highly inclusive behavior (Delfanti 2010, 2) as they break down cost barriers separating amateurs and professionals. As digital literacy increases among the public, crowdsourcing's value will increase. Crowdsourcing models also provide

companies with ample opportunities to headhunt skilled participants and participation in projects actively enhances the skill-set of the targeted labour pool in a manner that stimulates entrepreneurship and personal development (Brabham 2008, 84). Moreover, that collaboration is text-based means that introvert participants share their ideas on an equal basis as their extrovert peers (Albors et al. 2008, 195)(Albors, Ramos, and Hervas 2008b, 195). Sustaining an online community is perhaps the greatest challenge facing the crowdsourcing model. Yet even this basic problem of desertion can be reduced by implementing techniques of participation facilitation and community support that emerging technologies make possible since sustainability depends on whether there is sufficient community support for the collective initiative (Albors et al. 2008, 195)(Albors, Ramos, and Hervas 2008b, 195). Perhaps most importantly, crowdsourcing capitalizes on the *Semantic Web*: aggregated solutions to complex issues are efficiently achieved because web content is increasingly understood by computers that perform a large amount of the tedious tasks that share and combine the information provided by the multiple users (Albors et al. 2008, 198).

Successful crowdsourcing examples abound. Innocentive is an initiative launched by pharmaceutical company Eli Lilly in 2001 to link outside experts to the firm's internal departments in order to solve R&D problems it could not alone. By offering monetary rewards, more than 30% of the problems posted on the site were solved (Howe 2006, 3). iStockphoto, a website originally designed for cheap stock photography that now encompasses illustrations, video and audio, has created a market that has now drawn 29,000 total contributors (http://www.istockphoto.com/forum_messages.php?threadid=208351&page=2). Dell's 'IdeaStorm', launched in February 2007, has generated over 10,000 ideas while BP received over 20,000 contributions on how to combat the recent oil spill in the Gulf (<http://www.revenews.com/barrysilverstein/wisdom-of-crowds-more-corporations-turn-to-crowdsourcing/>). These are only the formal models. Informal communities on the internet have long been generating innovative ideas and solving complex problems. Clearly, crowdsourcing is generating results that cannot be ignored.

Harnessing the collective intelligence of the community for patent review

Scientific expertise, often consulted when opposition proceedings are filed against particular patents, must be brought into the patent review process earlier if patent quality is to be improved. In the same manner 'as the community of open source programmers can better spot mistakes in code than one individual can, the applicable scientific and innovation community is better equipped to address the science found in patent applications' (Noveck 2006, 144). Though patent examiners are trained to effectively search through the relevant patent literature, it is substantially more difficult and time-consuming for them to access non-patent literature that is often deemed just as important (DPMA 2009, 89). Essential to determining whether an application presents a novel, non-obvious improvement over prior technologies is that the examiner place themselves in shoes of someone 'skilled in the art'. Opening prior art search to a wider community of experts (and even amateur enthusiasts and

practitioners) overcomes this challenge by allowing people skilled in the art to take part in the process. An open system of patent review need not be overwhelming at all, since it divides the submission process of prior art searching into manageable tasks. Elements in the community in question submit prior art and commentary in response to pending applications posted online. The community itself then identifies those claims that are most relevant and positive reputations are built on productive participation. The information accrued is then automatically transmitted to the examiner who still retains the authority to make the final decision. The benefit is an obvious one: the examiner is able to make her decision based on stronger evidence.

The patent system as currently architected is based around a traditional view of expertise that purports that most information is centralized to administrative decision-makers. While the notion of effective, centralized bureaucratic expertise may have been true when government agencies possessed significantly more resources and technologies, this model totally ignores the current reality. Network technologies can now harness the collective intelligence of millions on a platform that provides instantaneous interactivity. It is crucial to understand that this does not place too much power into public and unaccountable hands. Akin to the judicial system in which a jury of peers provides input on a particular case but the judge's decision is final, the ultimate arbiter of this open review remains the examiner. The online scientific community provides information relating to prior art while the examiner, trained in the necessary statutory framework, determines legal patentability. Software combined with user ratings generates a list of the best prior art references submitted. This ensures that the examiner has sufficient information to make an informed decision without being overloaded. It thus solves the *Goldilocks problem*. The model is predicated on the idea that 'if the aim is to find relevant prior art, the best knowledge may not come from the center, but from the periphery, among the enthusiasts or graduate students who are immersed in, but not yet well known for, their knowledge of the discipline' (Noveck 2006, 154). The sheer number of participants helps to dilute the negative effects of unconstructive users while social reputation systems, already well-established online in communities such as Ebay and Amazon, ensure quality safeguards that help the examiner to make well-informed decisions on patent validity. Moreover, because the system asks for minor contributions from a wide variety of participants, and because those skilled in the art are quickly able to identify prior art in their given field, the model enables meaningful contributions to be made without demanding too much from each individual. Another benefit of the open review model is that, due to its nature in electronic form online, it creates a detailed and comprehensive record of the entire review process that can then be submitted to the examiner and archived by the relevant patent office.

Implementing a crowdsourced prior art search service in Europe can yield multiple benefits: patents granted by patent offices can be of a higher quality, firms will thus have added security when both traditional and NPE infringement litigation is initiated, and the public will not endure the unnecessary costs of monopoly rights over unworthy products. The rationale of the model is that more and better information will contribute to greater patent validity.

Structured public participation online, made possible by carefully designed software, will result in clearer and more focused patent applications while simultaneously engaging the public to take a more active role in the patent process by connecting them to government decision-making. Greater access to prior art material will augment the quality of applications and render the examination procedure easier. As tangible rewards stimulate participation and elevate patent quality, increased confidence in the patent system should stimulate innovation. Increased openness and transparency in the patent granting process promotes scientific education and literacy. Public oversight of a vital regulatory process will be improved. Enhancing the institutional competence of patent offices without the need for legal reform, such a project can generate enormous amounts of data that could eventually be used for deeper empirically-driven reform (Noveck 2006, 161). Finally, higher quality patents will reduce costly, non-productive litigation procedures and permit more resources to be allocated to research and development. This will enhance Europe's competitiveness in the global economy.

It sounds great in theory, but does it work in practice?

The USPTO and JPO have both implemented pilot projects to test the efficacy of open review in the patent review process. The USPTO initiated the Peer-to-Patent: Community Patent Review Project on June 15, 2007 and published their one year anniversary report in June the following year (CPI 2008, 4). An open call was made for public participation in 40 patent applications and prior art references were eventually forwarded to the USPTO in 36 of these cases. 173 prior art references were submitted in these 36 cases with an average of 4.8 references and 10 discussion comments per application. By the end of the pilot, registered users numbered over 2,000 from 140 different countries (CPI 2008, 18). Despite the fact that submissions were relatively low in number, they still contributed vital prior art that led to the rejection of 9 out of 36 applications; all but one of these rejections was based on prior art from non-patent literature often unavailable to the patent office itself (CPI 2008, 18). 21% of participating examiners stated prior art submitted through the program was 'inaccessible' to the USPTO, 79% want to see the project implemented full-time, 89% thought the information submitted was in clear form, and, finally, 92% would actively welcome another patent application with public participation (CPI 2008, 6). Description of the First Office Actions, in which prior art submitted through the pilot was used, is available in the Appendix of the report (CPI 2008, 27-35). The visibility and recognition gained from this pilot spurred the JPO to initiate their own pilot that, although encountering similar obstacles to stimulating participation, proved the potential of the peer-to-patent model (JPO 2010, 6). This pilot also elicited a positive response from reviewers and helped to obtain valuable prior art material as reviewer contributions exceeded expectations (JPO 2010, 2-4). Below is a table comparing the results from both pilots:

Figure 5: Comparison of pilot results in US and Japan (JPO 2010, 1)

	USPTO	JPO
Site Access		
Visitors	40,000>	11,950
Participants		
Reviewers	2092	253
Applicants	13 (3 indivis.)	16 ¹
Reviewed applications	40	39
Review Results		
Active reviewers out of registered reviewers (percentage)	365 (17%)	22 (9%)
Submitted prior art documents	173	137
Submitted non-patent prior art documents	96 (55%)	17 (12%)
Submitted comments	395	11
Prior art submission to JPO (Protest)		
Applications against which prior art was submitted to JPO	36	37
Prior art documents submitted to JPO	168	120
Exam Results		
Applications to which 1st O.A. was rendered	36	35
Applications in which O.A. cited submitted prior art	13	13
Cited prior art	14	19
Cited non-patent P.A.	8	0

While there were certainly differences in the pilot methodology between the US and Japan (for full overview of these differences see page seven of the report (JPO 2010, 7)), they both encountered important difficulties. This was primarily the need to augment the number of participants and increase levels of participation from active reviewers. The proposed solution: create incentives to build community, make profiles public to enhance quality assurance, and invite more experts into the process (JPO 2010, 4-5). Another major problem, particularly for the JPO, was increasing non-patent literature prior art submissions. The solution proposed was to increase researcher and engineer participation. These issues in creating, sustaining and assuring diverse participation in the review process are inherent limitations of an open review model. These are problems that can be overcome by carefully managing this process between public and private partners. Consequently, private involvement in these processes is growing. Proceedings at a recent conference hosted by Peer-to-Patent in Geneva - regarding their 2011 pilot project - established a partnership with Article One Partners that enables researchers involved in the open review process to gain Profit Sharing points for their contributions.

Why form public-private partnerships?

Public-private partnerships have proliferated globally since the early 1990s in an effort to enhance efficiency in the public sector. While patent offices have yet to fully leverage the positive effects of this management paradigm, public-private ventures are not entirely new to them. The EPO has already established a process of continuous dialogue with its primary users under the 'Partnership for Quality' program, which consults the European Patent Institute, BusinessEurope, and the American Intellectual Property Law Association (EPO 2009, 23). A more general example is The Coalition for Intellectual Property Rights (CIPR), whose guiding principle is that businesses and governments must work as partners to achieve effective IPR protection in former Soviet Union countries

(<http://www.cipr.org/about/index.htm>). The crowdsourcing of prior art search, where management of the online community is outsourced to a private company but decision-making power rests in public institutions, fits well into this paradigm of supporting public services with private resources and capacities. It bolsters patent office legitimacy by enhancing the efficiency of patent review procedures and elevating the quality of granted patents. Significantly, it does so without undermining the fundamental role played by the public institution.

To generate greater efficiency in patent review the peer review of prior art search must be crowdsourced, not opensourced. Privatization is not a valid solution since 'it is illogical to turn to private firms to conduct this review... because this simply replaces one closed group with another, and may still exclude those with the greatest expertise in a given area' (Noveck 2006, 144). However, crowdsourcing, which offers the benefits of open and transparent patent review while concomitantly solving some of the greatest obstacles inhibiting participation online, can be effectively combined with public sector decision-making processes.

The greatest problem of completely opensource patent review is the need to provide incentives for participation because 'even with the best technology and most considered process, without contributors the system will fail' (Noveck 2006, 159). It is naive to assume that a great many individuals will be willing to devote time and resources to reviewing patent applications simply because they want to defeat bad patents. This may attract a few die-hard activists but it will not generate the vast community of professionals and enthusiasts necessary to make peer review of patent applications as effective as it needs to be to solve current dilemmas in the innovation system. Building community and status incentives into the social network via the introduction of royalty and reputation points (in a manner similar to Ebay's trusted buyer/seller indicators) is certainly useful. However, the offer of material rewards for successful contributions attracts a significantly greater number of people and ensures that the right crowds are tapped. Multiple analysts outline the need for an incentive structure to create and sustain crowdsourcing communities online (Brabham 2008; Delfanti 2010). By offering more than \$500,000 in prize money to the top 25 finalists of their 'GoldCorp Challenge' (where participants were asked to examine geological data to determine potential mining targets) GoldCorp quickly attracted more than 475,000 hits online with more than 1400 registrations across 51 countries (GoldCorp Challenge Winners! 2001, 6; cited in Brabham 2008, 5). The famous success stories of such crowdsourcing models as Innocentive, Threadless, and iStockphoto are a good indication of the power of this new model when it is used effectively. In the context of patent review, Article One Partners – a model that combines the benefits of open peer review of prior art with an incentive system that stimulates broad participation – has leveraged the power of the crowd. This model could supplement existing patent office procedures in order to increase patent quality.

Public-private partnership provides more than just an incentive structure to participants. Uncertainty over identity can be a major problem in online communities. It engenders high monitoring costs as well as extensive judicial

work and frequent community policing to assure high quality contributions. A private company takes this burden out of public hands because it has every incentive to assure service quality in order to maintain integrity and customer satisfaction. Information shared on the patent review network must also comply with all relevant intellectual property laws (including copyright). Though mechanisms exist that allow public authorities to achieve this to certain degrees, privatizing the management of the community insulates patent offices from responsibility while again providing companies with sufficient reasons to ensure participants comply or simply remove the posts of those that do not. Another critical danger is infiltration of the review process by competitors seeking to cheat the rating system. Since a private company relies on their system's integrity to attract customers there is more impetus to monitor participation and enforce stringent standards of practice online. It is essential to recognize that wholesale privatization is not an option. Patent enforcement is a public responsibility that aims to serve the public interest. However, the careful partnering of the public and private sectors can be vastly beneficial to prior art search.

Time to innovate the patent system

As European business increasingly relies on intangible assets to remain competitive in the global economy and innovation continues to drive economic growth, the state of the intellectual property system is critically important. Patent offices, as key players in a working patent system, need to adapt to the massive increases in demand and accept the changing nature of scientific expertise as a result of new technologies. More effective prior art search is the key area in which efficiency can be substantially increased without major change to the institutions and laws implicated in the patent system. Augmenting the quality of patents granted, as well as reducing the current burden on patent examiners, crowdsourcing prior art search is a valuable solution. Public-private partnerships can help overcome some of the incentive problems of open review while maintaining critical public safeguards and ensuring that decision-making remains accountable. By leveraging new opportunities to capitalize on innovation, the implementation of public-private partnerships will bolster prior art search performance. This is of enormous value to patent offices, commercial firms, and the public. It is time for the innovation system to embrace its central tenet and innovate in response to new possibilities if it wishes to remain relevant in the age of the crowd.

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