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## **CIFRA: Challenging the ICT Patent Framework for Responsible Innovation**

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*This document is the outcome of the work of the CIFRA project (Challenging the ICT Patent Framework for Responsible Innovation), conducted under EU H2020 programme. Under said project the currently existing issues in the ICT patent ecosystem have been studied with a methodology that comprises a review of specialized literature, an empirical analysis of patent databases and a series of interviews to leading experts followed by a broader survey. More detail information on the evidences and basis for the recommendation in this paper can be found in the set of documentation produced by the project, available at: <http://www.cifra-h2020.eu/results/>*

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## PREFACE

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Social Sciences and Humanities (SSH) do not usually take a preeminent role in technical research projects. Sister projects arise as part of Horizon 2020 Framework Programme as a way to address this historical constraint and to allow SSH make a meaningful contribution to the shaping of the research agenda. To this regard, Sister projects are created to go beside the mainstream research in order to challenge existing biases in the research agendas and trying out more daring alternatives through the widening of imaginaries and by taking into account the SSH perspective.

CIFRA, as a Sister project, does not take the current status quo in the ICT patent ecosystem for granted, but on the contrary, explores the impact that potential new framings could have in ICT innovation and the value they could provide to the society.

Moreover, CIFRA project has addressed the ICT Patent ecosystem from the perspective of the Responsible Research and Innovation (RRI), thus with the aim of determining the way it can be better aligned with the values, needs and expectations of society.

## 1 INTRODUCTION

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As part of the dissemination activities, CIFRA project has the goal to achieve a publication in well-recognized journals. However given the time required by scientific magazines to evaluate papers (several months), our attempts will succeed not sooner than the end of the project.

Nevertheless, in order to achieve a broad and more expedite diffusion of the CIFRA project results, in addition to scientific journals, we considered publication options that could be more immediate.

We approached the specialized magazine IAM (one of the most relevant publications on IP management in the ICT sector) and achieved the publication in IAM blog to of an adapted version of our policy paper on November 23th 2017, (<http://www.iam-media.com/blog/Detail.aspx?g=db57f0cd-cc5c-4c7c-8b3d-8455157fc8ad>).

As of the date of writing this report the CIFRA consortium was interacting with the IAM editors to make our draft article fit with the editorial guidelines of IAM for an article in the IAM magazine.

Another paper proposal was submitted in October 2017 for publication in the “Telecommunication Policy” journal. Despite the initial positive feedback from the editor the reviewers identified some shortcomings that prevented that draft to be published as such. Nevertheless the editor invited the authors to resubmit a revised version of the paper, implementing the suggestions received from the reviewers. A revamped version of the article has been drafted for submission to the journal. It is included in section 4 of this deliverable.

In addition, the same paper with name "An Update of Challenges and Possible Solutions related to ICT Patents: The Perspective of European Stakeholders" has been submitted for the upcoming EPIP Conference 2018, to be held on September 5<sup>th</sup>-7<sup>th</sup> in Berlin (<http://epip2018.org/>).

During the additional review about the ethics of ICT, performed after the Final Review, the editor of Journal of Information, Communication and Ethics in Society, Simon Rogerson, encouraged us to submit a paper to said journal. A new paper about the "Ethics of ICT Patents in the Context of the Ethics of ICT" shall be submitted.

With the organisers of the conference about the Ethics of Innovation hosted in Munich 2017, it was agreed to deliver a paper "Ethical Aspects of ICT Patents: Insights from the literature, expert interviews and a stakeholder consultation" for an edited book to be published by a prestigious publishing house.

Other alternatives remain as backup, depending on the progress of the previous submissions. Despite the end of the formal term of CIFRA project, the consortium members are interested and committed to pursue the publication of the project results in relevant journals.

### ***Raising the bar agreed by patent holders and implementers as a positive measure to improve patent quality***

### ***The open source community still struggling against the patent system***

*EU-funded research project CIFRA (Challenging the ICT Patent Framework for Responsible Innovation) has recently published the results of a broad consultation across the ICT value chain, in order to assess the perception by the different experts on the most pressing challenges in the ICT patent ecosystem, as well as to determine potential measures to alleviate them.*

*As is to be presumed, the viewpoint on the problems of the ICT patent ecosystems varies significantly among patent holders and those entities not owning patents. The surprise arises from the fact that both set of entities seem to be more aligned when asked about the potential solutions. For instance, there is a broad agreement on the advantage to raise the bar in terms of the required levels of novelty and inventive step for patents, especially for computer-implemented inventions as well as to reduce the scope of granted patents.*

*It is worth mentioning the bias in the responses from the open source community, showing it is still struggling to get along with the patent system. Open source players keep on considering computer-implemented inventions, most commonly referred by them as “software patents”, as a threat for their activity, and claim for more demanding guidelines for this kind of inventions to qualify as patentable subject-matter.*

*The research action was conducted by Telefónica, Fraunhofer Institute – FOKUS, Università Commerciale Luigi Bocconi and Universidad Carlos III de Madrid. It comprised a thorough literature review, followed by an empirical analysis of patent databases and came to a head with a series of interviews to industry experts and a broader survey covering organizations with different types of business models and positions in the ICT value chain. The consortium claims to have conducted an unbiased analysis of the responses, causing the conclusions and recommendations of the study not to necessary reflect the position of neither of the consortium member companies and experts, nor, of course, that of the European Commission.*

### ***Assessment of the Challenges of ICT patent ecosystem***

*On the one hand patent owners appear to be less concerned in general with the different challenges around ICT patents. On the other hand organisations not holding patents, i.e. also*

*the majority of Small and Medium Enterprises (SMEs) stand out as the type of entities with a rather critical standpoint.*

*Among the different challenges of the ICT patent ecosystem confronted with the experts, the bigger concerns in the area of patent prosecution were related to the too broad scope of patents and their limited quality, phenomena specially criticized by the companies not owning patents. Furthermore, the criteria for patents on Computer-Implemented inventions (CII) are not be specified enough and heterogeneous between patent offices.*

*In relation to patent enforcement, the most relevant challenge is clearly the legal uncertainty caused by Patent Assertion Entities (PAEs), which is highlighted by both patent owners and non-owners. The high expected legal cost for resolution of conflicts regarding ICT patents was the concern following the list. Another sensitive aspect is the difficulties caused by ICT patents for the use of Open Source Software, which, unsurprisingly, is stressed by the independent software developers.*

### **Assessment of levers to alleviate the problems affecting ICT patent ecosystem**

*The results of the consultation revealed a common interest shared among all different actors in high-quality standards for patents, in terms of the required novelty and inventing step. This may denote the significant overhead caused by licensing negotiations and eventually by litigation for both licensors and prospective licensees, which could be reduced by relying on patents with proven quality. Special emphasis is placed by some actors on raising the requirements to obtain patents on computer-implemented inventions (CII).*

*Most of the consulted experts have shown to be concerned with the activity of Patent Assertion Entities (PAE). The report explains that the search for mitigation measures for the issues caused by these entities faces the problem of coming to an appropriate definition of PAEs in the first place. Thus any measure by regulators should, according to the study, be focused not on a specific type of company, but instead on limiting their most harmful practices, such as forum shopping, or the use of shell companies to avoid paying the court costs upon losing a lawsuit.*

*It is worth noticing that, despite the high level of support for patent pools, other types of licensing programmes and defensive patent aggregators, public policies supporting them are not endorsed, especially by entities without patents, alleging that public intervention could create a bias in the markets.*

*In order to facilitate the licensing of patents, there is some support, especially from the side of the implementers, the non-patenting respondents and the SMEs, to promote the publication of bilateral licensing terms. This would improve transparency for the licensing market and provide more ground for creating a corpus of cases, thus lowering overhead. On the contrary patent owners are less convinced about the viability and effectiveness of making details of licensing agreements public.*

*The promotion of specialized courts, which deal only with patent disputes including both questions of patent validity and infringement, is widely supported by the experts, but more heavily by patent owners.*

*In addition, there is a great support to having infringement and validity issues regarding ICT patents tried together before the same court. Therefore the bifurcated system existing in some jurisdictions is perceived to be associated to higher costs and risks, especially for SMEs.*

*Patent pledges, i.e. voluntary commitments by patent holders to give up some of the rights associated with the patent, are not well known to the majority of the interviewed experts. The informed experts confirm the effectiveness and efficiency of the instrument, and thus the research report advises to raise their public awareness, especially in combination with the promotion of specific technologies and eventually with Open Source.*

*Overall, mediation and arbitration are perceived by the experienced experts as effective and efficient approaches to conflict resolution, which requires sufficient expertise by mediators and arbitrators, but also resources and trust. However, the majority of respondents to the survey has no or only a little experience with these approaches, which suggests that further measures to increase the awareness about them could be helpful.*

*Another aspect where educational initiatives would be positive, especially for SMEs, is the interplay between open source software (OSS) and patents, where a limited expertise has been spotted, which may lead to some concerns about the usage of OSS due to the unclear implications.*

*The responses by SMEs, which reveal much more often that they are not able to assess both the relevance of the challenges and the effectiveness of the proposed measures, demonstrate they are probably the weakest players in the patent ecosystem.*

*Regarding patent law, a reluctance to any change has been made evident. For instance, there is scepticism against the effectiveness of changing application, renewal and even court fees. Reducing the protection period and the time to grant ICT patents, for instance by means of early certainty programs by the patent offices, are slightly more convincing to the experts. In fact, the requirement to grant ICT patents within five years is generally supported by the patent-owning respondents.*

*The full set of reports elaborated in the CIFRA project can be found at: <http://www.cifra-h2020.eu/results/>*

### 3 PUBLICATION IN IAM BLOG

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Previous article, with some adaptations by IAM editor, was published November 23th 2017, in IAM Blog: (<http://www.iam-media.com/blog/Detail.aspx?g=db57f0cd-cc5c-4c7c-8b3d-8455157fc8ad>).

Figure -1: Publication of CIFRA policy paper in IAM Blog

w.iam-media.com/blog/Detail.aspx?g=db57f0cd-cc5c-4c7c-8b3d-8455157fc8ad

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## ICT patent players want a higher bar for CII grants, report finds; but worries emerge about SME IP awareness

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EU-funded [CIFRA research project](#) (Challenging the ICT Patent Framework for Responsible Innovation) has recently [published the results](#) of a broad consultation across the ICT value chain designed to assess different experts' perceptions of the most pressing challenges in the ICT patent ecosystem, as well as to determine potential measures to alleviate them. Research team members Knut Blind, Eduardo Fullera and Toni López-Carrasco summarise its main findings, which identify a range of issues exercising the minds of market players, including: the quality of issued patents and the extent which they should be available for computer implemented inventions; concerns about the activities of patent assertion entities; and a worrying lack of patent knowledge among SMEs (a full list of the report's authors can be found at the bottom of this piece);



**Joff Wild**

*The CIFRA research was conducted by Telefónica, Fraunhofer Institute – FOKUS, Università Commerciale Luigi Bocconi and Universidad Carlos III de Madrid. It comprised a thorough literature review, followed by an empirical analysis of patent databases and came to a head with a series of interviews with industry experts and a broader survey covering organisations with different types of business model and positions in the ICT value chain. The consortium aimed to conduct an unbiased analysis of the responses, and the conclusions and recommendations of the study do not necessarily reflect the positions of either the consortium member companies and experts, or, of course, of the European Commission.*

*As can be imagined, viewpoints on the issues varied significantly among patent holders and entities that don't own patents. Perhaps surprisingly, though, both groups seemed to be more aligned when asked about potential solutions. For instance, there was broad agreement as to the advantages of raising the bar in terms of the required levels of novelty and inventive step for patents, especially for computer implemented inventions, as well as with regards to reducing the scope of granted patents.*

*It is worth mentioning that the responses from the open source community show it is still struggling to get along with the patent system. Open source players continue to consider computer-implemented inventions, most commonly referred to by them as "software patents", as a threat to their activities; and they asked for more demanding guidelines for such inventions to qualify as patentable subject-matter.*



### **Assessment of the Challenges of ICT patent ecosystem**

*Patent owners appear to be less concerned in general with the different challenges around ICT patents. However, small and medium enterprises (SMEs) stood out as having a mostly critical viewpoint.*

*Among the ICT patent ecosystem challenges identified by the experts, significant concerns in the area of patent prosecution were related to what were considered to be the too-broad scope of patents and their limited quality - phenomena particularly criticised by non-patent owning companies. Furthermore, the criteria for granting patents relating to computer implemented inventions (CII) were not considered to be specific enough, with diverse approaches between patent offices also identified as a problem.*

*In relation to patent enforcement, the most relevant challenge was clearly seen as the legal uncertainty caused by patent assertion entities (PAEs). This was highlighted by both patent owners and non-owners. The perceived high legal costs involved in resolving ICT patent-related conflicts was the next biggest concern. Another sensitive subject was the difficulties caused by ICT patents for the use of open source software – unsurprisingly, this was a particular concern among independent software developers.*

### **Assessment of levers to alleviate the problems affecting ICT patent ecosystem**

*The results of the consultation revealed a common interest among the different actors: high-quality standards for patents, in terms of the required novelty and invention step. This may relate to the significant overheads caused by licensing negotiations and eventually by litigation for licensors and prospective licensees, both of which could perhaps be reduced were patents of higher quality. Some respondents placed special emphasis on raising the bar on the requirements for obtaining patents on CII.*

*The report explains that the search for measures to mitigate issues posed by PAEs is hampered by the difficulty of coming up with an appropriate definition of what a PAE is. As a result, the study states that regulatory solutions should not be focus on a specific type of company, but instead on limiting certain kinds of harmful practices, such as forum shopping or the use of shell companies to avoid paying the court costs imposed upon losing a lawsuit.*

*It is worth noting that, despite the high level of backing for patent pools, other types of licensing programmes and defensive patent aggregators, public policies supporting these were not endorsed. This was particularly the case among entities without patents, which worried that public intervention could create a bias in the market.*

*In order to facilitate the licensing of patents, there was some support for the promotion of publication of bilateral licensing terms – this was particularly the case among implementers, non-patenting respondents and SMEs. Such an initiative, it was felt, would improve transparency for the licensing market and provide more ground for creating a corpus of cases, thus lowering overheads. On the other hand, patent owners were less convinced about the viability and effectiveness of making details of licensing agreements public.*

*The promotion of specialised courts, which deal only with patent disputes including both questions of patent validity and infringement, was widely supported by the experts, but most heavily by patent owners.*

*In addition, there was widespread support for having infringement and validity issues regarding ICT patents tried together by the same court. The bifurcated system that exists in some jurisdictions was perceived to be associated with higher costs and risks, especially for SMEs.*

*Patent pledges, ie voluntary commitments by patent holders to give up some of the rights associated with their patents, were not well known to the majority of the interviewed experts. Those that were aware of them confirmed their effectiveness and efficiency. The research report advises that public awareness of them should be raised, especially in combination with the promotion of specific technologies and open source.*

*Overall, mediation and arbitration were perceived as effective and efficient approaches to conflict resolution, but ones which require a high-level of expertise from mediators and arbitrators, as well as resources and trust. However, the majority of respondents to the survey had little or no experience of these approaches, which suggests that further measures to increase awareness about them could be helpful.*

*Another area in which educational initiatives would be positive, especially for SMEs, is the interplay between open source software (OSS) and patents, where only limited expertise was identified. This lack of knowledge may lead to some concerns about the usage of OSS.*

*The responses by SMEs, which revealed more often than not that they are not able to assess both the relevance of the IP challenges they face and the effectiveness of possible solutions to them, demonstrate they are probably the weakest players in the patent ecosystem.*

*Regarding patent law, there was evidence of a reluctance to push for change. For instance, there was scepticism about the effectiveness of changing application, renewal and even court fees. Reducing the protection period for and the time to obtain ICT patents, for instance via early patent office certainty programmes, were slightly more convincing to the experts. In fact, the requirement to grant ICT patents within five years was generally supported by the patent-owning respondents.*

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### ***An Update of Challenges and Possible Solutions related to ICT Patents: The Perspective of European Stakeholders***

#### **Abstract**

Patents in information and communication technologies (ICT) are on the one hand an important instrument to protect companies' inventions and to appropriate the value of the related inventions. On the other hand, the increasing dynamics and complexity in ICT are challenging the effectiveness of patents as protection and appropriability instrument. Based on the review of the literature and interviews with relevant stakeholders in Europe we have identified to most relevant challenges for patents in ICT and possible solutions. Here, we divide between the patent application and granting phase on the one side and patent enforcement and implementation on the other side. These insights have been used as input for the performance of a broad survey among European stakeholders. The results reveal on the one hand the different positions of the patent owners and stakeholders owning no patents, in particular related to the various challenges the patent system is facing in ICT. On the other hand, the differences disappear in the assessment of the effectiveness of the various solutions, but also between stakeholders following different business models. Finally, we conclude with some basic recommendations to improve the efficiency of the system.

Keywords: patent; application; granting; enforcement; implementation; ICT

## 4.1 INTRODUCTION

Patents have a crucial role in technology markets, and can be even considered the main currency for technology, that is, the tool used for technology appropriation and exchange between different actors in the value chain. Taking into account the huge size of the technology market in ICT (Information and Communication Technology) with its numerous players, e.g. the several hundreds of patent owners holding several thousands of patents related just to the smartphone, it can be understood that the patent ecosystem in ICT is subject to frictions and tensions among entities with different business models occupying different places in the ICT ecosystem. In addition, the high dynamics in ICT are challenging both existing business models, but also opening up new business opportunities. Thus, some of them may be interested in keeping the status-quo whilst others may tend to favour changes in one or the other direction. In order to cover all relevant issues, we have a very broad understanding of ICT patents following the OECD (Inaba and Squicciarini 2017) including both traditional telecommunication technologies, but also Internet related technologies and the various applications, incl. electronic payment systems, imaging and sound technologies, but also gaming. Furthermore, we consider also patents on computer-implemented inventions (CII).

Eventually, we are interested in addressing the following research questions. First, we are asking whether patents are still perceived as the appropriate instrument to protect inventions in ICT. Second, we investigate which challenges the patent system in ICT face. Third, we identify possible solutions and their effectiveness to address the challenges discovered in the second step.

In order to answer the three research questions, we review in a first step the existing body of literature. In a second step, we interview a broad range of stakeholders to identify all possible challenges related to patents in ICT and possible already tested, but also untested solutions to address them. Finally, the most relevant challenges and solutions are integrated into a questionnaire, which has been distributed widely in a consultation of all relevant stakeholders. Based on the findings of the stakeholder surveys complemented by the qualitative insights of the interviews and already existing literature, we conclude with some policy recommendations.

## 4.2 LITERATURE REVIEW

This section presents current problems with the patent system and possible solutions identified in relevant literature. The findings are based on a literature review searching Web of Science, ScienceDirect, GoogleScholar and the internet in general of relevant foresight or impact studies, but also of position papers.

The patent system was developed during a time where interoperability of technologies did not exist, nor were there means to share knowledge with a marginal cost close to zero. With the development of ICT, the patent system is struggling to find the right setting to provide appropriate incentives for innovation, research and development (R&D), while simultaneously enabling the efficient reuse and diffusion of technological knowledge. Moreover, the gaps of the patent system in regards to the requirements of ICT technologies have transformed the patent landscape for ICT into a volatile landscape, whose dynamics involve a series of challenges for all players. In the review, the most relevant problems and potential solutions identified are presented.

### 4.2.1 Possible Problems

#### 4.2.1.1 *Identified problems regarding patent application and granting*

ICT technologies are highly complex. Due to their nature, it is to combine various components to one complex product. As consequence, ICT technologies are built from many parts developed by multiple actors (EC JRC 2015b). The combination of technological complexity with the cumulateness of the innovation process creates problems such as technology fragmentation and fragmentation of patent rights and patent tickets (Graevenitz et al. 2013). According to Cockburn and MacGarvie (2011) and Hall et al. (2017), patent thickets reduce entry into new technologies and markets. The rising complexity of technologies has made it easier to block several technology providers with one single patent. In addition, there is an increase in probability of accidental infringement for companies. This is because the detection of possible infringements is made difficult by the complexity of the technologies (EPO 2007).

One of the main concerns is the increasing challenge to maintain a satisfactory level of patent quality (Harhoff 2016). The patent quality which is defined as “the degree to which a patent satisfies the statutory patentability requirements, leaves little doubt as to its breadth and discloses information that enables a person skilled in the art to implement that protected invention” (EPO 2012, p. 8). This pressure on quality is due to the challenges of the patent examination process and the, in some cases, inappropriate patent office policies, which also encourage the application of trivial and underdeveloped inventions (EC JRC 2015a). At the European Patent Office (EPO), various initiatives to raise patent quality have been initiated. Consequently, in patents granted by the EPO, the number and length of claims started to decline, when new claims fees became effective (Harhoff 2016). In addition, the grant rate, which started to decline in the 1990s (Frietsch et al. 2010), remained below 50% (EPO 2017).

The low-quality patent is also an issue regarding assertions. Assertions of low-quality patents might have negative welfare implications, such as, the encouragement of rent-seeking behavior. This might lead to a reduction of R&D resources by innovators threatened by patent assertion entities (PAEs), recently characterized by Thumm (2018). For the case of patents on computer-implemented inventions or “software patents”, quality is also of particular concern (EC JRC 2016), because the related investments in research and development remain rather low in the US (Bessen and Hunt 2007). However, Eberhardt et al. (2016) find rather heterogeneous effects in the case of Indian companies. With the current patent granting process, it is difficult to evaluate the patentability requirements of computer-implemented inventions consisting of a high degree of abstraction of the software algorithms. Furthermore, many applications end up being considered of a low quality. However, the increasing number of software applications and patents on computer-implemented inventions (Frietsch et al. 2015) demands a solution to assess them properly (EC JRC 2015b).

Particularly with digital communication and computer technology there is a continuous increase in the number of patent filings with the European Patent Office (EPO and EUIPO 2016). The increasing number of patent applications (EPO 2017) increases also the probability of granting patents of lower quality potentially facilitated by insufficient quality checks due to restricted number of examiners. This expectation might again increase the number patent applications (EPO 2007). The large number of patents in this field is due to the complex technologies and combinatory innovations. Currently, there is an exponential increase in the number of patent filings from the Asian economies in Europe (Fink et al. 2016).

Additionally, patent databases present problems such as, the lack of harmonized names of patent applicants. As a result, the same applicant may have several separate register accounts derived from each filing. The lack of comprehensive information leads to limited information about the applicants additional to the contact information. These issues complicate the tracking of the total files belonging to one single applicant.

As a consequence of the limited access to patent information, there is a lack of information about the market participants and their intentions (EC JRC 2015b). Another cause for the lack of transparency are the missing links between all existing data collections on technical knowledge and data on patents, which creates a shortage of market transparency. Many organizations being responsible for this information have limited skills in defining how to create these links, and on defining a set of criteria and incentives for stakeholders to open their data while ensuring control over the assets (EC JRC 2015a).

On the one hand, patents seem to have difficulties creating solid innovation incentives in industries based on high cumulative innovation such as in ICT. On the other hand, patent protection might increase the cost of developing work from existing ones because of the various permissions the follow-on creators have to obtain. In addition, these inventors might face hold-up problems (EC JRC 2015b). However, a recent existing empirical study cannot prove negative impacts of hold-up strategies on innovation (Galetovic et al. 2015).



The use of the patent system by Small and Medium Enterprises (SMEs) is not fully exploited (e.g. Neuhaeusler 2012). This is due to the high cost of the procedures, such as pre-grant costs and patent attorney fees, which are a barrier for the products and services of the SMEs and start-ups attempting to enter the market. In addition, most of the SMEs do not see the benefit of using the patent system, do not have the required expertise to use it and lack the necessary finance to legally protect their patents and to tackle possible infringing activities by other 'larger' companies (EC 2015, 2016). The few SMEs that use the patent system mostly stay local and do not dare go international, for instance by applying at the European Patent Office (EC 2016).

#### *4.2.1.2 Identified problems regarding enforcing and implementing patents*

In enforcing and implementing patent, litigation is a serious challenge not only for the patent owners, but also for those companies interested in implementing technology. The increasing litigation rates (Marco et al. 2017) are caused by various factors, such as lack of transparency in the patent system, opportunistic business behavior, unclear conditions of licensing and transferring standard-essential patents (SEPs) and litigation by PAEs (Darts-IP 2017). For example, the restricted access to relevant patents information such as patents disclosure, changes in patent ownership, transactions, links to standards, prior art, patent licensing and other technical information related to new technologies generates a lack of market transparency as suggested by EC JRC (2015a). This lack of transparency leads to high operative and transaction costs (EC 2015, Bessen et al. 2015) and in general not to innovation (Feldman and Lemley 2015). In addition, the increase in the number of patents in the ICT sector is causing an increase in the number of legal battles regarding patent validity and infringement. In the US, software-related patents were involved in 50 % of the lawsuits between 2007 and 2011 (GAO (2013) in EC JRC (2015b)). However, Lanjouw and Schankerman (2001), but also Lemley and Shapiro (2005) point to the very probabilistic character of patents based on the very low likelihood of litigation, but their significant impacts (Raghu et al. 2008).

Royalty stacking is an effect that happens when royalties are stacked, one on top of another, adding up to a disproportionate royalty rate. It occurs when a single product contains multiple patents, and each patent owner, in particular of SEPs, sets a high individual royalty to the licensee without considering the other royalties that also needs to be paid by the licensee to the other patent owners in order to commercialize a product (ECSIP 2014). In theory, the cumulative payable royalties discourage new investments in R&D hampering innovation as a whole (EPO 2007), but sound empirical evidence is missing according to Geradin et al. (2008).

Patent thickets are defined as an overlapping set of patent rights (Shapiro 2001), which requires innovators to reach licensing deals for multiple patents from multiple sources. They often lead to hold-up or even royalty stacking. Companies are motivated to use their patents as bargaining tools and to increase the number of patents they hold, thus increasing the number of patent filings (EPO 2007). Thickets place barriers in searching for prior art, which causes a decreasing in the quality of patents granted by patent and offices. Patent thickets are often seen in the ICT sector and often harm SMEs and companies that need to in-license technologies (EC JRC 2015b). According to Cockburn and MacGarvie (2011) and

Hall et al. (2017), patent thickets are a barrier and reduce entry into new technologies and markets.

PAE are the most controversial type of intermediaries (EC JRC 2015b). They are considered as businesses that collect third parties' patents and try to obtain benefits (revenues) against alleged infringers (FTC 2016). They strategically concentrate on high-tech patents, especially of companies in the ICT industry, and hold large portfolios, often containing hundreds or thousands of patents (FTC 2016). An increasing number of patent lawsuits are due to PAE counting for three out of four of accusations of infringing a PAE patent in the UK (Helmets et al. (2013) in EC JCR (2015b)). PAEs assertions target primarily the more vulnerable and often lower segment of the supply chain such as telecom operators (EC JRC 2016). Also known as 'patent trolls' are patent holders who attempt to obtain profits from patent infringers far beyond the actual value of the patent, and often do not manufacture or produce any product or service based on the owned patents. PAE focused on *ex post* patent transactions target businesses that already (allegedly) use within their products the patented technologies (FTC 2016). The empirical evidence about the impacts of PAEs is still limited, but they generate obviously social cost (Bessen et al. 2011, Lemley and Feldman 2016), but might only a phenomena of deeper problems of the patent system (Lemley and Melamed 2013). Recently, Kiebzak et al. (2016) find a negative influence of PAEs, identified a frequent patent litigators, on venture capital investment, whereas Cohen et al. (2016) even identify negative implications for the innovation activities of the litigated companies.

Bundles of Intellectual Property Rights are thought to be used in order to exploit the aggregated value driven by cost and the market. However, it is unclear how ICT companies can mix the different IPRs, i.e. patents, copyright, and trademarks in an effective manner (EC JCR 2015b).

Finally, but very relevant for our analysis about the ICT industry, there is an increasing coexistence between the acquisition of software patents to protect the products and the usage of open source software (OSS) in the industry. The possible legal conflicts due to patent infringement by open source software developers are a concern in the long-term, especially because of the hybrid software products in which open and proprietary software are combined (EC JRC 2015b). However, empirical evidence is still missing.

## 4.2.2 Identified solutions

### 4.2.2.1 Identified solutions patent application and granting

Reflecting the challenges mentioned related to patent quality, appropriate policies and examination procedures in the patent offices should discourage trivial, insufficient or underdeveloped patent applications (EC JRC 2015a). The patents system requires a harmonized approach to high-quality patents through a set of examination criteria for patents applications (EC JRC 2015a). The measures to be taken in order to improve patent quality should be cost efficient and should not extend the patent procedure (EC 2015a). The following actions are suggested by EC JRC (2016) in order to limit large-scale assertion of low quality patents. First, it should be ensured that the standards maintained in patent granting procedures are also of the highest quality by continuously promoting effective ways of



conducting prior art search that fully utilizes technological advancements, and to use patent fees as a market-based mechanism which acts as a screening device to “raise the quality bar”. Second, the costs of validity checks could be reduced for instance, by incentivizing a larger expert community to perform these checks (ECSIP 2014).

In order to increase transparency in the patent market, the patent offices should consider the possibility of requesting the registration of patent ownership and changes in ownership (EC 2015a). Transparency related to SEPs would be improved through different measures (CRA 2016) such as developing random independent tests of essentiality, making public the royalty rates determined through arbitration, forbid unilaterally imposed confidentiality clauses by one of the contracting parties, and making *ex post* specific declarations in order to link those relevant parts of the standard to the families of declared patents.

For the case of Europe, some of the possible improvements suggested by the European Commission (EC 2016) to support SMEs are streamlining European patent awareness schemes for SMEs and providing a cooperation platform for Member States. In addition developing an EU patent mediation and arbitration network for SMEs, the creation of European-level insurance schemes for patent litigation and theft and building a common patent valuation method are suggested. Finally, improving coordination of patent support funding schemes, including by means of a possible guidance to Member States and by developing monitoring methods their impact and improving and developing patent pre-diagnosis services are endorsed in order to allow SMEs including patents in their business strategy.

#### *4.2.2.2 Identified solutions related to enforcing and implementing patents*

Patent pools aim at mitigating transaction costs, avoiding royalty stacking, improving market transparency, speeding up the access to technologies, offering non-discriminatory and equal access to all potential licensees. They are perceived as licensing model that successfully allows the arrangement for collaboration and benefits the patent market as a whole (ECSIP 2014), even for open source based companies (Wen et al. 2016). Technology transfer in the ICT field could be further facilitated if relevant benchmarks are drawn from examples of efficient patent pooling and their effects on patenting incentives (EC JCR 2015a). For the case of SEPs, patents pools could be improved by strengthening the relationship between SSOs and pools; creating incentives to attract the participation of SEP holders in patent pools; encouraging the participation in patent pools of other institutions e.g. universities and SMEs (EC JRC 2015b).

Patent supermarkets are a possible way to facilitate licensing. They standardize the way in which patents are offered and enable an easy choice of what to license (ECSIP 2014). In addition, they are similar to patent pools in the sense that they are based on multiparty agreements, and they serve as ‘agents’ between licensees and patent owners. However, in patent supermarkets mainly individual patents are chosen by interested licensees instead of patent packages offered by the patent owners.

Clearing houses are usually two-sided markets that attract licensors and allow them to identify potential licensees. According to Van Zimmeren et al. (2006) in ECSIP (2014), there are different types of clearing houses classified by means of the service they offer. Firstly,

information clearing house, which is the basic concept offering access to (protected) information, like a database; secondly, technology exchange clearing house, which adds to the database service a platform for negotiation between licensors and licensees; thirdly, open access clearing house, which offers access and use on open access royalty-free basis; fourthly, royalty collection clearing house, which offers a access and use of standardized licenses, royalty collection, monitoring of the patent rights transfer to clearing houses, independent dispute resolution mechanisms ECSIP (2014). So far clearing houses are established for biotechnological and pharmaceutical patents. However, it has to be investigated whether a transfer of this approach to ICT is effective and efficient.

Some PAEs take advantage of the legal uncertainty of the system, thus reducing these uncertainties by directing the policies towards this objective, will hinder these behaviors from PAEs. As suggested by EC JRC (2016), this could be achieved by increasing patent ownership transparency. This ensures that the courts strive for the highest quality, supported by highly technical, specialized judges who have substantial experience in the subject matter. However, the up-coming unitary patent (UP) and the unified patent court (UPC) system are considered to be game-changing for the activities of PAEs in Europe (Thumm 2018).

### 4.3 METHODOLOGY

The issues and potential solutions identified in the literature for the ICT patent ecosystem have been taken as input for the performance of over 30 interviews were conducted with highly experienced experts from the whole range of concerned stakeholders along a guideline based on the insights of the literature review. These stakeholders comprise representatives of the European Commission, research organisations, patent offices, ICT patent owning companies, ICT patent implementing companies, telecom operators, patent pools, academic experts, Open Source Software (OSS) community, SME organisations, patent attorneys, patent support services, a consumer organization and the OECD.

*Table 1: Interviewed Types of Organizations and Number of Interviews*

DGs of the European Commission	3
Research organizations	2
IP Support Services	2
Patent offices	2
ICT patent owning companies	6
Telecom operators	2
Other ICT patent implementing companies	2
Patent pools	3
Academic experts	2
Open Source Software (OSS) ecosystem	3
SME organizations	2
Patent attorneys	2
Consumer organisation	1
OECD	2

After completion of the majority of the interviews, a questionnaire has been drafted and distributed to several experts representing different stakeholder groups asking for their feedback. Based on these responses, the final questionnaire has been shortened and optimized in various feedback loops in order to assure a better comprehensibility. It has been openly distributed online. The target audience were the members of the ETSI IPR Special Committee, which have been directly approached twice via their mailing list. The Free Software Foundation Europe FSFE, the mobile operators organization GSMA, the Open Invention Network OIN, the European Association of Research and Technology Organisation EARTO, the European DIGITAL SME Alliance, the largest network ICT small and medium sized enterprises in Europe, of the Bundesverband IT-Mittelstand BITMI, the German member association of DIGITAL SME, of the European Patent Lawyers Association EPLAW distributed emails to their members including a link to the online survey. In addition, both the European IPR Helpdesk and the German Patent and Trademark Office DPMA posted information about the survey as well as the link to the survey on their homepages. Finally, representatives of the companies identified as being responsible for the majority of the patent applications in ICT were invited in person via email to participate in the survey.

Consequently, the approached groups covered all main stakeholder groups already covered in the interview. Due missing information about the number of members in the mailing lists of the above mentioned organizations, it is not possible to exactly determine the number of

organizations or individual experts, which have received an email with the link to the survey. In addition, the recipients approached have been invited to forward the email to further experts. Consequently, it can be assumed that way above one thousand individuals or organizations have received the email with the link to the survey. This very open approach is, in general, applied in the open consultations of the European Commission or the impact assessments performed on behalf of the European Commission in order to allow all interested stakeholders to participate. Indeed, such a procedure is in contrast to approaches in academic studies, which draw from a homogeneous universe, e.g. of companies, a specific closed random sample in order to calculate response rates and check for response biases. However, since we cover both ICT companies in the widest sense, legal and other services, independent software developers and research organizations, both defining the universe, drawing random samples and calculating response rates is not feasible.

Finally, due to the support from some interviewees and their contacts plus the support of the above mentioned organizations, it was possible to receive 839 feedbacks in total. Despite the length and complexity of the questionnaire, 167 respondents – probably with strong interests – answered the questionnaire from the beginning to the very end. This is a rather high number compared to the just one hundred respondents to the official public consultation of the European Commission on patents and standards closed in 2015.<sup>1</sup> Therefore, we conclude that the topic of ICT patents is relevant and our approach accepted by the addressed stakeholders.

## 4.4 SURVEY RESULTS

The presentation of the results is divided into three sections. In a first section, we show and discuss the assessment of effectiveness of patents in ICT as a baseline for the following analysis of first the challenges and secondly the solutions.

### 4.4.1 Effectiveness of ICT Patents

In order to establish a reference point for the assessment of the problems, the participants have been asked for their assessment of ICT patents in achieving specific patent-related objectives identified by Blind et al. (2006).

Overall, for none of the objectives is the effectiveness of patents rated high, even by the patent owners. The limited effectiveness of patents in comparison with other protection strategies was already revealed the Cohen et al. (2000) survey. However, the ranking of the effectiveness is different compared to Cohen et al. (2000). Firstly, the protection from imitation of invention achieves only a medium effectiveness. Secondly, patents are mostly used as barter chips in negotiations, which has already been revealed by Blind et al. (2006). Thirdly, using patents by securing freedom to operate is surprisingly important for the respondents. However, the survey targeting the owners of standard-essential patent owners

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<sup>1</sup> [http://ec.europa.eu/growth/content/public-consultation-patents-and-standards-modern-framework-standardisation-involving\\_en](http://ec.europa.eu/growth/content/public-consultation-patents-and-standards-modern-framework-standardisation-involving_en)

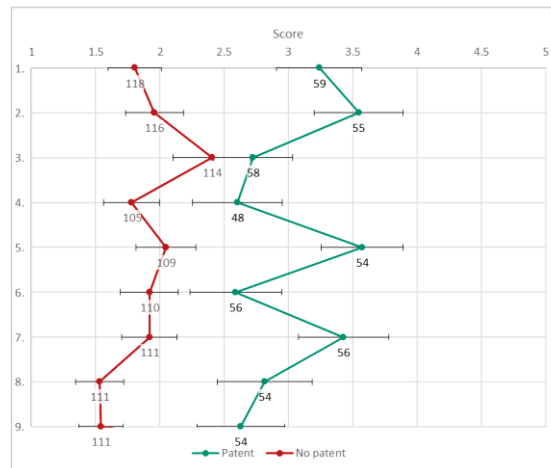
by Blind et al. (2011) reveals freedom to operate already as the most important motive to patent. Finally, using patents to enhance the own reputation is ranked above medium effectiveness. This is also in line with the finding of Blind et al. (2011) of using patents for signaling own technological competencies. Surprisingly, the licensing generating revenues via patents is ranked lowest.

The assessment of the interviewees related to the general effectiveness and efficiency of the patent system for ICT is highly dependent on the stakeholder group they belong to. Consequently, there is a much better perception of the overall value of patents by patent-owning entities, especially with the aim of securing their freedom-to-operate, as bargaining chips in negotiations and as a way to obtain a return on R&D investment. Patents are also positively considered in terms of enhancing the reputation of the patenting companies. All these aspects have been already revealed for other sectors in the past. However, there seems to be not much emphasis among patent holders on patents as a tool to block competitors, which clashes with the perception from entities not owning patents, in particular independent software developers, which see this aspect as the only one for which patents are effective. Despite the rather intensive licensing activities of the responding organisations the role of ICT patents to generate licensing revenues is perceived as rather limited, probably linked to the numerous challenges that the market for licensing faces.

Analysing the assessment of the respondents not owning patents, which is quite similar to SMEs' perception, it becomes obvious that they see the highest effectiveness of patents in blocking competitors, which comes close to the relatively low assessment of the patent owners. Obviously, patent applications in ICT are perceived lesser effective to block competitors than in other areas (e. g. Blind et al. 2006), because in ICT circumvention of existing patents is easier also due the involvement of many more components in a final product compared e.g. to pharmaceutical product. Finally, the differentiation of the responses depending on a company's business model reveals further details. Firstly, independent software developers are most critical regarding the effectiveness of patents in all dimensions, in particular, to their – relatively unfamiliar – coordination function in research processes. However, they consider patents as being effective to block competitors. Secondly, companies supplying components are very positive about the effectiveness of patents in most of the dimensions. Thirdly, network operators are besides from the independent software developers, the most threatened by the blocking function of patents but in contrast, are positive related to using them as assets in negotiations.

**Figure 1. Effectiveness of ICT patents ranging from very low (1) to very high (5) (differentiating between entities owning and not owning patents)**

1. Preventing imitation of inventions, e.g. for securing the means to obtain a return on the R&D investment
2. Securing own freedom to operate by disclosing prior art (e.g. to prevent legal conflicts)
3. Blocking competitors
4. Using the coordination function in research processes and collaborations incl. open innovation
5. Using as asset in negotiations (incl. cross licensing)
6. Generating licensing revenues
7. Enhancing reputation
8. Measuring performance of research and development
9. Rewarding employees



#### 4.4.2 Assessment of the Challenges of ICT patent ecosystem

After providing the general background of the respondents, their usage of patents and their assessment of the effectiveness of patents, we now move to the evaluation of the challenges related to ICT patents. Here, we divide the challenges between those related to patent application and granting on the one hand and those related to enforcing and implementing patents on the other hand. The rating revolves around five possible answers ranging from “totally disagree” to “totally agree”.

Almost all challenges that were raised, in the areas of patent application, prosecution, enforcement and implementation, were considered significantly relevant by the majority of the experts. However, patent owners appear to be less concerned, whilst all others and in particular Small and Medium Enterprises (SMEs) including the independent software developers stand out as the type of entities with a mostly critical viewpoint about these challenges.

The statement that received the highest level of agreement was “The scope of granted ICT patents is too broad”, which is particularly criticized by those companies that do not own patents. However, not only the broad scope, but also the length of patent protection are criticized as being too long. Furthermore, the quality of ICT patents granted is perceived to be low, which might be closely related to the critique that “patent examination practices do not adequately consider relevant existing prior art”. These skeptical assessments are in particular driven by the answers of the independent software developers. Due to their general skeptical attitude towards patents, they perceive the differences of “the statutory patentability standards for ICT patents (e.g. technicality, etc.)” among patent offices not so much as a problem. Regarding this statement, there is also no significant differences between the answers of the patent owners and the other respondents, but also between large companies and SMEs. However, a rather high share of more than one quarter of respondents, most of them SMEs, is unable to provide any assessment.

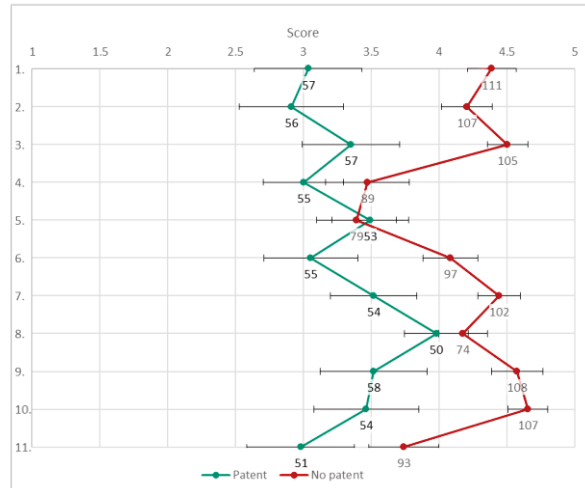
Overall, the challenge that “Implementations cannot be effectively protected by patents because they include code under an Open Source license that includes patent licenses” is

perceived only as ambivalent as well as the high cost for applying for ICT patents. Regarding the insufficient speed of granting patents, the significant differences between patent owners and the other respondents disappear. Obviously, both the patent applicants and those not applying for patents are interested in timely decisions in order to reduce the uncertainty, which is both groups negative. According to the empirical analysis by Farre-Mensa et al. (2016), this speeding up would increase firm growth, job creation and innovation in particular in start-ups. On the one hand, the patent owner is not sure whether he can eventually enforce his right and is also not able to license the patent protected technologies to third parties. On the other, those interested in implementing technologies and licensing them in are also suffering from this uncertainty.

Finally, the patent owners perceive significantly less problems for ICT patents due to the technological dynamics or technological convergence and fragmentation in the ICT sector compared to the other respondents, in particular the independent software developers. For the latter, “the language of ICT patents is too complicated to qualify as a good source of information” is also perceived as a major problem, which has already been expressed by the interviewees of the OSS community.

**Figure 2. Assessment of the challenges for ICT patents regarding patent application and granting ranging from totally disagree (1) to totally agree (5) (differentiating between entities owning and not owning patents)**

1. Due to the technological dynamics in the ICT sector, patents are not effective to protect innovation
2. Due to technological convergence and fragmentation in the ICT sector, patents are not effective to protect innovation
3. Patent examination practices do not adequately consider relevant existing prior art
4. The cost for applying for ICT patents is too high
5. The granting process for ICT patents is too slow
6. The language of ICT patents is too complicated to qualify as a good source of information
7. The quality of ICT patents granted is low
8. The statutory patentability standards for ICT patents (e.g. technicality, etc.) differ among patent offices
9. The maximum protection period of 20 years is long for ICT patents
10. The scope of granted ICT patents is too broad
11. Implementations cannot be effectively protected by patents because they include code under an Open Source license that includes patent licenses



In comparison to the level of agreement to the challenges in the application and granting of ICT patents, we observe an even higher support to the problems related to the enforcement and implementation of ICT patents. In addition, there is only a minority of problems where the patent owners and the other respondents disagree significantly. Obviously, the patent owners perceive much more difficulties in enforcing and implementing their patents compared to the application and granting phase. Finally, a large share of respondents also have problems assessing the various challenges.

The top three challenges according to the respondents' assessments are the following. In contrast to most other challenges, the patent owners agree significantly less to these three statements. Firstly, the expected legal cost for resolution of conflicts regarding ICT patents are considered as rather high, whereas the cost for enforcing granted ICT patents are less of a problem. Secondly, it is feared that ICT patents owned by Patent Assertion Entities (PAEs) will increase the legal uncertainty for the implementers of ICT related technologies, whereas the general legal uncertainty for companies creating or implementing ICT patents is rated significantly lower. Thirdly, the use of ICT patents protected technology generates problems for the use of Open Source Software, which is, in particular, stressed by the independent software developers and is in line with the fear already expressed in the interviews. They are also most critical against patents on computer-implemented inventions (CII), in brief, software patents, because they might create difficulties for innovation of ICT-related technologies. Consequently, they, but also all other respondents, perceive the least problems for ICT patents by using Open Source Software. Obviously, this represents not a real problem.

In contrast to the interviews expressed in the literature, the rated second least problem is the threat of courts granting an injunction to prevent infringements of ICT patents. Here, the fear of the independent software developers is still highest, whereas the companies providing patent services, i.e. patent lawyers and attorneys, perceive the least difficulties. However, the general likelihood of litigation (infringement) of ICT patents is considered to be higher again explicitly expressed by the independent software developers.

Focusing on hold-up's, i.e. licensors' unwillingness to license ICT patents, and hold-out's, i.e. implementers' unwillingness to license in third-party ICT, we observe no significant differences. Surprisingly, patent owners do not agree significantly more to the hold-out problem as the others, i.e. potential licensees, who perceive hold-up as the more severe problem. However, looking at the differences between business models, the companies producing final consumer products as well as the network operators, -often accused for hold-out- consider this less a problem compared to hold-up. In contrast, companies supplying components, sometimes accused for hold-up, regard it to a lesser degrees as a problem. Finally, almost one quarter of respondents were not able to give an assessment both for hold-up and hold-out underlining the difficulty in identifying the real extent of the problem, which has already been expressed in the interviews.

Closely related to the intertwined problems of hold-up and hold-out are the negotiations of the licensing agreements for standard-essential ICT patents (SEPs). Overall, this is rated higher as a challenge than hold-up and hold-out. However, the major opponents in these negotiations, the companies supplying components and the companies producing final consumer goods, agree at the lowest level to this challenge. The same is true for their assessment of large patent owners not joining pools of ICT patents.

Finally, the risk, that many ICT patented technologies are not used or commercialized, is particularly supported both by the independent software developers and by the semi-public and public research institutes. The latter are afraid that the technologies they are developing are eventually not commercialised. In contrast, companies supplying

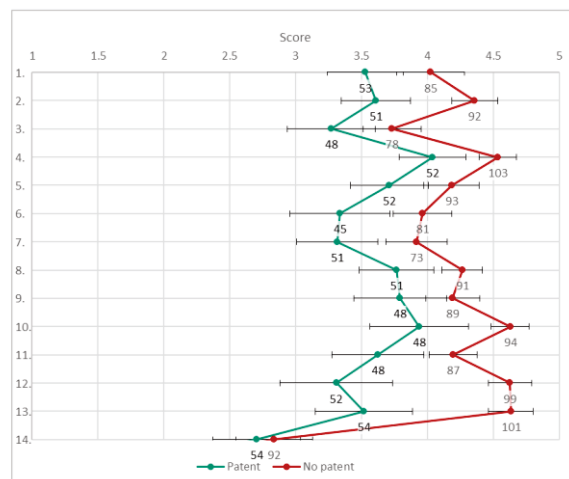


components consider this challenge – also among the other challenges – as one of the least relevant ones.

In summary, almost all challenges considered to be relevant are reflected by the level of agreement from the experts. However, the valuations are significantly lower by the patent owners and higher by the SMEs with a few exceptions. Furthermore, not only the use of patents and the company size, but also the various business models lead to different assessments. In general, the independent software developers have more serious concerns related to the challenges generated by ICT patents.

**Figure 3. Assessment of the challenges for ICT patents regarding enforcing and implementing patents ranging from totally disagree (1) to totally agree (5) (differentiating between entities owning and not owning patents)**

1. The cost/risk to enforce granted ICT patents is high
2. The likelihood of litigation (infringement) of ICT patents is high
3. The likelihood of courts granting an injunction to prevent infringement of ICT patents is high
4. Expected legal cost for resolution of conflicts regarding ICT patents are high
5. The legal uncertainty for companies creating or implementing ICT patents is high
6. Licensors are not willing to license ICT patents covering their technologies (hold-up)
7. Implementers of ICT patents are not willing to licensing in the third-party ICT patents covering their implemented technologies (hold-out)
8. Agreeing on licensing agreements for standard-essential ICT patents (SEPs) is challenging
9. Large patent owners not joining pools of ICT patents challenge the implementation of ICT-related technologies
10. ICT patents owned by Patent Assertion Entities (PAEs) increases legal uncertainty for implementers of ICT related technologies
11. Many technologies protected by ICT patents are not used or commercialised
12. Patents on computer-implemented inventions (CII) or software patents challenges innovation of ICT-related technologies
13. The use of ICT patents protected technology generate problems for the use of Open Source Software
14. The use of Open Source Software generates problems for the use and protection of ICT patents



#### 4.4.3 Assessment of Solutions to address the problems affecting ICT patent ecosystem

Based on the review of the literature and the proposals mentioned in the interviews to improve the present framework for ICT patents, we developed a set of possible solutions. These are divided into those related to successful patent application on the one hand and the enforcement and implementation of patents on the other hand.

In contrast to the high agreement to almost all proposed challenges for ICT patents, the effectiveness of some of the suggested approaches aimed at making the framework for ICT patents more conducive to innovation are questioned by the majority of the respondents. However, a major new insight from the stakeholder survey is the high level of agreement to almost all proposed solutions between the patent owners and the other respondents despite the rather different assessment of the challenges.

However, we start with the most significant result. A majority of the respondents assess the exclusion of software from patenting “both for the program listing and the technical content underlying the software” as close to be very effective. This positive assessment is particularly driven by the valuations of the independent software developers and SMEs. However, the respondents representing the other business models also support this

proposal, in particular the service companies. In contrast, the network operators and the component suppliers are reluctant in their support for this proposal. In line with the broad support of the exclusion of “software as such” from patenting, is the strong backing of the proposal of raising and specifying (e.g. related to technicality) the bar for patents on computer-implemented inventions by both patenting and non-patenting respondents, in particular active in SMEs. This proposal was already supported in the early days of the discussions about software patents (Blind et al. 2005). Implementing this proposal reduces obviously uncertainties for both stakeholder groups in a sense that software is not protectable by patents, whereas ICT hardware is. This is a rather clear demarcation in contrast to other more vague and complex distinctions. In contrast, but very consistent with the previous assessment is the strict denial of patents for “software as such”, i.e. program listing is not patentable. Here, we observe even a greater homogeneity among all respondents. Although the sample is slightly different, there are interesting differences to the findings of Blind et al. (2005), who investigated the options on patenting software and computer-implemented inventions at the very beginning of the discussion about possible changes of the European Patent Convention. More than fifteen years later, the position of the independent software developers has not changed at all. However, we can observe that the representatives of both the software suppliers and of the non-patenting companies of the manufacturing sectors have recently started to follow closely the position of the independent software developers.

Besides the specific aspects of software patents, the other proposal rated as effective focuses on the quality of granted ICT patents, which is identified to be challenging. Whereas not all stakeholders consider raising the application and renewal fees as being effective, the patent scope as the most supported challenge should be narrowed. This proposal is especially endorsed by the non-patenting respondents. This high level of correspondence between the most relevant challenge and the most effective solution confirms the consistency of the answers and also the implemented survey approach. Besides narrowing the patent scope, the required degree of novelty and the required inventive step are evaluated as being effective in making the framework for ICT patents more conducive to innovation.

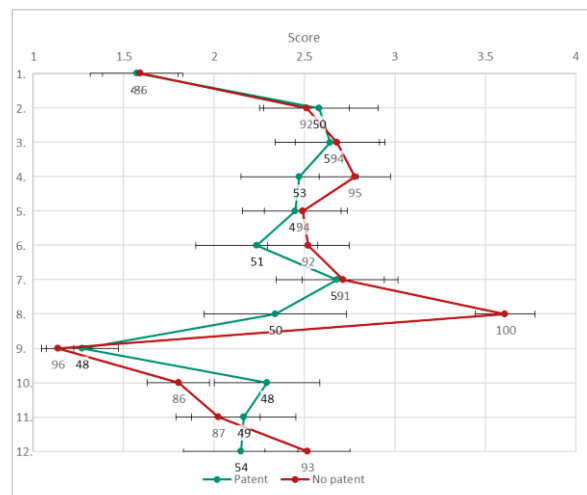
In contrast to these rather traditional proposals, the idea of crowd-sourced validity checks supporting patent offices and the requirement of implementing an invention before granting an ICT patent receive less support, in particular the latter by patenting respondents. They are also not in favor of reducing the protection period for ICT patents to ten years, which is considered to be more effective by the independent software developers. Love (2011) argues for a reduction of the protection period, because the majority of litigations of “older” patents is caused by Non-Practicing-Entities. However, the requirement to grant ICT patents within five years is supported by the patent-owning respondents, in particular by the network operators.

In summary, the proposals related to successful patent application are considered to be effective in restricting patenting for “software as such” by the majority of the respondents. In addition to this specific topic suggestions focusing on raising the quality of ICT patents are

considered to be less effective both by patent owners and by non-patenting respondents. In particular, raising the costs for patent applications or renewals of granted patents are not perceived to be very effective nor speeding up the granting process of ICT patents or halving their protection period. In general, it will be challenging to effectively implement these proposals either due to legal restrictions set by TRIPS or limited resources for investing in patent examinations, e.g. to reduce the scope of patent applications.

**Figure 4. Assessment of solutions for ICT patents promoting innovation related to patent application and granting from not effective (1) to very effective (4) (differentiating between entities owning and not owning patents)**

1. The application fees for ICT patents are raised
2. The quality of granted ICT patents is improved by raising the required degree of novelty
3. The quality of granted ICT patents is improved by raising the required inventive step
4. The quality of granted ICT patents is improved by narrowing their scope
5. Crowd-sourced validity checks support the patent validity checks by patent offices
6. Granting an ICT patent requires already the implementation of the invention
7. Raising and specifying (e.g. related to technicality) the bar for patents on computer-implemented inventions
8. Software is excluded from patenting both for the program listing and the technical content underlying the software
9. Patents for "Software as such" are granted, i.e. the program listing is patentable
10. ICT patents are granted within five years
11. The renewal fees for granted ICT patents are increased during all the protection period
12. The protection period for ICT patents is shortened to 10 years



In addition to the solutions related to applying and granting patents, even more proposals are being discussed in the literature and by the interviewed experts to improve the present framework for ICT patents related to enforcing and implementing patents in order to make the framework for ICT patents more conducive for innovation.

In the first part, we focus on solutions and institutions facilitating the licensing of patents. The second part deals with proposals to solve conflicts both within and outside courts easier.

Compared to the assessment of the relevance of the challenges the valuation of the effectiveness of the various proposals never reach on average the level "effective". The majority of the respondents consider the challenges as rather demanding, but on average, the proposed solutions are not expected to be effective. This general observation justifies further research to identify effective solution including both deepening the existing insights, but also applying further approaches to test the effectiveness of the most promising proposals in practice, e.g. via experiments.

Reflecting the high assessment of the relevance of threats generated by Patent Assertion Entities (PAEs), regulations restricting their activities are considered effective at least by the majority of patent-owning companies. The other intensively debated topic of licensing conditions for standard-essential patents (SEPs) is leading to at least a limited support to the

proposal of incentivizing the publication of information including product specifications and licensing fees for Standard-Essential ICT patents. Surprisingly, both proposals receive slightly more support from the patent owners than from the non-patent owning organizations.

The suggestion that a declaration of willingness to grant a license for commercial use to anyone (license of right L.O.R.) is required to receive the maximum of twenty years of protection for ICT patents is only rated as ambivalent related to its effectiveness to promote innovation evaluated slightly higher, in particular by the patent-owning companies is, the idea of defining a set of well-known and trusted patent pledges, i.e. voluntary commitments by patent holders to give up some of the rights associated to the patent (e.g. grant permission for commercial use without any direct compensation, no injunctions, FRAND, etc.). In contrast, the public support for technology exchange clearing houses to support bilateral licensing negotiations is considered as being the least effective measure for promoting ICT-related innovative technologies, which is consistent with the skeptical comments from several interviews.

Public policies supporting the formation and development of ICT patent pools, especially of SEPs, or of bilateral or joint licensing programs are also not positively rated regarding their effectiveness in promoting ICT innovations. However, the network operators, companies producing final consumer goods, component suppliers and companies providing patent services endorse these solutions slightly more, whereas the SMEs are rather unconvinced. Defensive ICT patent aggregators, as a specific type of patent pools, receive slightly stronger support particularly, from the non-patenting respondents and the SMEs. Surprisingly based on the critical discussions in the interviews, the publication of the licensing terms of bilateral licensing agreements receives a stronger support, in particular from the non-patenting respondents and the SMEs. In addition, the network operators and the software developers are – at least partly – convinced about the effectiveness of this measure to promote innovation in ICT.

Finally, the development of compatible licensing solutions for Open Source Software and ICT patents is considered partly effective in promoting ICT innovations. Particularly, from the non-patenting respondents as well as from the network operators and public and semi-public research institutes. The proposal of integrating only Royalty-Free ICT patents into Open Source Software is less convincing, notably for the non-patenting respondents. Here, the concerns already raised in several interviews are confirmed.

Besides the – at least partly endorsed – suggested regulations related to PAEs and SEPs, the other two proposals related to the court system received a positive evaluation from the patent-owners regarding their effectiveness in promoting innovation. On the one hand, infringement and validity issues regarding ICT patents should be tried together before the same court, which is in particularly supported by companies providing patent services. On the other hand, specialized courts instead of general courts should deal with ICT patent disputes. This is supported by the patent owners and especially, the network operators. This is consistent with their statements in the interviews.

The other proposed solutions related to ICT patents disputes in courts are evaluated with ambivalence. In addition to increasing the court fees for patent disputes, patent owners -in particular the companies supplying components- are more inclined to favour the losing parties being responsible for all legal costs and the restoration of the financial situation of the winning party before the court case. The other respondents, in particular the SMEs, are very skeptical regarding the efficiency of these ideas. The skepticisms among the patent owners even increases related to the proposal of introducing caps on ICT patent court case costs, which are recoverable by the winning party. The same is true for restricting plaintiffs by only challenging one ICT patent of one defendant in any given court case. In particular, companies providing patent services and companies supplying components doubt the effectiveness of this restriction. However, the non-patenting respondents had even slightly better evaluate these two suggestions.

In order to avoid court cases, the support of mediation and arbitration processes to reach a mutually satisfactory settlement of ICT patent disputes is significantly more appreciated by patent owners and in particular by the network operators compared to the other respondents. It is very likely, that they have already had positive experience with arbitration and mediation, which is also reported by some interviewees. In contrast, they are not at all convinced about the effectiveness of publicly supported insurances against ICT patent litigations, which are slightly more positively considered by the other respondents and the SMEs.

Finally, the influence of the European trade secret regulations on the incentives to file ICT patents is quite ambivalent and difficult to assess, as one third of the respondents were not able to provide an evaluation. However, the SMEs traditionally relying on this instrument are slightly more confident regarding the effectiveness of this instrument in promoting innovation in ICT.

In general, the proposed solutions derived from the literature and the interviews are perceived by the majority of the respondents of the stakeholder survey not to be effective in promoting ICT innovation. This is contradictory to the high agreement on the relevance of most challenges. However, the assessment of the challenges differ depending on patent ownership and company size, because patent owners perceived less and SMEs more relevance of the challenges. In addition, even within organizations, management perceives the challenges more severely compared to legal or IT experts. However, these differences do not exist in their assessment of the effectiveness of almost all proposals. Therefore, the consequence of this comprehensive impact assessment covering all relevant challenges and all possible solutions is not to stick to the status quo, but rather to prioritize the most convincing solutions (especially from the perspective of those who do not own ICT patents as well as SMEs).

Not surprisingly, the respondents put the focus within the patent application and granting phase on the various approaches improving patent quality. The other more specific proposal being considered to be effective for promoting innovation is raising and specifying the bar for patents on computer-implemented inventions and excluding the patentability of “software as such”, which is in line with the current regulations of the European Patent

Convention. Another observation, which supports the status quo of the existing regulation, is the skepticism towards the effectiveness of changing patent application, but also of renewal and even court fees. The impact of these cost components on the behavior of the various stakeholders is limited. Reducing the protection period and the time to grant ICT patents is though a slightly more convincing argument. However, the protection period is regulated by TRIPS and therefore difficult to change.

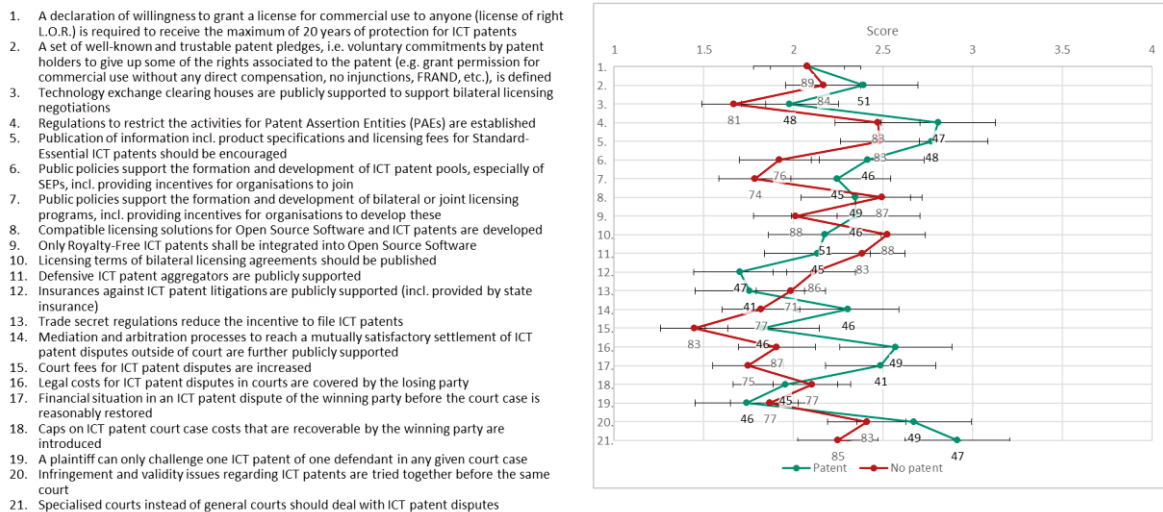
The option of the Agreement on a Unified Patent Court (UPC) allowing for the separation of infringement and validity issues to be treated in different courts, i.e. bifurcation, is perceived critically, especially by the patent owners. This is supported by the empirical study by Cremers et al. (2016) about its disadvantage for Germany compared to an integrated approach in the UK. However, the specialized courts to be implemented within the UPC reflect the expressed needs of the stakeholders. Besides these institutional aspects, experts perceive the need to address the possible challenges caused by Patent Assertion Entities with regulations. However, based on the interviews, the details remain open as to how these regulations would be shaped in order to be effective. The second challenge is increasing the transparency of the licensing agreements related to Standard-Essential Patents (SEPs), which is assumed to be effectively achieved by providing more information, including product specifications and licensing fees.

The recently published EC Working Paper “Putting intellectual property at the service of SMEs to foster innovation and growth in the Single Market Strategy” (EC 2016) proposes some support measures focusing on start-ups and SMEs “...addressing sub-optimal use of IP by them across the EU”. On the one hand, the results of our survey support the streamlining of European IP awareness schemes for SMEs. This is attributed to SMEs responses often revealing that they are not able to assess both the relevance of the challenges and the effectiveness of the proposed measures. On the other hand, the support for developing an EU IP mediation and arbitration network for SMEs has to be considered carefully as its effectiveness in promoting innovation has only been evaluated with ambivalence by the respondents to our survey. The same degree of skepticism exists for publicly supported insurance schemes for litigation. However, SMEs are more positive. Therefore, the creation of European-level insurance schemes for patent litigation theft can be justified by the results of our survey, but the critical assessments raised by some interviewees should be taken into account. Finally, expanding the support of funding schemes to support patent use by SMEs might be not so effective, because the application costs are no major challenge and changing costs structures are not considered to be very effective.

The responses by SMEs, which reveal much more often that they are not able to assess both the relevance of the challenges and the effectiveness of the proposed measures, demonstrate they are probably the weakest players in the patent ecosystem. Along these lines, further support for SMEs in patent application and implementation, but also in court disputes, in addition to existing programmes, is suggested by many experts. However, there are also concerns about the need and the effectiveness of such SME-specific measures. What seems clear is the appropriateness to raise their awareness and understanding of the

whole ICT patent ecosystem starting from R&D projects, but also including the opportunities and challenges of OSS.

**Figure 5. Assessment of solutions for ICT patents promoting innovation related to enforcing and implementing from not effective (1) to very effective (4) (differentiating between entities owning and not owning patents)**



#### 4.5 CONCLUSIONS AND RECOMMENDATIONS

In general, there are significantly different views about the problems of the ICT patent ecosystems among those entities owning patents and those not using them actively, which is a quite expected finding. However, there is less difference in the perception about the potential solutions for both sets of organizations, which is more surprising and worth mentioning as a starting point for working together on common solutions.

Despite the acceptance and support of the proposed measures are in general moderate, there are some proposals which seem to have a better endorsement. Other are still be less known by the industry, which denotes that their potentials may have not yet been fully experienced. Thus, both types of measures deserve especial attention.

Despite the opposed standpoints of different stakeholders in the value chain, and the fact that no recommendation was considered a panacea by the respondents to our consultations, a few potential levers stand out among the rest. Regulators, legislators, patent offices and any other entity with influence on any of these aspects are invited to take the views of the stakeholders into consideration.

One of the aspect that deserves more attention is the limitation of those practices usually conducted by PAEs that are considered to have a predominantly negative impact on the ecosystem, namely, the limitation of injunction whenever there are alternatives, limiting forum shopping, and securing their ability to take the court costs whenever they are legally bound to it.

Incentives to promote a more transparent licensing market, such as publications of bilateral licensing terms, whenever this does not affect competition, should be considered, especially as a tool to address a potentially discriminatory behaviour towards small licensees, and thus levelling the playing field.

With regards to ICT patent enforcement, recommendations gathering strong support are the promotion of specialized courts and the avoidance of bifurcated patent litigation systems.

A need has been identified to promote education on different aspects of the ICT patent framework, especially aimed at actors such as SMEs. These awareness and educational actions are advised to address also less known tools and practices, which could be useful to overcome certain issues of the ecosystem, for instance on patent pledges, on the interplay between OSS and patents, and on alternative dispute resolution mechanisms.



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