



Transparency, Predictability, and Efficiency of SSO-based Standardization and SEP Licensing

A Report for the European Commission

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1. Introduction

We have been commissioned by DG Internal Market, Industry, Entrepreneurship and SMEs (“DG Growth”) to conduct a study to assess issues related to the standardization process and consider a number of policy options which might help alleviate these problems. The study proposes and assesses practical solutions to the identified issues, taking into account their costs and benefits, with a view of facilitating an efficient standardization process.

The study builds on a widespread consultation from stakeholders to complement the evidence available from the academic and policy discussions, as well as our own experience working in this area. While stakeholders often hold opposing views on a number of questions related to the standardization process, the arguments and evidence brought by the various parties involved in the standardization process are used as an important input in our analysis, not only as a way to identify problematic areas, but also assess specific policy options. In addition to the more traditional standard-intensive industries, our assessment also covers standardisation in the “internet of things”, the emergence of which makes it particularly important to ensure the efficiency of standard-setting and SEP licensing procedures.

In this introduction, we first highlight the importance of compatibility standards and the standardization process. We then briefly summarize the study’s methodology and outline the structure of the study.

1.1. Compatibility standards

There are two broad types of standards: those that ensure that different parts of a “system” can operate well together and those that refer to some stand-alone property of a product, be it operational safety, impact on human health or on the environment. A main difference between these two kinds of standards is that safety, health or environmental standards can usually be expressed in terms of *minimum performance*, e.g. how resistant the steel used in a boiler might be or what the maximum of authorised CO₂ release is. Firms are then free to use any technology allowing them to meet the specified performance requirements. In that sense then, standardisation does not tie implementers into narrowly specified technological choices.

By contrast, while compatibility standards are of course also supposed to deliver high performance, they must primarily ensure that various products manufactured by various companies can work smoothly together. More often than not, this requires choosing a very specific manner of addressing a number of technological issues, making the implementation of the standard dependent on accessing specific technologies which might well be patented. This raises important policy questions about the choice of the technologies that are embedded in compatibility standards and the conditions at which they are licensed to potential implementers.

Compatibility standards can arise in a number of ways. At one hand of the spectrum, the technical specifications chosen by a dominant companies become a *de facto* standard to which the rest of the market must adapt. Microsoft’s PC operating systems in the late 1990s and early 2000s is a case in point. At the other extreme, a standard

can be established by an industrywide collaborative effort. This usually happens within standard-setting organisations (SSOs) or equivalent institutions. Between these two extremes, one can find a variety of hybrids, including “consortia”, which are collaborative efforts between a closed subset of industry participants. Standards also differ in their market coverage. While interoperability is at its best when all industry participants coordinate on a single standards, it is not unusual for more than one standard to coexist – or at least to do battle for a while -. When several standards do persist, one usually sees the emergence of some form of “adaptor” technology which allows for at least a measure of compatibility between rival standards.

This report focusses on attempts to generate industry-wide standards through explicit cooperation between industry participants. Moreover, we will mostly consider situations where there is a single standardisation effort led by an organisation open to any stakeholder willing to abide by its internal rules. We will therefore largely ignore the pros and cons of competition between rival standard-setting processes.¹ The main reason for this approach is simply that, in spite of an abundant early literature on competition between firms that rely on different standards², there is essentially no rigorous economic analysis of how individual companies would choose to join rival standardisation efforts that proceed under different internal rules and very little systematic evidence as to how such (potential) standard competition unfolds in the real world.

SSO-based compatibility standards are pervasive and involve rather large amounts of resources. Table 1 presents estimates of the number of Standard-Setting Organisations (SSOs) currently in activity in a variety of industries. Not surprisingly, electronics and telecoms are the two sectors with the greatest incidence of SSOs. Still, SSOs in these two sectors plus consumer electronics account for less than 40% of the SSOs listed in the table. In reviewing SSO-based standardisation we must therefore keep in mind that the relevant economic environment in other sectors might be quite different from what is found in the sectors where standardisation has recently made the headlines.

¹ While we make the methodological choice to focus on single standardization efforts, we do point out in the report specific areas where competition among standard-setting bodies is particularly relevant for the analysis. For example, in situations where the technical choice of the standard within a SSO is not affected by economic considerations but only driven by pure engineering criteria, we explain that individual royalty caps are ineffective and that aggregate royalty caps can only limit the risk of hold-up if competition between standard-setting bodies is at least a possibility (since implementers can in such a case credibly threaten to support an alternative standard-setting effort if it offers a more advantageous total royalty).

² See for example Katz, M.L. and C. Shapiro, 1986, “Technology Adoption in the Presence of Network Externalities”, *Journal of Political Economy*, 94:4, pp. 822 – 841; Katz, M.L. and C. Shapiro, 1985, “Network Externalities, Competition and Compatibility”, *American Economic Review*, 75:3, pp. 424 – 440 and Katz, M. and C. Shapiro, 1994, “System Competition and Network Effects”, *Journal of Economic Perspectives*, 8:2, pp. 93 – 115.

Table 1: SSOs per Industry

Industry	Number of SSOs
Aeronautics	8
Automotive	23
Bio IT and Life Sciences	19
Clean Tech and Renewable Energy	40
Construction	14
Consumer Electronics and Content	27
Defence	10
Digital and Distance Learning	22
Electronics	100
Health and Medical	52
Manufacturing	35
Power and Smart Grid	30
Real Estate	5
Telecom	89
Multi-Industries	84

Source: Gandal, N. and P. Régibeau, 2015, "Standard-Setting Organisations: Current Policy Issues and Empirical Evidence", in Delimatsis, P. (Ed.), 2015, *The Law, Economics and Politics of Standardization* Cambridge University Press.

As for resources, Chiao, Lerner, and Tirole (2007)³ cite an estimate that IBM spent \$500 million on standards related activities in 2005 and Farrell and Simcoe (2012)⁴ report that a medium to large size firm will spend about \$50,000 a year to just to participate in a single SSO in one year. So, if we take the total number of SSOs in Table 1 (548), the total cost involved would be equal to \$27,400,000 times the average number of participants in these SSOs. Even at a likely conservative 50 members by SSO⁵, this adds up to more than \$13B a year.

This number is of course a severe underestimate of the value that standardisation creates for the global economy as a whole. Without standardisation there would, for example, be no internet, no roaming with mobile phones or smartphones, DVDs or Blue Ray and no possibility for distant hospitals to exchange patient information.

³ Chiao, B., J. Lerner and J. Tirole, 2007, "The rules of standard-setting organisations: An empirical analysis", *Rand Journal of Economics*, 38:4, pp. 905 – 930.

⁴ Farrell and T. Simcoe, 2012, "Choosing the rules for consensus standardisation", 2012, *Rand Journal of Economics*, 43:2, pp. 235 – 252.

⁵ A large SSO like ETSI has more than 800 members. Calypso, a much smaller smart card association has 58 members and the "International Commission on Illumination" counts more than 70.

Indeed, given the current explosion in products that rely on modularity – and hence compatibility – and the dawn of the “internet of things” where a huge variety of devices is supposed to eventually communicate seamlessly, it is hard to overestimate the importance of having efficient, smooth-running standardisation processes.

1.2. Goals and methodology of this report

A previous study commissioned by DG Growth (Ecorys study) identified a number of issues related to the standard setting process, namely:

- Lack of clear rules and procedures on the inclusion of patented technologies
- Problems related to declaration systems
- Problems related to transfer rules
- Problems related to patent pools
- Problems related to FRAND definition
- Problems related to Dispute resolution

For each of these categories, our study aims to identify qualitatively and/or quantitatively the problems which had real significance and impact “on the ground”, to consider a number of policy options which might help alleviate these problems and to assess what the impact (both positive and negative) and costs of implementing such policies might be. A specific focus is placed on practical and readily implementable solutions, with a special emphasis on measures that would enhance the overall transparency of the SSO-based standardisation process and reduce transaction costs. Standardisation, standard-setting organisations and standard-essential patents have already been the subject of considerable discussion in both academic and policy circles. There is therefore a very considerable knowledge base on which we can draw, in addition to our own experience and work in this area. This study builds on this body of knowledge, which is confronted to – and augmented by – the opinions of stakeholders. These opinions were collected through three channels:

- First, prior to commissioning this report, DG Growth conducted a broad consultation exercise which attracted a significant number of responses from very different quarters. Not only is this consultation exercise a major source of evidence for our analysis, it also helped shape the questions discussed in our further contacts with stakeholders.
- Second, contacts with stakeholders took the form of a set of hour-long interviews with SEP-owners, users, SSO officials and academics as well as a day-long workshop with similar types of stakeholders. The methodology used to set up and conduct these interviews is discussed in section 5, where the main lessons from the three stakeholder-oriented exercises are also presented.
- Third, we organised a workshop at our Brussels office in November 2015. This workshop was open to any stakeholder who had participated in one of the two

previous parts of the consultation. One of the main purposes of this “wrap up” workshop was to allow each stakeholder to confront his or her views directly with the views of others.

Building on this consultation and existing work, we assess the likely costs and benefits of specific policy options related in particular to commitment/ disclosure rules and to a number licensing practices. Our goal is not to propose one-size-fits-all recommendations, but to assess in what specific circumstances intervention may be beneficial, taking into account the specificities of the sectors considered. In doing so, particular attention is paid to how various policy options may interact with each other, so that coherent policy packages can be considered.

1.3. Outline

The study is structured as follows.

In section 2, we begin the report by identifying the main problems confronted by SSOs and their members and by providing a first assessment of practically important these problems appear to be. In doing so, we chose to deviate from the categories of issues identified in the Ecorys report. While the Ecorys categories essentially refer to different “parts” of the overall SSO-based standardisation process, we prefer to organise the analysis in terms of *the kind of economic issue* involved, including such well-known topics as hold-up, hold-out and royalty stacking. However, it should be clear that, in spite of the difference in organisation principle, all of the concerns identified in the Ecorys report are discussed in our report as well.

Section 3 introduces the different families of policies that might prove useful in addressing some of the issues identified in the previous section. We not only present a quick description of each type of policy but also try to “map” category of policies into the issues that it might help alleviate.

In section 4, we discuss the stake-holders’ interests concerning these issues. Section 4 first briefly assesses what the “self-interested” positions of various stakeholders are likely to be. In other words, we try to identify the parties that are most affected by specific issues and we try to broadly assess who is likely to lose or win from some types of policy intervention. Section 4 then describes the three types of consultation exercises from which we obtain much of our evidence. We also use this section to offer a broad summary of the stakeholders’ main concerns, thereby complementing our initial assessment of which “problems” matter most and which ones might be safely ignored.

Sections 5 and 6 contain the core of our analysis, presenting our assessment of specific policy options. Section 5 focuses on commitments and disclosure rules, while section 6 deals with a variety of licensing practices, including the bundling of SEPs and non-SEPs and the choice of the royalty base.

In sections 5 and 6, policy options are mostly evaluated on a stand-alone basis, i.e. with limited discussion of how various policy interventions might “fit together” to form a coherent package. Such a package is presented in section 7, which explains why we believe that our proposal would help address most of the issues identified at the beginning of this report.

2. The main issues

In this section, we review the main obstacles that a SSO-based standardisation process has to clear in order to achieve its goal of designing an efficient standard, which is then made broadly available at reasonable terms. This section has a double purpose. Firstly, we need to define clearly from the start the economic concepts on which much of the report will rely. Unfortunately, in spite of several years of discussion in policy circles, several of these concepts are commonly used without the required precision. Secondly, as this report is concerned with practical solutions to practical problems, we need to assess the empirical relevance of each issue. In doing so, we rely mainly on the available academic literature, as it has the advantage of relying on systematic evidence rather than just hearsay or anecdotes. The view of agents taking part in the SSO-based standardisation process will be examined later, in section 6. In spite of its emphasis on rigorously defined concepts and systematic empirical studies, this section should not be seen as a review of the academic literature on SSOs. We only aim at providing the necessary foundations for a meaningful discussion of the very concrete problems that SSO-based standardisation tends to run into.

2.1. Hold-up

“Hold-up” is one of the most controversial terms in the discussions on standardization and standard essential patents. However, in the debates it is not always clearly specified what exactly authors refer to. However, hold-up has a clear and unambiguous definition in economics, which is central to understanding the main incentives that can lead to excessive pricing in a standardization context. In this section we first define hold-up, then discuss why standard essential patents can be subject to the hold-up problem, and then discuss what evidence can potentially be available, what the available evidence tells us about hold-up, and what the reasonable conclusions for policy making are on the basis of that evidence.

“Hold-up” occurs in a trading relationship, when two conditions are met. First, there must be some kind of commitment that a party to a trade makes, so that its bargaining position in trade before the commitment is made is stronger than its bargaining position after the commitment is made. Second, there must be some contractual incompleteness so that the parties cannot commit to the contractual conditions for the trade before the commitment is made or cannot enforce such conditions in court. As a result the trade will take place at conditions that are negotiated after the commitment has been made, leading to an outcome that is worse for the party having to make the commitment.

The best known example of such a change in bargaining power concerns relationship specific investment. Such an investment has little value outside of the specific transaction. In this example the transaction is only worthwhile, if one of the parties makes it. If the price at which the transaction takes place could be fixed before the investment takes place and be conditioned on the investment, the party making the investment would only participate if the price was enough to cover the cost of investment (including a fair return). If the value of the transaction is higher than the investment costs, the investment would always take place.

However, if the price can only be set after the specific investment was made, the investment becomes “sunk” it means it becomes irrelevant for the decision of the investing party of whether it should trade or not. It will now accept the contract whenever the price is high enough to at least cover the costs *still to be incurred*. But this means that there is no guarantee that the initial investment costs is covered, so that in some circumstances the investing party will prefer not to invest at all, despite the investment being efficient. Note that hold-up is more severe if the investor has many options before the investment to contract with different parties, but after the investment can only use it with one contractual. In that case the investor can have contractual partners compete and generate a high return on the investment. But after the investment, the investor and the contractual partner are in a bilateral bargaining situation in which the partner can now extract a much bigger portion of the return from the investment.

Quite independently of how big the investment effect is, hold-up will therefore always mean that the investing party does not get fair share of the return from the investment based on what would have been obtained ex-ante under normal competitive conditions. In this sense the final price of the transaction is excessive.

2.1.1. SEPs and Hold-Up

In the context of SEP licensing, the relevant commitment is not necessarily an investment but the commitment to a specific technology included in the standard. “Hold-up” then refers to the fact that a specific patent-holder’s market power increases once his technology or design has been locked into the completed standard. Before the competition there might have been different technological solutions for the same problem leading to an ex-ante low royalty. But after the commitment to the standard, the holder of the SEP for the chosen technology has a monopoly and has incentives to negotiate higher royalties than he could under ex-ante contracting. Hold-up simply refers to a difference between the patent-holders’ pricing incentives *ex ante*, namely before the standard is set, and their pricing incentives *ex post*, i.e. after the standard is set.

This version of “hold-up”⁶ does not require that implementers have undertaken standard-specific investment before the completion of the standard and the licensing of the corresponding SEPs. The damage from this form of “hold-up” comes excessive royalties relative to the ex-ante benchmark. These price increases are likely to be partially passed through into higher prices for the devices bought by consumers. Since the ex post increase in the market power of SEPs is not the direct result of “competition on the merits”, which ex-ante competition would be, competition authorities have found this distortion problematic on the basis of competition analysis. Note, however, that in this setting hold-up does not always occur. If even in the hypothetical ex-ante world there had been no competition between technological solutions, the commitment to using the technology in the standard does not generate any additional market power due to standardization. In that specific case there is no excessive pricing problem or hold-up.⁷

6 As this version of the argument does not rely on any investment made by users, any related inefficiency cannot possibly proceed from “hold-up” *stricto sensu*.

7 For the avoidance of doubt, please note that this does not imply in any way that there can be no hold-up associated with legacy technology because there would no longer be competition in this respect. Indeed,

In some industries, the problems arising from the lack of ex ante commitment to royalty rates may, however, be made worse because potential implementers feel the need to invest significantly into their products well before the standard is actually chosen or before it is known whether a technology will violate an existing patent.⁸ This may occur well before SEPs are licensed. In such a case there is the additional potential welfare loss due to the effect on (early) investments by potential implementers, that we explained discussing the basic hold-up problem. Clearly such a situation is more likely to occur in fast-moving industries where device makers are eager to be first to market. The problem of this type of hold-up may often not be that investments do not take place at all, but that they are delayed.

2.1.2. Is Hold-up Widespread?

While our discussion so far has shown that idea of hold-up has a firm theoretical foundation, the question is whether this is simply a theoretical possibility or Hold-up is a very robust economic mechanism. After all, if a firm finds itself in a situation with increased bargaining power, why wouldn't it exploit it? However, the actual prevalence of hold-up and the magnitude of the implied loss of welfare are two rather vexing questions.

While there is, in our opinion, no reliable empirical analysis of hold-up within SSO-based standardisation processes, there are excellent studies of hold-up in a large variety of industries from coal to aluminium or natural gas⁹. All of these studies rely on a similar approach: they check whether strategies and organisational forms that help solve the hold-up problem arise readily in situations where the basic ingredients for hold-up are present. So, for example, Paul Joskow (1987)¹⁰ looks at the contracts between coal suppliers and electricity plants and finds that contracts are longer in situations where higher relationship-specific investments are required. In a similar vein, von Hirschhausen and Neumann (2008)¹¹ analyse the duration of natural gas contracts and show that the contract length increases with the required relationship-specific investment and decreases as international gas markets become more competitive. Indirect evidence for the hold-up problem has also been generated from studies of changes in asset ownership. Hold-up theory suggests that agents making specific investments into an asset should own it to avoid the hold-up problem. Modern theories of the firm have this as a central theme (see Hart and Moore 19??). Baker and Hubbard (2004) have shown that the introduction of on board computers, which

legacy technology is relevant if it was part to an initial standard which becomes entrenched because of upward compatibility issues. Taking into account the ex-ante competition for the initial standard, the possibility of hold-up is still relevant – and hence FRAND commitments are still pertinent – for as long as the technology is needed as part of subsequent upgrades.

⁸ Even if the standard is not yet known, implementers might begin investing in developing features of their products, the value of which depend on the success of a standard. For example, the mere knowledge that a better telecommunication standard is on its way would lead mobile-phone makers to invest in including new features such as a better camera into their devices.

⁹ See P.G. Klein, 2005, "The Make or Buy Decisions: Lessons from Empirical Studies", in C. Ménard and M.M. Sirley (Eds.), *Handbook of New Institutional Economics*, Springer, Ch. 17, pp. 435 – 464.

¹⁰ P.L. Joskow, 1987, Contract Duration and Relationship-Specific Investments. Empirical Evidence from Coal Markets", *American Economic Review*, 77:1, pp. 168 – 185.

¹¹ C. von Hirschhausen and A. Neumann, 2008, "Long Term Contracts and Asset-Specificity Revisited: An Empirical Analysis of Producer-Importer Relations in the natural Gas Industry". *Review of Industrial Organization*, 32, pp. 131 – 143.

made the actions of truck drivers contractible, reduced the share of driver owned trucks in the US as theory would predict when hold-up problems are important.

All of this evidence is indirect. It shows that the contract and ownership choices correspond closely to what we would expect if hold-up were an important feature of incentives. Unfortunately, these studies give us little idea of the likely magnitude of the cost of un-remedied hold-up. But that type of estimate is virtually impossible to obtain. It would require the comparison of a market with un-remedied hold-up with another market with remedied hold-up that is otherwise identical. The problem is that in markets in which there is an effective remedy we will not see un-remedied hold-up while in markets where there is no remedy available, a comparison is also not possible.

Indeed, the indirect empirical evidence that we have cited could lead at first sight to the conclusion that hold-up does not really matter: precisely because hold-up relies on the observation of *solutions* to the hold-up problem, the literature can be read as saying that hold-up is readily dealt with through a set of contractual and organisational solutions.

We do not think that this would be a correct conclusion to draw from the literature.

First, the formal empirical literature - supported by a large number of case studies - shows quite unambiguously that, in the absence of contractual or organisational solutions, hold-up would be a significant issue.

Second, it is generally hard to write complete contracts about innovations, since it is hard to write down an ex-ante contract about a solution that still has to be found. If we would ever expect un-remedied hold-up to occur, this would concern investment and exploitation of intellectual property rights.

Third, the usual solutions to the hold-up problem are further made difficult by the current SSO process. There is essentially no attempt to force participants to sign reasonably complete contractual agreements at the beginning of the process. Very few SSOs require participants to make explicit commitments on the prices and conditions at which their IPRs would be made available to implementers. Traditional contractual solutions to potential hold-up are therefore not used. Common "organisational" solutions such as the formation of joint ventures or vertical integration between IP-owners and implementers are also not used in the SSO-based standardisation process. As we discuss later, when we talk about transactions costs of standardization processes, these features of the standardization process may have good economic reasons that make some contractual incompleteness unavoidable.

Fourth, in some sectors like ICT, recent technological evolution has destabilised some of the mechanisms that might have greatly reduced the hold-up problem in the past. In particular, the emergence of new actors such as computer-oriented companies and non-practicing entities has decreased the degree of vertical integration between SEP-owners and implementers and has disrupted a culture of repeated collaboration between more traditional SSO participants.

Our own assessment on the basis of these observations is that, if left unchecked, hold-up, in the sense defined, is an issue in the context of SEPs. Moreover, as recent changes have weakened some of the mechanisms that have likely limited opportunistic behaviour by SEP-holders in the past, renewed attention to hold-up minimising regulatory mechanisms seems warranted. It is therefore important to contemplate policy measures aimed at reducing hold-up and its negative impact on

prices and, possibly, investments. However, we should also expect the relevance of hold-up to vary considerably across industries. Intense competition between users to be first to market, complex, uncertain and fast-moving technologies and the emergence of new, non-integrated players are all factors that would magnify concerns about hold-up related costs.

2.1.3. Patent Ambush

Patent ambush is a specific form of the hold-up problem, where firms commit to a standard or an investment only because the owner of a patent, or more importantly a patent application, deceived the firms into believing that the relevant technology was not covered by any patent or was available at favourable terms. There is thus patent ambush when a patent holder reveals an undeclared standard essential patent or standard essential patent application only after the standard has been set or when a perceived commitment to licensing the technology on some specified terms is arbitrarily withdrawn¹².

A patent ambush, namely deceiving other members of the SSO that a technology is not patent protected or is available at better terms than the patent holder is planning to charge, may lead SSOs and potential implementers to make technological choices and investments that increase the market power of the ambushing party and that they might not have been taken without the deception. The best known form of standard-related patent ambush occurs when the patents declared by SSO members must also come with a FRAND commitment. If the required declaration relates to explicitly identified patents ("specific declaration"), then wilfully omitting some standard-relevant patents from the declaration makes it in principle possible to demand royalty payments which are not FRAND constrained if the chosen standard ends up infringing the hidden SEP.

However, there can also be more subtle forms of ambush. Assume for example that SEPs held by SSO members are subject to FRAND commitments regardless of whether they are explicitly declared or not. If the SSO is unaware of the patent's existence, it might choose the patented technology rather than a marginally inferior unpatented technology even though, given full knowledge of the available options, the economically efficient solution would have been to go with the freely accessible technology.

It is important to distinguish between an ambush by patent-holders who take part in the SSO's efforts and the behaviour of patent holders who choose to remain outside of this process and are therefore not constrained by SSO rules including FRAND licensing terms. We refer to the first situation as "internal" ambush and to the second as "external" ambush. As we will document in more detail in sections 6 and 7, participants in the standardisation process do not feel that patent ambush is a significant issue within SSOs. In contrast, there appears to be a dominant impression that the antitrust-based fear of being accused of a "patent ambush" is one of the reasons why participants in the SSO tend over-declare potentially essential IPRs. By contrast, the fear of an ambush by "outsiders" is real. This would not be an issue if SSO members were aware of the patents held by outsiders. In that case they can

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*See, for instance, Case COMP/C-3/38.636—Rambus, Common Decision (Dec. 9, 2009); Rambus, Inc. v. Infineon Techs. AG, 318 F.3d 1081 (Fed. Cir. 2003); Rambus, Inc., FTC Docket No. 9302, 2006 WL 2330117, at *53 (Aug. 2, 2006), rev'd, 522 F.3d 456 (D.C. Cir. 2008).*

decide whether to choose a technical solution that might infringe these patents, leaving implementers exposed to high royalty demands, or to look for another approach which is either unpatented or depends on patents for which FRAND commitments were made. However, it is very hard for members of an SSO to find out at reasonable cost whether a chosen solution would infringe on some patent. There is therefore considerable fear that the chosen standard might *inadvertently* infringe on unknown patents held by outsiders.

The fear of ambush by outsiders is one of the main reasons why policy-makers must be concerned that any reform package does not significantly reduce likely patent-holders' incentives to participate in the standard-setting effort. Not only would such decreased involvement decrease the expertise available within the SSO but it would also increase the likelihood of hold-up through an "external" patent ambush, which might more often lead to royalty payments that would exceed FRAND rates.

2.2. Royalty-stacking

2.2.1. General Principle

Royalty-stacking refers to the excessive total royalty that licensees might have to pay when the rights to which they need access are owned by different, independent agents. The root cause of royalty staking is complementarity: when complementary goods are sold by separate profit-maximising entities, the total price charged will be higher than if all products were sold by the same firm. This is true whether the "products" are goods and services or whether they are IPRs.

The intuition behind this result is simple. Assume that there are two products A and B, which are complements. If they are sold by two independent firms, each of the firms will ignore the fact that they would *increase* the demand for the other product by lowering their price. However, if both products are owned by the same firm, that firm would recognize that it benefits from a lower price on product A through greater sales of product B. If both products are sold by the same firm, the incentives to raise prices are therefore smaller, that this firm will set lower prices than two independent firms. This is the so called "Cournot Effect".¹³

A direct consequence of this analysis is that the price levels will be lowest when all complementary products are sold by a single firm. Since total profits are maximised under monopoly, it follows that any less concentrated market structure leads not only to higher prices but also to lower total industry profits. In other words, dispersed firms end up charging prices that are too high from the viewpoint of their collective interest and from the point of view of the customer. Patent holders and patent implementers should therefore have the same views on "royalty stacking" and should therefore willingly subscribe to policy changes aimed at minimising the issue, provided that they are not too onerous in terms of other transaction costs.

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Note that the opposite is true with substitutes. When a firm lowers the price of its good A the firm producing substitute product B will face reduced sales and be hurt by the price reduction. If both products are sold by the same firm, then this firm will recognize that a price reduction partly have the impact of just stealing sales from its other product. The incentives to reduce prices are therefore lower for a single firm selling both substitute products than for two firms selling them independently. For this reasons mergers between substitute products are generally scrutinized carefully for anticompetitive effects while mergers between complementary products are seen as having a high likelihood of being favorable for consumers.

The Cournot effect is of particular relevance in technology complex industries, where access to a large number of different technologies is required in order to produce a final product. If a firm needs access to ten technologies, the total royalty that it will have to pay will be higher if each technology is controlled by a different patent-owner than if they all belong to a single player. So “royalty-stacking” should be expected to be prevalent in complex industries, regardless of whether or not standardisation is involved.

2.2.2. Additional Considerations for the role of royalty stacking with SEPs

While technology licensing outside of standard setting can raise royalty-stacking concerns, the impact of royalty-stacking tends to be magnified by the standardisation process. This arises from the interaction of the royalty stacking problem with the hold-up problem that can arise from the commitment to the standard. In the absence of a standard, it is likely that some of the needs of the manufacturer might be satisfied by more than one technology, i.e. there may be competition between substitute technologies within each of the different technological “categories” that the end user needs to produce the product. But the more competition there is for the use of a specific patent in a product, the lower the market power that a patent holder can exercise. But if a patent does not enjoy market power, it cannot contribute to the royalty stacking problem. So competition between different technological solutions puts downward pressure on royalty rates, reducing – or even eliminating – any upward pressure due to the complementarity across complementary technological categories. But once a standard has been agreed upon, the technological freedom of the user is reduced and it is likely that several aspects of the standard can only be implemented by accessing a very specific technology for which there are no substitutes. In this context, royalty-stacking applies with full force. This means that royalty stacking will be a much more important problem for SEPs than for other patents as long as the hold-up problem is relevant for the industry in question.

Note that there are two sources of complementarities that can give rise to royalty-stacking in SEP licensing: the complementarity between SEPs reading on different aspects of a specific standard and the complementarity between SEPs reading on different standards which must all be implemented within a given device. In that sense, the dispersion of SEP ownership for a given standard will tend to underestimate the magnitude of the potential stacking problem faced by implementers. What matters is the dispersion of the ownership of all of the SEPs to which access must be obtained in order to produce a device that complies with the standards which are themselves essential to the commercial success of a device.

To get a feel for the order of magnitude of the “royalty stacking” problem one can compute the percentage increase in the total price of obtaining a set of perfect complements as the market structure becomes more dispersed relative to all complementary patents being owned by the same firm. In a simple linear demand with zero costs With 5 owners of the patents royalties are increased by 66.7%. With 20 owners, royalties would be increased by 90.5% relative to monopoly ownership of the patents. In the example with linear demand the maximal royalty increase that can be obtained by maximal dispersion of patents (namely an arbitrarily large number of

owners) is 100%.¹⁴ There are two main observations. First, the bulk of the price increase due to stacking occurs as one moves from a single seller to just a few. Indeed, for the special case of linear demands, the percentage increase in prices due to increasing dispersion of the upstream industry is the same whether the downstream market is perfectly competitive or monopolised. Secondly, royalty-stacking is of a similar order of magnitude, whatever the downstream market structure is. In fact, in our special example with linear demand, the percentage increase in prices is the same.

The first observation is particularly important since it means that “solving” the royalty stacking issue by reducing the number of patents granted by the PTOs or by reducing the proportion of such patents which are judged to be essential to a standard is not realistic. Nor does it appear realistic that one could reduce the number of distinct patent owners so much that the problem is small.

2.2.3. How Relevant an Issue?

While from a theoretical point of view we have shown that the royalty stacking problem should be expected to be considerable in the absence of mechanisms to limit the market power of SEP holders, one should still consider whether this theoretically robust prediction is also valid from an empirical point of view: “Is there royalty stacking?” and “How large is the impact of royalty stacking on the total price of accessing a bundle of standard essential technologies in particular industries?”. Unfortunately, the relevant empirical literature is rather thin due to the general *methodological* difficulties of identifying royalty stacking on the basis of market data.

Ideally one would observe the change in royalty rates that occur after the ownership of diffusely held patents was consolidated. We do not know of any study that has been able to exploit such an event to study the theoretical predictions about royalty stacking for patents. This has a good reason. Estimating the direct effect of thickets on the total royalty paid by downstream developers is simply not even possible.¹⁵ There are therefore only indirect ways to assess how important the problem is empirically: First, one can sometimes study the impact on pricing of the consolidation of complementary assets in other markets. Second, to determine the likelihood of important royalty stacking problems from existing studies on the dispersion of ownership of complementary patents, industry participants and the observed licensing process.

The impact of ownership consolidation between complementary assets has been studied in the economic literature for some markets, in particular by Slade (1998, *Economic Journal*¹⁶) for the beer industry. She exploited regulatory intervention that forced the divestiture of pubs in the UK by their former owners, the brewers. In the literature on vertically related markets the royalty stacking problem is known as the double marginalization problem: the pub would mark up on the price at which it buys the beer from brewer without taking into consideration that this reduces the sales for the brewers. Consequently beer prices to pub customers should go up when brewers are forced to divest pubs. This is precisely what Slade observed in the UK data. This

14 See Annex 1.

15 On this point, see Gandal and Régibeau (2015).

16 Slade, M.E., 1998, “Beer and the Tie: Did Divestiture of Brewer-owned Public Houses Lead to Higher Beer Prices”, *Economic Journal*, 108:448, pp. 565 – 602.

means that we have some solid evidence that the complements problem has real effects on prices in some settings.

Since for SEP ownership such a nice policy experiment is not available to assess the importance of royalty stacking, it appears reasonable to start by looking at the preconditions for royalty stacking to arise in theory and then study whether the presence of the theoretical conditions for royalty stacking lead to other decisions that one would expect if royalty stacking mattered.

As a first step, one can study the prevalence of complementary patents in different industries, which is sometimes referred to as the existence of "Patent thickets". This has been done by Von Graevenitz et al (2013)¹⁷ find significant thicket presence in nine out of thirty technology areas. As their measure of "thickets" refers to the number of patents required by an implementer *which are owned by different entities*, it already captures the most relevant aspect of the fragmentation of ownership, which we have identified as crucial for royalty stacking. However, these authors augment their analysis of patent thickets with a measure of "fragmentation" based on an index of the dispersion of patent-ownership *for the relevant prior art*. Overall, the authors find that thickets most common (and influence patenting behaviour) in sectors such as audio-visual technology, telecommunications, information technology, semi-conductors and optics.

However, the mere existence of ownership fragmentation is not in itself of great interest to the analysis of SSOs since, by their very nature, SSOs do inevitably *lead to* a large number of patents around the standards that they develop, which will be dispersed among its members because knowledge is pooled in standard setting. The vast majority of standards involve IPRs are therefore held by more than a couple of companies. It is therefore almost a given that the theoretical preconditions for royalty stacking are fulfilled. What we would like to know, then is whether we can see *effects* of ownership dispersion among patent holders that would indicate that firms do have the incentives that lead to royalty stacking. For example, Ziedonis (2004)¹⁸ asks whether – and how – the presence of patent thickets has affected patenting behaviour. She finds that, the effect of increased patent ownership dispersion on patenting is five times higher for capital-intensive firms –which are more likely to be involved in technology complex markets, providing strong evidence that "thickets matter"¹⁹.

Finally, recent litigation experience suggests that on the other hand, there is simply no direct, rigorous, evidence that thickets do actually lead to higher total royalties.

Outside of the academic literature, there seems to be some contradictory evidence that comes out of the recent litigation experience. On one hand this experience suggests high stacks because the level of royalties demanded by some SEP owners would imply very large total royalties for a single standard if these royalties were applied proportionally to all declared SEPs.²⁰ On the other hand, information about

17 Von Graevenitz, G., S. Wagner and D. Harhoff, 2013, "Incidence and Growth of Patent Thickets – The Impact of Technological Opportunities and Complexity", *Journal of Industrial Economics*, 61:3, pp. 521 – 563.

18 Ziedonis, R.H., 2004, "Don't Fence Me In: Fragmented markets for Technology and the Patent Acquisition Strategies of Firms", *Management Science*, 50, pp. 804 – 820.

19 See also Noel and Schankerman (2013) for another take on the effect of thickets on patenting and innovation behaviour. These authors also find a significant effect.

20 We have ourselves seen demands that – if applied proportionally across all SEPs – would have generated a stack higher than 30% of the price of a smartphone for only two mobile standards.

actual payments suggests that the stack is in fact rather limited because these are far lower.²¹ To us, this indicates that it is still too early to get reliable estimates on the extent of likely royalty stacking: there is still so much on-going litigation and – possibly – sufficient licensee “hold-out” (see below) that current *actual* payments are likely underestimate what the total stack will effectively be once litigation is concluded. What actually matters for the distortions created and for the attractiveness of new players entering the development of IoT solutions, is the final royalty stack that these market participants *expect* to face after litigation is settled. This may not be small even with the current experience.

Our own evaluation is that on balance patent ownership dispersion and thus royalty stacking matters and should therefore be taken seriously when discussing SEP licensing rules. We base our opinion on four main considerations. Firstly, the economic mechanism that generates royalty stacking is extremely robust and – as we have seen – has substantial effect even with relatively little ownership dispersion. There are no good reasons why profit-maximising firms would not behave according to the prediction of such robust theory. Secondly, thickets are likely to have a larger effects when they are associated with standards because the licensors are no longer constrained by potential competition from substitutes IPRs. In other words, we are more likely to face “true complements” when standards are involved. Thirdly, there is carefully established evidence that thickets can have a large effect on other dimensions of firms’ behaviour. Why then it not have a material effect on their *royalty setting*? Finally, failure to find direct evidence of the effect of ownership dispersion of patents on prices/royalties does not mean that such effects do not exist. In particular if, as we have seen, the most significant effect arises when one moves from one sole patent-holder to a few independent patent-holders, then one would expect the complementarity effect to inflate total royalties in almost every possible industry. This makes it hard to identify the effect of ownership dispersion by comparing industries with high dispersion and low dispersion.

2.3. “Reverse” Hold-Up and Hold-out

2.3.1. “Reverse” Hold-up

It is sometimes claimed that competition authorities have focussed too much on the potential hold-up faced by the implementers of the standard and not enough on the hold-up situation in which SEP holders find themselves. After all, at the stage where licensing contracts are negotiated, SEP owners have already sunk the investment required to obtain the technology, and have also sunk the time and effort on jointly designing a coherent standard. Moreover, some of these investments have little value outside of the implementation of the standard. This is clearly true for the resources invested in the SSO process itself but, in some fields, it is also true of the initial investment in R&D (or at least a material share of it) as the type of innovation that is useful for standard-setting might not have any useful stand-alone application outside of the standard-setting process. For example, investors know from the start that

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See for example K. Mallinson, “On Cumulative Mobile SEP Royalties”, August, 19th, 2015, at <http://www.wisearbor.com/pdfs/Mallinson%20on%20cumulative%20mobile%20SEP%20royalties%20for%20IP%20Finance%202015Aug19.pdf>. The author finds a total stack of less than 5% for all mobile-related standards.

researching some aspects of communication between mobile devices is of little value if does not lead to the adoption of a related standard. Just as SEP-holders often do not commit to specific licensing terms before the SSO process begins, it is just as rare that potential users agree on licensing terms with the innovator before the innovator invests in research. On the face of it, it might therefore seem that companies that invest in the type of innovation that is used in the standard-setting process are subject to at least as severe a hold-up as potential implementers of the standard.

Such a conclusion would, however, ignore a crucial difference between the situation of SEP-holders and potential implementers. By the time licensing agreements are discussed, SEP-holders are no longer exposed to competition from other IPR-owners, while implementers have to worry about competition in the downstream market for devices. This always shifts the bargaining power to the SEP-holder and therefore mitigates the hold-up problem for the SEP holder and makes it larger for the implementer.

To see this effect, consider the royalty bargaining between an SEP holder and an implementer for a given SEP portfolio. If there were only one implementer, it could simply refuse to accept a very high royalty demand exaggerated offer because without its implementation the SEP holder would not be able to obtain royalties. Both sides have significant bargaining power and will split the surplus from the availability of the SEP. But now suppose the same high royalty demand was made when there are ten implementers who use the SEP for producing a device that they all compete with in the downstream device market. The potential implementers could of course also refuse to license the SEP. If all other implementers behave in this fashion, then the SEP owner would have to relent and lower the royalties. However, even at high royalties, there is a strong incentive for an individual implementers to deviate from this common posture and accept the initial terms. By doing so, the implementers ensures that she is first to market and enjoys monopoly rents for at least a certain time. This incentive to deviate is stronger the stronger downstream competition is and the more important it is to be first to market. Such incentives therefore mean that SEP-holders can essentially negate the hold-up problem that they face by “playing adopters against each other”.

2.3.2. Hold-out

The term “Hold-out” refers to a situation where an implementer of a standard simply refuses to pay royalties to SEP owners until forced to do so by a Court. In practice, hold-out is rarely as “naked” as blanket refusal. Instead, it takes the form of endless litigation and appeals, demands for negotiating each SEP separately and similar practices.

There are three common concerns about the effects of hold-out strategies. The first one is that hold-out leads to lower incentives for firms to invest in standard related innovations. The second is that it increases litigation costs and the third is that it may lead to an unfair competitive advantage of implementers engaged in hold-out over implementers who license the IPRs from SEP holders. We discuss the degree to which these three issues are of significant relevance in turn.

The first concern is that SEP-holders are prevented by hold-out strategies from obtaining a market return from their investment in innovation. Anticipating such difficulties firms would be less likely to invest in standard-oriented innovations.

Economically this argument is not generally valid. As long as any failure to come to a negotiated agreement eventually ends with a court determination of a royalty rate and a court order to pay the owed royalties including back interest, the innovator will get paid. In that sense, delay in itself does not lead to reduced incentives to invest. Delayed payment can only matter for the innovator when there are financial market imperfections that increase the costs of financing investment when the royalty income stream is reduced. For financially constrained entities, the failure to collect royalties promptly may have the effect of preventing further research because the costs of financing increase with lower cash flows.²² Note that generally this will only be the case in a minority of cases since, in contentious industries such as some ICT fields at least, most of the SEPs are held by large firms which are not cash constrained in a way that prevents the relevant investments. Moreover, patents are (increasingly) highly liquid assets so that a small SEP-holder can easily monetise disputed SEPs by selling the rights to a larger SEP-holder or some form of patent intermediary.

A further issue may be that with sufficient delay the implementer may not be able to pay past royalties and interest out of the available funds. In this case the firm could escape owed royalties by going into bankruptcy. Such behaviour is addressed in US law by allowing injunctions at an early stage if there may be irreparable harm to the licensor, which would be the case if there is a significant probability of bankruptcy. Similarly, in any judicial system where the licensee is required to put royalty payments into an interest-bearing escrow account until a final Court decision or settlement is reached, there issue of eventual non-payment cannot arise. The same is true a fortiori in systems in which injunctions can be enforced before a Court decision on the substance of royalty rates has been reached. In these cases there would not be any feedback effect on innovation incentives since the appropriate payments will be made eventually.²³

The second problem potentially associated with hold-out is that it increases litigation costs for all parties if litigation costs are expected to increase with the length of delay to an agreement. As a cost required to collect the rewards of R&D, litigation costs act as a "tax" that decreases the incentives for standard-related innovation. In 2010, the WIPO reported average patent litigation costs in the US to be between 2.6M EUR and 8.8M EUR²⁴. However, this problem appears to be of little importance for innovators with large patent portfolios and implementers who use large numbers of patents. Typically litigation is only on a small subset of patents, so that litigation costs can be spread over a large number of patents making the cost relative to the overall portfolio a relative small distortion.

A third concern about hold-out, is that an implementer who is holding out, gains a competitive advantage over other implementers who have decided to pay the required fees. Clearly this argument can only hold if the royalty payments are dependent on the output of the licensee, i.e. if they affect variable costs. If a royalty were independent on output, it would not affect the output or pricing strategies of the implementer. However, many royalty schemes are set as percentage of price so that

22 See, for example, Himmelberg, C.P and B. Peterson, 1994, "R&D and Internal Finance: A Panel data Study of Small Firms in High-Tech Industries", *Review of Economics and Statistics*, 76:1, pp. 38 – 51.

23 Note that this solution does not address the issue of financial constraints on the side of the SEP owner since it is very unlikely that a bank would accept the escrow account as collateral for a loan.

24 Patent Litigation Costs, WIPO, available at http://www.wipo.int/export/sites/www/wipo_magazine/en/pdf/2010/wipo_pub_121_2010_01.pdf

they would fit this criterion. Nevertheless, this concern is generally not valid. **A licensee who decides to hold-out should consider that each additional unit of the downstream device sold will generate higher royalty payments in the future, when the payments are eventually imposed by a court. The holding out implementer should therefore behave as if it was already paying the fees that will eventually come due.**

There are nevertheless specific circumstances under which this conclusion does not hold, which closely mirror those of the SEP holder. First, if implementers are financially constrained the delay in royalty payments will lower the cost of raising capital and therefore investment costs. This could give a financially constrained firm a competitive advantage. Nevertheless this effect might actually be welfare enhancing. Second, if the implementer believes that there is a significant probability of going bankrupt, it would face lower variable costs and a competitive distortion would arise. However, any court system that requires payment into an escrow account until the court decision is made would prevent such distortion. Third, the implementer may simply be acting with an economically short horizon, which might arise for behavioural reasons or because incentive systems within the firm over emphasize short run performance. In this case the perceived variable cost would again be lower and lead to a competitive distortion. But again a system in which royalties have to be paid into an escrow account will remedy this situation. (In fact, if the royalty rate is too high, this might even induce a competitive disadvantage.)

Overall then, one would expect hold-out to only be a significant issue for SEP-holders with small portfolios (so that litigation fees cannot be spread across a large number of patents) and limited resources (i.e. facing financial constraints to finance further innovation) and where implementers are financially weak so that bankruptcy is a real possibility. Nevertheless most of these issues are mitigated by legal rules in many jurisdictions.

Another question is, of course, whether hold-out is a real problem in the sense of occurring to a significant extent. Do a significant number of licensees systematically rely on delaying tactics? This question is very hard to answer because what is perceived by one's party's as "delay" is interpreted by another party as resisting royalties that exceed FRAND rates. For this reason we are not aware of any empirical study on this issue. However, there is some anecdotal evidence that there are possibly some implementers who may be pursuing a hold-out strategy. For example, the fact that a firm like Apple has so far paid rather little to SEP-holders on mobile standards suggests that hold-out may be a real phenomenon. However, given the financial position of Apple and the main SEP-holders there is also the question whether there are serious effects associated with this observation.

2.4. Choice of Standard

While the issues concerning the payment for IPRs in the context of SSOs are of great importance, it needs to be kept in mind that the main task of a SSO remains to come up with a standard that addresses the needs of the industry in the most efficient possible way. The technical quality of standards is rarely in doubt. The emphasis on engineering objectives of obtaining the best possible solution makes one expect that this would not be an issue. Unsurprisingly this is reflected in the economic literature.

Rysman and Simcoe (2008)²⁵ examine the citations received by SEPs, comparing these SEPs to a control group of patents from similar technology classes that were not used or disclosed within the SSO. Rysman and Simcoe find that the citation rate for SSO patents is about double that of non-SSO patents. This difference can of course come from two very different effects. On the one hand, it is natural to believe that being part of a standard would increase the visibility and importance of a given technology and would hence lead to more citations for the patents reading on it. On the other hand, since much effort is presumably expended to choose the best possible technologies for the standard, there might also be a *selection* effect, i.e. the patents covering the technologies which end up being included in the standard should already have been recognised as superior – and hence cited more – before the SSO process began. Comparing the citation profiles of SEPs and the control group both before and after the standard is set, the authors conclude that about one fourth of the difference in citations is due to the selection effect. This suggests that SSOs do indeed settle on technologies that are significantly better than average. We will therefore ignore questions of technical efficiencies.

However, *economic* efficiency is not guaranteed by best in breed technology. From the point of view of society as a whole, the best standard is not always the most technologically satisfying one. Instead it is the solution that strikes the best trade-off between performance and costs. In order to consider this trade-off the parties who choose the standard must have sufficient information as to which technologies are patented and which ones are not. They also need to have a good idea of the terms and conditions at which patented technologies would be made available to the implementers of the standard. As we will see below, policies relating to declarations, FRAND commitments and ex ante commitment to maximum royalties all have implications for efficient technology choice. Notice, however that, in order to be influenced by the “economic” dimension of standard choice, the personnel working on the standard must have access about information on existing patents and likely royalty rates. Currently, a number of SSOs make this impossible by requiring that patents and royalties cannot be discussed within the committees that look for technical solutions.

2.5. Transaction costs and uncertainty

SEP licensing can involve significant costs. These costs can be assigned to four broad categories. Firstly there are the costs of identifying the patents which are likely to be infringed by firms that wish to implement the relevant standard. These costs are typically borne by the SEP holders since they have the responsibility of choosing the patents that are declared standard-essential. Secondly, there is the cost to each party of assessing more precisely which patents might actually be relevant to the specific implementation of the standard in the licensee’s devices and the cost of assessing the likely validity of these patents. As these costs are specific to a unique bilateral negotiation between the SEP-owner and one potential licensee, they tend to be shared by the two parties. Thirdly, there are the costs of bargaining and the costs of writing the agreement reached as unambiguously as possible. Finally, if agreement cannot be

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Rysman, M. and T. Simcoe, 2008, “Patents and the Performance of Voluntary Standard-Setting Organizations”, *Management Science*, 54:11, pp. 1920 – 1934.

reached, there is the additional cost of conflict resolution, be it through arbitration or litigation.

Importantly the last three categories of costs apply equally to the licensing of any patents, not just SEPs. Indeed, the second type of cost is likely to be less important in the case of SEPs. This is because, with SEPs, the number of technological options available to a firm wishing to implement the standard is fairly small. Checking which of these options was chosen and whether they indeed infringe a specific patent is therefore relatively easy. By contrast, with a standard patent, the number of ways of “inventing around” the protected technology is potentially unlimited making it in principle harder to establish that the patent has been infringed. Since the focus of this report is on improving the SSO-based standardisation process, we will not consider any policies aimed at making technology licensing more efficient in general. However, standard-related licensing often differs in two important respects: the number of patents involved and the number of parties interested in getting access to the same set of patents. While this does not change the *nature* of the transaction costs involved, it creates greater opportunities for cost-saving measures. For example, the fact that a number of implementers need access to a similar set of patents means that substantial savings can be realised by avoiding duplication of effort in identifying the relevant patents and assessing their essential character. Furthermore, all implementers need access to the SEPs for the same reason, i.e. to practice the standard. This means that, even though there can be some individual variations, the essential character of patents can be mostly judged with respect to the standard itself, without systematic reference to the individual technical choices of each implementer. This creates scope for economies of scale in the assessment of patent essentiality. It is this type of SEP-specific opportunities for reducing transaction costs that we will concentrate on.

As we will see later, obtaining precise estimates of transaction costs is difficult. However, there can be no doubt that those costs are substantial so that any policy that could significantly reduce them would be of undisputable practical relevance. To fix ideas, it is generally agreed that evaluating the essential character of a single patent family costs anywhere between 1,000 Euros (for a quick internal evaluation) and 10,000 Euros (for a thorough evaluation from an external expert).

Besides direct transaction costs, the licensing process can also impose costs linked to its uncertainty. For example, a firm would understandably be reluctant to carry significant investments to develop and market a new product and service before being assured that it has acquired all relevant IPRs and can therefore properly assess the economics of the whole project. In this perspective, policies that help reduce uncertainty in SEP licensing should also be considered as they might well have significant benefits in terms of planning and investment.

2.6. Licensing practices

Licensing agreements can be quite complex. They can involve a few patents or large portfolios, be for a fee-based cross-license or involve convoluted royalty schemes. The parties must also agree on a royalty basis, a contract term and the scope of application of the licenses. Furthermore, additional clauses like no-challenge clauses or grant-back clauses might be considered.

A thorough review of the legal rules governing patent licensing is beyond the scope of this report. We are only interested in licensing practices that seem to have some particular relevance to the licensing of standard essential patents. This includes the possible bundling of SEPs with non-essential patents and the rules governing the transfer of FRAND obligations when SEPs change hands as well as the type of conflict resolution procedures that might be most appropriate when dealing with FRAND-encumbered patents. We will also briefly discuss two issues that have figured prominently in the on-going debate on SEP licensing: the appropriate royalty “base” and the appropriate vertical “level” of licensing.

2.7. Internet of things

Broadly speaking, the internet of things refers to a world where most devices – from household appliances to cars or machine tools – would be connected to the internet and would be able to communicate and interact without direct human intervention. Digital communication on such a grand scale must inevitably rely on a number of standards. It is therefore a particularly opportune time to investigate whether some relatively simple policies might help this crucial standardisation exercise to run smoothly and avoid the disputes and controversies that have recently marred standard-setting in some parts of the ICT sector.

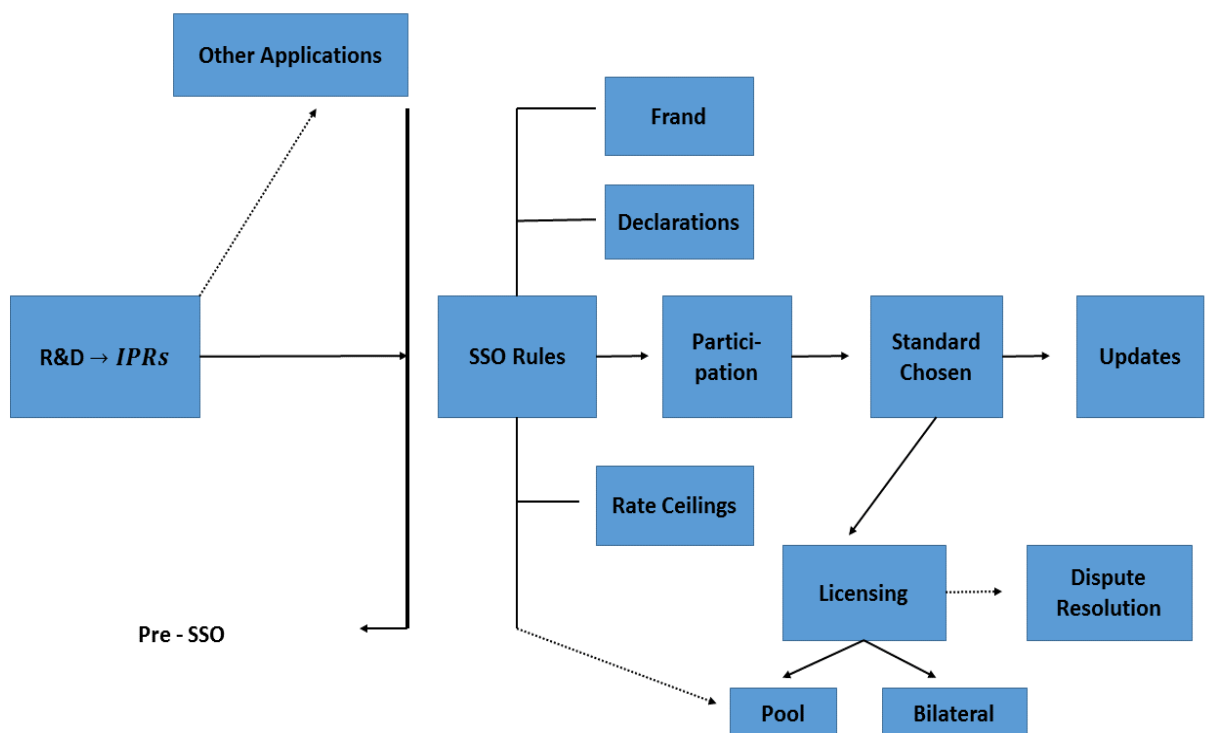
The rise of the internet of things also raises another concern. In standard-intensive industries such as ICT, most patent-holders and standard implementers have substantial experience with the standard-setting process and the related SEP licensing. Even companies that have come from the “computer” side of things have by now become rather familiar with the benefits and pitfalls of SSOs. However, the internet of thing will greatly extend the number of sectors that will have to participate in the determination of standards or, at least, obtain the relevant licensing rights to implement the required standards. In many sectors, this will be a new experience. Ensuring that the standard-setting and SEP licensing procedures are simple, transparent, economical and are perceived to be fair is therefore even more crucial than in the recent past.

3. Mapping issues into solutions: where might policy intervention be most effective?

Having identified the main issues raised by the SSO-based standardisation process, we turn to the type of instruments that policy-makers might use in order to address these problems. Our goal in this section is to develop a broad “map” matching specific instruments to specific issues and to briefly explain the economic reasoning behind this matching. A more detailed analysis of policy instruments, including the stakeholders’ reaction to specific policy proposals will be presented in the following sections.

Figure 1 shows a schematic representation designed to help the reader keep in mind how various types of SSO rules must be chosen when, as well as what the main decisions of stakeholders (participation, standard designs, licensing...) are at different points in time.

Figure 1: Time-Line of SSO Rules and Decisions



Our overall “road map” is described in Table 2.

Table 2: “Mapping” of Policies into Economic Issues

	Royalty Stacking	Hold- up	Hold- out	Patent Ambush	Choice of (economically) Best Standard		Transaction Costs
					Participation	Technology Choice	
FRAND Commitments		+	-	+(internal) 0 (external)	-	+	
Litigation/Arbitration Rules	+	+			+/-	+	+
Ex Ante Disclosure	+	+(ex ante)		+(ex ante)	+/-	+/-	+
Ex Post Disclosure				+		+	+/-
Ex Post Disclosure							+
SEP Validation (ex post)			+				+
SEP Pools	+		+				+
Litigation/Arbitration Rules		+/-	+/-				+/-

+ = positive impact; + = main positive impact; +/- = impact depends on the type of policy.

3.1. (F)rand Commitments

The purpose of the “F” and “R” in (F)RAND is simply to avoid hold-up in the sense defined in section 2. As we have seen, hold-up can arise because patent-owners usually do not (and possibly cannot) commit to licensing terms and conditions before the standard is set and the patents reading on it determined. It follows immediately that the right conceptual benchmark for the determination of FRAND rates are the rates that independent patent-holders would have been able to charge *ex ante*, i.e. before the standard has been chosen and, hence before any patent-holder or user knows whether a given patent will actually end up reading on the standard. Note then

that FRAND commitments are not, by themselves at least, designed to address the royalty-stacking problem.

While our benchmark applies best to the royalties for each separate SEP owner, one can also perfectly well conceive of a FRAND commitment on the *total royalty stack* that implementers would have to pay. As a FRAND commitment, aimed at dealing with the hold-up issue, the correct height of such a stack would still be the sum of the royalties that would have been set independently by patent owners before the choice of the standard. As we will discuss in the next section, a FRAND commitment on the total royalty stack might also help alleviate the royalty-stacking problem.

In principle, the “ND” part of FRAND simply means that licensees who are in similar objective conditions should be offered the same kind of deals. In practice, however, this non-discrimination requirement is all but impossible to apply. To begin with, licensing agreements include many important clauses besides those specifying the level of royalty payments due. It is therefore very difficult to argue that a party is discriminated against just because its royalty payments are higher. There is also a long tradition in IP and Competition Law that allows licensor to discriminate according to field of use. For example, the holder of a LASER patent may charge a higher royalty rates to licensees using the technology in an eye-operation device than to licensees who produce a data-reading device. The scope for discrimination according to “field of use” is rather ambiguous. Does a smart phone belong to a different field of use than a tablet? Finally, to further complicate matter, may SEP licensing agreements include confidentiality clauses which prevent others to learn about the terms of the agreement? Without such information, it is nearly impossible for a licensee to know whether or not she faces unlawful discrimination.

For all of these reasons, there does not seem to be any reasonably simple policy measures that would help enforce the Non-discrimination requirement. Moreover, we are not aware of any evidence showing that this part of the commitment is systematically violated with adverse effects on competition and consumers. This report will therefore only deal with the “R” aspect of FRAND commitments.

3.2. Ex-ante royalty caps

SSOs can in principle require that patent-holders commit to maximum royalty rates/conditions at which their IPRs would be available if they happen to read on the chosen standard. Indeed, some standard-setting organisations do just that.

Such ex ante caps usually apply to the whole portfolio of the declaring member: it is the maximum price at which any number of SEPs that happen to be owned by the firm would be licensed. Of course, to be meaningful, a price commitment must also be accompanied to a commitment to a number of “normal” licensing conditions, such as the scope of the expected license.

Ex ante royalty caps have several potential benefits. Firstly, because they provide information about the relative cost of accessing various patent portfolios, they make it possible to consider possible trade-offs between technological excellence and economic efficiency. This is true even if royalty caps are not made mandatory: some technologies with no commitment or a high maximum price tag can be ignored in favour of other approaches which are more reasonably priced. In other words,

maximum ex ante royalties can reintroduce a measure of ex ante competition and hence help alleviate the hold-up problem.

From a policy point of view, there is an important interaction between FRAND commitments or royalty caps as a solution to hold-up and royalty stacking. Consider first the situation at the very beginning of the standard-setting process, when no specific IPR has yet been embedded into the standard. Suppose then that there is ex ante price competition between patent-holders for the privilege of having their technology adopted. The royalties resulting from such free-wheeling competition would be FRAND since there could not be any hold-up. Define the resulting total royalty stack for the standard as a whole as S_A .

Whether this stack is higher or lower than the stack that would have been chosen by a single entity owning all potentially relevant patents is a priori unclear. On the one hand, a unique patent owner would internalise the complementarity between patents which read on different aspects of the standard. This would lead to a lower stack. On the other hand, the monopoly patent-holder would also internalise the substitution between patents that offer alternative ways of handling a given part of the standard. This effect leads to a higher stack for a monopoly owner than for a set of independent patent-holders. So, defining the ex-ante monopoly stack as S_{AM} , we can have either $S_A \geq S_{AM}$ or $S_A < S_{AM}$.

Now let us assume that royalty rates are set after the standard has been determined so that they reflect the additional monopoly power of SEP holders due to the lock in of their patents into the standard. Define the total ex post royalty stack that would be chosen by independent patent-owners as S_F and the total stack that would be chosen by a single monopoly owner of all SEPs as S_{FM} . Ex post, all patents are complements. This means that the total royalty stack would be lower with a monopoly owner, i.e. that $S_F > S_{FM}$.

We can now compare ex ante and ex post royalty stacks. With a monopoly owner of all patents, the ex-ante and ex post stacks must be the same: the patent-holder's initial monopoly position cannot be further strengthened by inclusion in the standard. With independent patent-owners, however, the ex post stack must be higher than the ex-ante stack as any possibility for substitution has now been eliminated. So we have $S_{AM} = S_{FM}$ and $S_F > S_A$. Overall, then there can only be two situations, depicted in figures 2a and 2b.

Figure 2: Comparison of ex ante and ex post Royalty Stacks

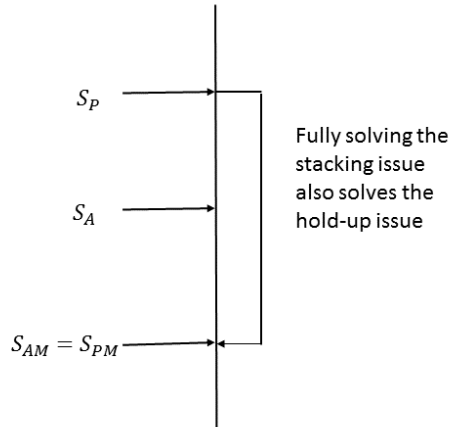


Figure 2a

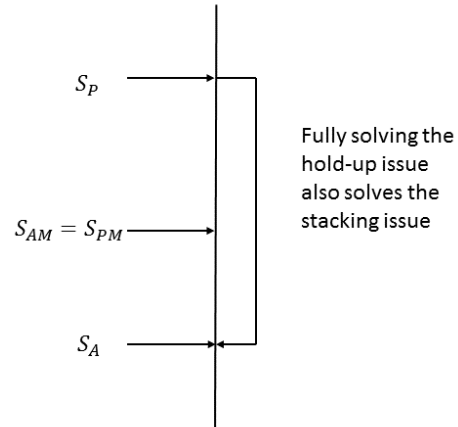


Figure 2b

Without any ex ante cap or effective FRAND commitment, the total stack would be equal to S_P . This high stack would reflect both the increased ex post monopoly power of SEP holders and their failure to coordinate their pricing to avoid the “Cournot complement” effect. In figure 2a, the stacking issue “dominates” the hold-up issue so that the monopoly stack is smaller than the stack which would be chosen ex ante by a set of independent patent-owners. In this case, effective FRAND commitments or independently committed ex ante caps would bring the stack down to S_A , solving the hold-up problem but not the royalty-stacking issue. To solve both problems, one would then need a total royalty cap set at the lower level S_{AM} .

In Figure 2b, the hold-up issue “dominates”. In this case, effective FRAND commitments or mandatory setting of ex ante royalty caps would solve both the hold-up and the royalty-stacking issue.²⁶ In such a situation, then, there would be no need for additional policies – such as the use of patent pools – in order to address the royalty-stacking problem.

Finally, royalty caps also simplify the ex post bargaining between SEP-owners and licensors, reducing transaction costs. This might still be true even if the publicised caps are indicative rather than committed to. In particular, an indicative “cap” on the total royalty stack could provide a useful point of reference and allow licensing negotiations to focus on the licensor’s legitimate “share” of such a total.

Note that while solving both issues requires a total cap set-up at S_{AM} in the first scenario, the cap would need to be set at S_A in the second scenario. As detailed in section 5.1.2, given the practical difficulties associated with the determination of the level of the cap, we propose to use both instruments (aggregate caps and FRAND commitments) to address both the stacking and hold-up issues.

3.3. Ex-ante disclosure

We must distinguish between the potential effect of ex ante disclosures by themselves and their potential effect when combined with FRAND commitments. There are essentially two broad types of declarations. In a negative declaration a patent-holder only identifies the patents (and possibly the patent applications) which are *not* available on FRAND terms. Without FRAND commitments, then, such declarations do not serve any purpose. By contrast, a *specific* declaration identifies all patents that the holder believe to be relevant to the type of standard about to be designed. So, even if such declarations are not tied to any form of price commitment, they at least help identify potentially relevant technologies and help determine which approaches are covered by patents and might therefore not be available free of charge. In this sense, specific ex ante declarations facilitate the choice of an economically efficient standard and decrease the likelihood of “internal” patent ambush.

Declarations are also a necessary complement to FRAND or royalty commitments since the IPRs to which such commitments apply need to be identified. In this context, it is now negative declarations which offer the best protection against internal patent ambush since any patent to which commitments would not apply must be clearly identified.

3.4. Ex-post disclosure

Ex Post disclosure refers to the identification of the patents that are deemed to read on the standard that was actually chosen. Of course ex post disclosure is only meaningful if it is specific, i.e. if it defines the set of patents involved. The main purpose of ex post disclosure is to lower the uncertainty affecting the licensing process and to lower the transaction costs of licensing negotiations.

3.5. Patent pools

Patent pools are organisation that manage a portfolio of patents contributed by a variety of IPR-holders. Typically, the patents in a pool are only available as a bundle for a single price. Patent-holders normally retain the right to license their own patents outside of the pool. Pools vary in the manner in which the pool revenues are divided among patent-holders. In the SEP context, some pools provide an independent assessment of the essentiality of members’ patents, while others do not.

A main function of a pool of SEP is to ensure that the single price charged reflects the joint interest of the pool members. In principles then, patent pools address the royalty stacking issue. On the other hand, they do not directly deal with hold-up since a pool should be as prone to exploit the additional market power that SEPs enjoy ex post as a set of independent SEP owners. That function of patent pool is of course of special importance in the context of standardisation since SEPs are in principle complements once the standard has been chose. There should therefore not be any concern about potential collusion between SEP members. This has long been recognised by Competition Authorities.²⁷

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See for example the European Commission’s 2011 *Horizontal Guidelines*, section 7.

Patent pools also help reduce the costs of identifying the patents that are relevant to the implementation of the standard and, by providing a “one stop shop” they decrease the transaction costs associated with the SEP licensing process.

3.6. Essentiality assessments

Standard essential patents are badly named. “SEPs” are in fact patents which are declared as essential by their owners without any independent check of that claim. When standards are complex, this leads to a very large number of “SEPs” through which potential implementers have to find their way. For example, so far, more than 6,000 patent families have been declared essential for the LTE standard. Since each licensee wants to have some understanding of the actual value of the rights that he is getting, the costs of assessing SEP portfolios tend to be multiplied by the number of times a given portfolio is licensed to a different party. A more organised, public assessment of essentiality could save on this duplication.

Also, in a world where there is little objective verification of essentiality, there is an incentive for patent-holders to declare a large number of their IPRs as essential, if only because royalty payments tend to increase with the size of the licensed portfolio. To the extent that the number of patents involved in a given licensing negotiation increases the cost of reaching a contractual agreement, a more precise evaluation of essentiality could reduce transaction costs by muting the patent-owners incentives to over-declare.

Finally, introducing more clarity with regard to essentiality might also make it harder for unwilling licensees to “hold-out” by hiding behind the need to make their own thorough assessment.

3.7. Conflict resolution rules

Conflict resolution rules are necessary to give substance to ex ante commitments – like FRAND – made by patent-owners, settle the validity and essentiality of SEPs and enable SEP-holders to get payment from unwilling licensees. As such conflict resolution is crucial to enable other policies to tackle the hold-up, hold-out or even the ambush issues. Conflict resolution can be long, uncertain and costly. Reforms that would reduce the uncertainty and transaction costs attached to conflict resolution would therefore make the whole SSO-based standard setting process more efficient and more attractive to potential participants. At the same time, it is also important that conflict-resolution procedures establish the right balance between the legitimate interests of SEP-holders and implementers.

4. Stakeholder Interests concerning the Main Issues

Issues concerning SSO rules and rules for standard essential patent licensing have been highly controversial among stakeholders. Any attempts at improving these rules will have to find common ground between the different parties involved in the standardization process. It is therefore important to be aware of the economic incentives of different stakeholders (like SEP owners and implementers) will have a central impact on the direction into which they want SSO rules to develop. In particular, such an understanding allows one to better understand the patterns to answers in the comments received in the Commission consultation, the interviews, and the workshop that we have evaluated as part of the preparation of the report. Before we discuss the main themes in the answers and comments received, we therefore present a brief analysis of the incentives of different stakeholders and identify on this basis the potential scope for common ground for the improvement of SEP rules. In section 4.2 we then discuss the main themes that have come up in the consultation, the interviews, and the workshop.

4.1. Understanding the main stakeholder's incentives

The most important distinction to make among stakeholders is between patent-holders and implementers. Of course, there are some firms that are both patent-owners and implementers. We would expect their views to be more of a mixture of those of pure implementers and pure SEP-holders since they will find their interests sometimes aligned with one group and sometimes with another. Such firms might then allow one to identify potential compromise solutions for the improvement of SSO and SEP licensing rules.

The following table summarises, based on basic economic incentives, which views on the main issues and policy choices we have identified in the previous sections we would expect SEP holders and implementers to express. We summarize this classification in Table 3. Notice that this table only refers to "complex" industries, i.e. sectors – like smart-phones – where there is a large number of potentially essential patents and, a priori at least, a given, technically proficient, standard could be achieved in a variety of ways.²⁸ The likely position of patent-holders and implementers in less complex industries will be discussed further below.

Table 3: Expected Position of SEP-Holders and Implementers, Based on their Self-Interest

	Complex Industries		Agreement?
	SEP-Holders	Implementers	
ISSUES			
Hold-Up and Ambush	Play down practical importance of these issues	Emphasise the damage resulting from these issues	NO

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See Annex 3 for a Table of "complex" and "discrete" industries drawn from Von Graevenitz et al. (2012), Ibid..

Reverse Hold-Up and Hold – Out	Insist on the need to recover large R&D investments. See unwilling licensees as a pervasive problem	Not a significant issues. Courts are well armed to deal with hold-out.	NO
Royalty-Stacking	A problem but one that should be addressed collectively	Same as SEP-owners	YES, in principle.
Choice of Standard	Favour a choice based on technical criteria only	Favour the introduction of economic considerations (i.e. best quality price ratio)	NO
Transaction Costs	Favour reduction	Favour reduction	YES on overall reduction in transaction costs/uncertainty but opposing interests about the sharing of costs and benefits
SOME SPECIFIC POLICY TOOLS			
FRAND Commitments	Do the job	Hopelessly vague and therefore do not prevent hold-up	NO
Individual Royalty Caps	Oppose	Favour	NO
Total Royalty Cap	Favour if stacking dominates hold-up, otherwise oppose.	Favour	MAYBE
Disclosure	Not opposed in principle but concerned about the transaction cost for SEP holders	Favour to reduce transactions costs to implementers	YES on disclosure NO on sharing the costs of disclosure
Essentiality Assessments	Not opposed in principle but concerned about the cost to SEP holders.	Favour, assuming that costs are born by SEP-holders.	YES on (some) assessments NO on cost-sharing
Pools	Favour if equitable revenue sharing rules can be found.	Favour	YES, in principle

There are two categories of issues and policies:

- a) those for which patent-holders and implementers have diametrically opposed interests,
- b) those for which there should be broad agreement and issues or policies where the parties should agree that joint benefits can be achieved but where the two sides have diametrically opposed interests as to who should bear the costs that creating such joint benefits might involve.

Issues and policies with diametrically opposed interests: On the issues of hold-up, reverse hold-up and hold-out SEP holders and implementers have obviously directly opposed incentives: There is no reason for a patent-holder ever to admit that hold up is an issue because higher royalty payments are not a problem for the SEP-holder. Acknowledging the hold-up problem can only trigger further efforts to limit the size of royalty payments and therefore will be questioned by SEP holders.²⁹ By the same logic, implementers have an interest in dismissing any suggestion that reverse hold-up or hold-out are real phenomena, because this would naturally suggest that some aspects of dispute resolution might need to be adjusted in a direction that would favour higher royalty demands of the patent-holders.

These positions on the basic issues naturally extend to some of the associated policy tools. As discussed FRAND (or more explicit individual royalty caps), would primarily address the hold-up issue and would have the purpose of limiting royalties the SEP holders can obtain.

There is also a diametrically opposed incentive between the two types of parties on whether the choice of the standard should be based only on technical criteria, or whether economic considerations of the relative cost of quality improvements should play a role. When no consideration is given to whether a technology is patented or not the consequence is that the royalty is likely maximized: the better the standard, the higher the demand for the resulting devices and, hence, the higher a royalty can be set and licensing revenues earned. This can only favour the SEP-holders. By contrast, implementers should want to consider possible trade-offs between the cost and the quality improvement of a specific technological choice. Best engineering solutions are often more expensive than the economically efficient ones and implementers would have a strong incentive in bringing the net benefit up, even if does not yield the technologically optimal solution

These issues primarily have the feature that they are purely about the redistribution of rent between the implementers and the SEP holders. In this sense there is little room for a compromise on these narrow issues themselves.

The main issue on which the parties should be able to agree on in principle is royalty-stacking since, as we have seen, the complementarity between SEPs tends to lead to a total royalty for the standard which is higher from the viewpoints of both patent-holders and implementers. The main problem in terms of royalty-stacking is that different SEP-holders have opposing interests in the distribution of the overall royalty on all patents relevant to the standard. However, both patent-holders and

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Moreover, if procedures to control hold-up actually need to be tightened, some SEP-holders clearly prefer to try to find informal solutions within the confines of specific SSOs rather than have policy-makers step in.

implementers should favour the formation of patent pools that pre-specify revenue sharing rules and if the cost of setting up such pools is not too high.

While there could therefore be in principle an agreement for a patent pool, the interests of SEP holders and parties concerning a total royalty cap will again be in partial conflict. While the patent pool mitigates the royalty stacking problem, it does not completely solve the hold-up problem, since the patent pool still has an ex-post monopolist on the complete patent portfolio. To understand why, let us refer again to figures 2.a. and 2.b. obviously, implementers would like the lowest possible royalty stack. On the other hand, as a group, patent-holders are best off with the monopoly stack $S_{AM} = S_{PM}$. So, when the stacking issue “dominates” the hold-up issue, as in figure 2.a., Patent-holders and implementers can agree to set the level of the cap at the monopoly level, solving both the stacking and hold-up problems at the same time. In the situation where “hold up dominates” (Fig. 2.b.), the parties would still agree to have a cap at the monopoly level, which would solve the stacking problem, but the parties would disagree about the further tightening of the cap required to also address the hold-up issue.

Note that SEP holders should always want to argue for a patent pool and against an overall royalty cap. A patent pool in both cases achieves the monopoly royalty for patents on the standard while avoiding royalty stacking in the first case. At the same time refusing a royalty cap and implementing a patent pool ensures that implementers cannot negotiate the royalty down below the monopoly level. We may therefore expect SEP holders to favour patent pools while implementers would push for a total royalty cap instead. In this sense there would still be a persistent conflict in the type of rule that each side would negotiate for.

In terms of royalty caps, one should expect SEP-holders to be - in relative terms - less opposed to total royalty caps than to individual royalty caps. Indeed, while both would in principle be as effective against hold-up, total royalty caps have the added benefit of addressing the stacking issue. Furthermore, determining the reasonable value for the stack is easier than figuring out what individual caps ought to be. One might therefore wonder why total royalty caps have not so far been more enthusiastically supported by stake-holders. We see two main reasons. The first one is that one needs to decide who would get to declare such a cap. This is not something that SEP-holders can do individually. The natural solution is for the SSO itself to step in...but SSOs are notably reluctant to assume any duty that goes beyond the elaboration of a technologically efficient standard. The second – related – reason is that SSOs and patent-holders fear that such declaration would be regarded as joint price-fixing. While competition authorities have now warmed up to the idea that joint pricing of SEPs, *ex post*, within a patent pool is unlikely to be anti-competitive, there is not yet sufficient clarity as to how jointly set *ex ante* total caps would be regarded.

Finally, attempts to decrease transaction costs should in principle be welcomed by both sides. However, most of the policies designed to reduce transaction costs and uncertainty involve costs of their own. Disclosure (especially specific disclosure) requires a search of potentially relevant patents and an essentiality assessments. These can be rather expensive and who bears the cost and who obtains the greatest benefits will be determined by the disclosure rules. Unless these costs and benefits of such rules are fairly shared, the party bearing most of the expenses might oppose a

policy even if it has the potential, with appropriate redistribution of costs and benefits, to make all stake-holders better off.

Less Complex industries

The situation in less complex industries³⁰, such as construction, pharmaceuticals or food processing, is rather different. In these sectors, standards commonly involve the use of only a limited number of patented technologies held by a limited number of firms. This has several implications. If standards can rely mostly on unpatented or freely available technologies, then most of the issues that we have linked to the standard-setting process become much less relevant. Indeed, if all technologies are available for free then there is no hold-up, no stacking, no licensing and no conflict, leaving SSOs to concentrate on delivering the best possible technical standard.

What if there are only a few relevant patented technologies? One would think that some of the problems that we have identified would return in a hurry. For example, we know that stacking issues become rapidly significant as the number of independent patent-owners increase. Similarly, there can be a very significant hold-up problem even if there is only one SEP reading on the standard: provided that this SEP is valid and truly essential, its owner can extract the full monopoly rent due to the technological lock-in of the standard. On the other hand, the costs of disclosure and essentiality certification as well as other transaction costs associated with the licensing process should still remain much lower than in complex industries.

SSOs

SSOs have traditionally been given the mission to produce a high-performing standard in a timely manner. In order to succeed, SSOs need to gather members who have the required expertise and to ensure that the standard is eventually adopted by implementers.

Historically, SSOs have resisted getting involved in any other aspect of the process. In particular, SSOs have not been given the task to intervene in the actual ex post licensing process including the verification of essentiality claims, the organisation of patent pools or other aspects of the licensing process such as the choice of royalty base, portfolio licensing or conflict resolution mechanisms. An exception is the (F)RAND rule, which was adopted by some SSOs. However, this was mostly in response to regulatory pressures and has remained wide open to interpretation in concrete cases.

The reluctance of SSOs seems to be partly the result of SSOs' consensual modus operandi combined with the fact that standard setting was seen historically as an engineering task with little economic relevance beyond the establishment of the standard. If all types of members need to agree then it can be difficult to implement rules that affect the division of rents in SEP licensing. Furthermore, those in charge of discussions at the SSOs were historically members of the engineering staff and not thinking in terms of trade-offs between the economic costs and benefits of standards. Since the historical default rules generally are beneficial to patent holders³¹, it may

³⁰ An indicative list of "complex" and non-complex (i.e. "discrete") sectors can be found in Annex 3.

³¹ Such "historical" rules include the "technology focus" at the exclusion of economic considerations as well as the initial lack of disclosure requirement – a lack that still characterises some of the larger standard – setting/certifying organisations today.

not be surprising that the net effect of any tightening of procedural and licensing rules might have been primarily perceived as shifting benefits away from the SEP holders. Under a unanimity rules this would then generally be blocked.

On the other hand, one would expect that policies that might lower transaction costs for all parties would be a natural field of activity for SSOs. Their lack of activity in this area remain therefore somewhat puzzling. Our best guess is that it is due to a lack of agreement not on the principle of cost reduction but on how to ensure that the benefits from such cost decreases are equitably shared between SEP-holders and implementers.

4.2. Consultation, interviews and workshop

The comments and ideas that we have received from a variety of stakeholders are an essential part of this report. They were obtained through three channels:

- The consultation exercise organised by DG Growth before the launch of this research project, to which 40 stakeholders responded
- A set of 36 hour-long interviews, and:
- A workshop organised at CRA's Brussels offices in November 2015, with participants representing 17 companies

For the interviews, we contacted about 80 stakeholders. These included companies operating in a number of different fields, representatives of standard-setting entities and academics. For some of these stakeholders we used the contact given in their response to the Commission's public consultation. Others were approached on the basis of existing contacts of CRA. Furthermore, a dozen IP and competition law firms were asked to identify clients that are active in standardization and who might have an interest in making their views known. Finally, we have also approached a significant number of stakeholders via the public contact details on their webpage (wherever possible, addressing the request to IPR departments, in-house counsel or public relations). For the workshop, invitations were sent to those having taken part in the interviews as well as to a number of stake-holders known to have significant experience of the standardisation process.

Table 4 summarises the composition of respondents to the consultation exercise, of the entities (and individuals), which were interviewed and of participants to our November workshop. The vast majority of industry participants come from the ICT sector. This keen interest to participate likely reflects that, in some parts of the ICT sector, the standardisation process and subsequent licensing of SEPs have recently become the subject of intense controversy. It is therefore important to realise that the views expressed and the information provided might have little relevance outside of these specific technological areas. Comparing the consultation exercise with the interviews, we notice that the latter had some more participation from outside the ICT sector. The consultation exercise, in contrast, has obtained feedback from trade associations and public entities, which were not involved in the interviews

Although we had exposure to experts from a wide range of industries and functions, we note that the willingness of SMEs to participate in interviews and respond to the consultation was extremely low. We had contacted a significant number of SMEs in different product areas who are involved in standardization. With the exception of a few representatives of SMEs who happen to lead standard-setting bodies they have shown any willingness to participate.

Stakeholders in the consultation and in the interviews have displayed an extremely wide range of opinions. There is clearly strong disagreement among stakeholders on many points, both in terms of conceptual outlook and views on practical implementation. Even within separate groups (e.g., implementers and patent holders), there is a large heterogeneity of views. Although the sample of respondent is clearly not representative of all the actors and industries to which standardisation matters, we feel that the answer still gives us such a wide range of views that it appears unlikely that major concerns or arguments were missed.

Table 4: Participation in the Consultation, Interviews and Workshop

Type of Stakeholder	Sector	Consultation**	Interviews	Workshop
Industry	ICT	15	18	10
	Automotive	0	4	0
	Machine Tools	0	2	0
	Miscellaneous	2	2	0
SSOs		4	6	3
Patent Pool		0	1	1
Academic		1	3	2
Trade/Lobbying Associations		10	0	0
Public Authorities		3	0	1
Patent Offices		2	0	0
Misc.		3	0	0
TOTAL		40	36*	17*

**These are the number of companies involved. Many companies sent more than one representative to the workshop. We also sometimes interviewed people with different qualifications (engineer, legal) within the same company*

***Registered answers only.*

Table 4 provides a brief overview of the content of the interviews and of the registered responses to the consultation exercise. The first part of the table indicates the frequency with which some of the issues that we discussed in section 3 were mentioned as important by interviewees or respondents to the consultation. The second part of the table records the number of interviewees and respondents who discussed a specific policy option. The first number reported indicates how many stakeholders felt that the policy would be beneficial and the second number tells us how many respondents thought the policy useless or even harmful.

To assess the meaning of these numbers, one must understand how the interviews were conducted. The interviews took place over the phone or through Skype. They followed a semi-open format. Interviewees were first ask to mention what they saw as the most important challenges faced by the standard setting process and to discuss which of these challenges might be tackled. The interviewer would then press the interviewee on some of these statements. If time allowed the interviewer would then bring in issues and policy alternatives which were mentioned in the previous

consultation exercise. So, while some of the topics were covered at the instigation of the interviewer, the table should still paint a fairly accurate picture of the problems and policies that seem to be on the mind of stakeholders.

Table 5: Main Issues and Policies Mentioned by Stake-holders

Issues	Mentioned as Important in interview	Mentioned as important In responses to the consultation
Royalty-Stacking	7	12
Hold-Up	7	11
Ambush	2	0
Hold-Out	5	12
Injunctions	5	19
Too Many SEPs/Over-declaration	13	3
Portfolio Licensing	5	6
Royalty-Base	6	7
"Level" Of SEP licensing	4	4
Policies/Rules	Mentioned (helpful/unhelpful):	
Negative disclosure	12/3	10/2
Specific disclosure	13/2	7/4
FRAND Commitments	9/2	27/4
Royalty Caps	8/2	4/4
Independent Essentiality Tests	9/2	7/2
Patent Pools	12/0	19/5
Better Database (with PTO)	11/0	9/0
Patent Families to Standard Mapping	7/1	4/0
(Optional) Arbitration	6/2	9/5
Maintain Commitments when SEPs are transferred	9/0	18/0
Making Royalties Charged Public	5/0	0

Let us first consider the respondent's assessment of the issues facing the standardisation process. Overall, injunctions, hold out, hold up, royalty-stacking and over-declaration of SEPs were identified as the main problems and the interviewees who gave more prominence to the perceived "over-declaration" of SEPs. We notice that, although mentioned less frequently, aspects of SEP licensing such as the royalty base and portfolio licensing were of concern to a non-negligible number of respondents.

Turning to the assessment of specific policies, we find that there was unanimous support for requiring that FRAND commitment be maintained when SEPs change hands as well as for an improvement of the quality of SEP data-base through collaborative efforts between SSOs, SEP-holders and patent-offices. Many respondent felt that the value of this database would be increased if each family of SEP was linked to the sections of the standard on which it might read.

There was also very broad support for encouraging the formation of standard-specific patent pools and combining early “blanket” disclosure with a more specific disclosure once the standard is set. Most respondents believed that, although sometimes hard to define, FRAND commitments were still an essential ingredient of the SSO-based standardisation process. On the other hand, relying more heavily on arbitration, committing early to royalty caps and promoting independent testing of essentiality were clearly seen as more controversial policies.

A more precise description of the feedback received can be found in the next two sections where we assess the merit of a number of specific policy proposals. Before we move to this analysis, however, we must emphasise that the information obtained from the consultation exercise and the interviews also reveals a great divide between stake-holders from the complex, patent-dense, technology areas (e.g. telecoms, machine tools, information technology) in which SEP licensing has recently be troublesome and actors from sectors where technologies are less complex (e.g. chemical engineering, pharmaceuticals, materials) or are less often protected by patents. While the first group is clearly eager to engage with the type of policy discussion that makes up the rest of this report, the second group feels strongly that the current state of the standardisation process in their sector is quite satisfactory and that regulatory intervention would be counter-productive.

5. Individual assessment of possible policy options: commitments and disclosure

As explained in section 4 and illustrated in Table 2, the relationship between policy instruments and the set of issues that they are trying to alleviate is complex. Not only are most policy tools relevant for a number of issues but each issue is often better addressed through a combination of policies. In this section, we examine more closely the policies which might help alleviate some of the practically relevant issues identified in the first part of the report. We distinguish between policies that relate to disclosure of information about potential SEPs and ex ante commitments on the one hand and policies affecting the actual licensing of SEPs once the standard is chosen, on the other hand.

In this discussion, we consider the pros and cons of each policy tool independently, i.e. we do not ask how different tools might be combined. Section 7 will then present a concrete proposal for a coherent set of policies which, we feel, would help address most of the pressing issues faced by some SSO-based standardisation processes today.

5.1. Commitments

A number of SSOs demand that members make some form of commitment to the terms and conditions at which they would make their IPRs available to firms eager to implement the standard. The most common approaches are a commitment to license on "FRAND" terms and commitments to some forms of royalty caps. As discussed in section 2, FRAND commitments and individual royalty caps are meant to address the hold-up problem, while aggregate royalty caps would target royalty-stacking. In practice, however, as we have seen, effective FRAND commitments might also eliminate royalty stacking, just as aggregate royalty caps set at a level that resolves the stacking issue might also avoid help avoid hold-up.

5.1.1. FRAND

Perhaps the most heated dispute in the area of SEPs is about what constitutes a FRAND licensing offer, or, more precisely about the meaning of the "Reasonable" part of FRAND. As we discussed in section 2, the conceptual definition of a FRAND agreement is clear: it is the agreement that a given patent-holder and a given licensee would have struck if they had signed a licensing deal before any of the features of the standard were set. In that sense there is not necessarily a unique set of FRAND conditions for a given patent portfolio: since different licensees have different needs, the agreements that they would have reached ex ante would have involved different combinations of royalties and licensing conditions. It is also entirely possible that FRAND rates might be quite high for some portfolios. If some of the technologies covered are very hard to design around, then the owner of the corresponding patents has considerable bargaining power, even ex ante, and this power would be reflected in high FRAND rates.

The main difficulty is to make this conceptual understanding of FRAND operational. Of course, if all else fails, "FRAND" will be given practical content by the decisions of the Courts. Unfortunately, Courts in the US and Europe have not yet reached any kind of

broad agreement as to how FRAND rates and conditions should be determined. For this reason, it has sometimes been suggested that SSOs define in their IPR policy a derivation methodology for FRAND or that they set up alternative dispute resolution mechanisms such as arbitration to resolve conflicts about FRAND terms more quickly and more cheaply than the judicial system. The desirability of such SSO policies as well as concerns regarding the “non-discriminatory” part of FRAND will be discussed in section 7. In this section, we simply take FRAND as a broadly accepted – though ill-defined – commitment and discuss the kind of disclosure rules required for its implementation.

5.1.2. Royalty caps

In a system of *individual* royalty caps, each potential SEP-owner commits to a maximum royalty rate at which his patents would be licensed. The idea is that such commitments would reintroduce a form of ex ante price competition between technologies and would hence solve – or at least limit- any potential hold-up problem. For such a mechanism to work, ex ante competition between technologies needs to take place, and hence the choice of the technologies included in the standard must be sensitive to differences in the price at which the technologies would be available. Individual royalty caps are therefore wholly ineffective if SSO rules keep technological decisions strictly isolated from legal and economic considerations (which would require searching for the best quality/price ratio), as seems to be the practice in many standard-setting organisations.

Individual caps also run into practical difficulties. One of them is cost. In order to effectively guide technology choice (if permitted) and hence trigger ex ante competition between patent-holders, one would ideally need a cap for each patent family. This would be prohibitively expensive. As we will discuss further below, patent-holders already object to the cost of providing fairly minimal information about SEPs once the standard has been chosen. Setting a price for each patent at a time when the number of potentially standard-relevant patents must be considerably larger than the number of SEPs declared once the standard is chosen must be orders of magnitudes larger.

Aggregate royalty caps seem more promising, if only because, contrary to individual caps, they can be helpful to alleviate the negative effects of both hold-up and royalty stacking.

The manner in which an aggregate cap might address hold up is quite different from the mechanism at work with individual caps. As we have just seen, individual caps work by triggering ex ante competition between rival technologies. This is why they can only be effective if relative prices are a factor in the design of the standard. A total royalty cap can limit hold-up by triggering competition between (potentially) rival standardisation efforts. So while aggregate royalty caps can be effective against hold-up even if the technical choice of the standard within a SSO is not affected by economic considerations, they can only limit hold-up if competition between standard-setting bodies is at least a possibility. In this case, implementers can credibly threaten

to support an alternative standard-setting effort if it offers a more advantageous total royalty.³²

Aggregate caps also directly address the royalty-stacking issue. As noted in Section 5, overcoming potential problems of royalty stacking is not only in the interest of consumers and implementers, but is also be in the interest of patent holders. Specifically, coordinated pricing of strict complements may allow limiting potentially excessive royalty requests on the part of individual licensors, thereby leading to lower final consumer prices and hence more successful commercialization of end products.³³ This mutual benefit is broadly recognised by all parties. In spite of this consensus, aggregate royalty caps run into two potentially serious, related, difficulties.

The first difficulty is that, realistically, we should not expect too much from “potential” competition between standard-setting organisations. The notion that a standard-setting organisation choosing too high an aggregate royalty would lead to the emergence of a rival effort advertising a lower total payment is certainly attractive in principle, but it is untested in practice.

The second difficulty is that a common aggregate royalty cap needs to be chosen by someone. This someone can only be the SSO itself. This, however, raises the further questions of the rules that an SSO would use to determine the level of the cap. As SSOs tend to work by consensus, it seems reasonable to assume that a royalty cap would be determined jointly by the SSO membership which typically includes both patent-owners and implementers. In order to understand how well such a decision process might work, it is useful to refer back to section 4, where the dual role of an aggregate cap as both an anti-stacking and an anti-hold up policy tool was discussed. We argued that the SSO could find itself in any one of two situations represented by figures 2.a. and 2.b. In situation 2.a., the choice of the cap could be left to the patent-holders: they would agree to a cap low enough to eliminate stacking and realise monopoly profits for the group of patent-holders as a whole. In the process of eliminating royalty-stacking they would also drive royalties below the level of royalties which would have eliminated the hold-up problem. Therefore, implementers would be happy with the patent-holders’ decision and should therefore not object to delegating the choice of the aggregate cap to them. However, if the SSO finds itself in the situation described in figure 2.b., then leaving the patent –holders to choose the cap would lead to a level that does eliminate stacking but still does not fully address the hold-up issue. If both implementers and patent-holders are involved in the decision, there might be further bargaining leading to a somewhat lower cap but part of the hold-up issues would remain unsolved.

Of course, in practice, SSO members are likely to have very little idea of whether they find themselves in “situation 2.a” or “situation 2.b”. Accordingly, and given that patent-holders seem, understandably, more frightened by the idea of an ex ante aggregate cap than implementers we *would suggest that ex ante aggregate royalty caps be set by the SSO members with a significant number of potentially standard-*

32 In this sense, aggregate royalty caps can favour ex ante competition for a standard. While an aggregate cap aimed only at dealing with stacking could be set ex-post, like with individual caps, setting the aggregate cap ex-ante is necessary to also deal with hold-up issues.

33 We should emphasize again at this point, however, that the existence of royalty stacking in the sense of the Cournot complements problem cannot simply be presumed just because SEPs are complements. For instance, if there is sufficiently intense ex-ante competition for inclusion into the standard coupled with genuine FRAND caps ex-post, then there would be no reason to presume that aggregate royalties are excessive.

relevant patents. This would ensure that the royalty-stacking problem is dealt with and would also go at least some way towards addressing the hold-up issue. *Such a cap would then be complemented by a classic commitment to FRAND* to help address whatever hold-up problem might remain.

While we believe that a good case can be made for the adoption of aggregate royalty caps, not everyone agrees. Quoting from an especially thorough response:

(Aggregate caps) *"cannot be done at SDO level. See my comments above: Problem 1 is antitrust. Problem 2 is property rights: firms have the right to set their own price. People can voluntarily decide to join a patent pool. Problem 3 is: licenses are determined in negotiations with back and forth. So people start high and then negotiate down. With an aggregate cap, everyone will give the highest price.*

It is true that part of the antitrust community still has an almost instinctive allergy to the idea of rivals setting prices together. However, in the standard setting, it should by now be well-understood that joint price setting is a solution not a problem. If we do not push for what is right, then no progress is ever made. On the other hand, we disagree with the other two objections. Let us first consider the second argument. Patent-holders can voluntarily decide to join a SDO just as they can voluntarily decide to join a pool. There is therefore no fundamental legal right at stake here. Also, accepting an aggregate royalty cap still leaves plenty of room for the bilateral negotiation of the royalties paid to specific portfolio-holders. Finally, as we have argued above, even a non-binding cap could be useful to anchor ex post bilateral negotiations. As for the incentives to set individual or aggregate caps "as high as possible", we believe that price setting incentives have been thoroughly discussed above. In general, the level at which caps could be effective depends on the SSO's willingness to mix engineering and economic considerations (i.e. considering the technology with the best quality and price combination), for individual caps and of the degree of potential competition in the "market for standards", for aggregate caps.³⁴ There are therefore environments where cap would be useful and others where they might not be.

However, as far as aggregate caps are concerned, the common interest of SSO members to avoid royalty-stacking means that such a measure must at least have some usefulness. Indeed, appropriately determined aggregate caps may solve the royalty stacking issue even in the absence of competition between alternative standard-setting initiatives and if SSOs don't mix engineering and economic considerations.

Two specific and alternative mechanisms could be used to set up such aggregate caps. The first one would be to make this total royalty cap an SSO commitment to which all members must subscribe. The second one would be to require a SSO declaration but to not make it a formal commitment for the SEP-holders. In the second (weaker) version of the mechanism, ex ante declaration could serve as a reference point, including by the Courts.

Of course using a total royalty cap only makes sense if there is a mechanism that ensures that this cap is respected ex post... One could e.g. consider a rule that specifies that, as long as individual royalties demanded add up to more than the

Notice that setting an effective aggregate cap only requires an assessment of the value of having a standard that meets the need identified by the industry. It does not require any detailed knowledge of how that needs will be addressed. Such a cap can therefore be set early on, when potential competition between standards is still possible.

promised cap, all royalty payments are put in escrow. Indeed, one could even further concentrate the SEP-holders' mind on the need to agree to a cap-compatible sharing by stipulating that the SSO would levy a monthly tax on this escrow account, with the proceed going to cover the costs of developing further standards (or improving the current one).

However, we do not think that such mechanism would necessarily need to be very formal. If individual royalties add up to more than the promised caps, SEP-holders would be rather vulnerable to litigation since the Courts would be bound to take this cap as a point of reference. Indeed, were a total royalty cap be introduced, one may consider beginning without a formal enforcement mechanism to see whether the threat of judicial enforcement might suffice.³⁵

5.2. Disclosure

"Disclosure" refers to the information provided by SSO participants about the IPRs which might be relevant to the standard. The IPRs concerned are mostly patents, patent applications and copyrights (in areas such as software where copyrights can be relevant to technological choices). On-going research is not usually declared since doing so might jeopardise the firms' ability to obtain patent protection later on. Design patents or design rights are also commonly left out since, by their very definition, they cannot cover any product feature that would affect the product's functionality. Disclosure can occur "ex ante" or "ex post". It can also be specific or not specific.

5.2.1. Ex ante disclosure

"Ex ante disclosure" refers to the information that SSO participants provide *before* the work of creating the standard begins in earnest. Making information about IPRs available early in the standard-setting process can serve three main purposes: providing information about existing technical solutions, identifying the technologies that might not be available free of charge (since they are protected by IPRs) and making ex ante commitments to price caps or FRAND operational.

There are two broad categories of ex ante disclosure policies: *negative* disclosure and *specific* disclosure.

Negative disclosure

Negative disclosure is a form of blanket declaration of potentially essential patents. Under this policy, a SSO member only needs to declare the IPRs which it intends not to license on committed terms. Since individual patents are not identified, negative disclosure does not fulfil the first two functions mentioned above: it does not improve the SSO members' knowledge of existing technologies and provides little information as to which technological solutions are IP-protected and which are not. Clearly then, negative disclosure only makes sense when combined with some form of ex ante commitment to ex post licensing terms and condition. Effectively, then, negative disclosure means that patent holders give a blanket declaration assuring potential licensees that (i) licenses will be granted and (ii) that royalties will be subject to the

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Further research would be necessary to assess the interaction between standard-setting rivalry, SSO participation and the proposed aggregate royalty caps (and other commitments). For instance, in the context of rivalry between standard setting organizations, one may question whether there would be an incentive for some organizations to free-ride on the work of SSOs using aggregate caps.

pricing rule employed by the SSO (e.g., FRAND, royalty free or royalty caps). As a result, specific disclosure occurs only reveals information about carved out SEPs which are not subject to the SSOs rules on licensing terms.

Specific disclosure

(Ex ante) specific disclosure means that a patent holder identifies the patents and other IPRs that he owns and might be relevant to the standard about to be developed. In principle then, the declaration would include a list of patent numbers and/or patent families. These declarations are not subject to any external check. Indeed, in most SSOs, the IP-holders are only required to declare the relevant patents and copyrights that “they are aware” of. So, at the level of the SSO at least, failure to list a patent which later proves to be relevant to the standard is not by itself a disqualifying offence. Indeed, even Antitrust Authorities do not regard an inadvertent failure to disclose as problematic. Still, given that telling an inadvertent lapse from a wilful one might be difficult in practice, there is a general feeling that the safer course of action to avoid later accusations of ambush is to declare rather broadly.

Stakeholder opinions

In reading the feedback from stakeholders, it is important to distinguish between opinions about the desirability of blanket disclosure *per se* and the perceived merits of having such negative disclosure *instead* of specific disclosure.

There seems to be broad agreement that negative disclosure is helpful in protecting the standardisation process from patent ambush by SSO participants. Even respondents who feel that wilful ambush is not a significant issue agree that negative declaration provides useful protection against the possibility that some participants might simply not be initially aware of patents that later prove to be essential to the standard. With negative disclosure these “late revelations” are subject to the patent-owners initial commitments, while they would not under specific disclosure. This quasi-consensus is also helped by the fact that blanket disclosure policies are not perceived as costly to implement: patent-holders with large portfolios do not need to engage in a thorough search since they are already presumably aware of the “jewels in the crown” that they would like to exempt from commitments. Moreover, the experience of standard-setting organisation with significant experience of negative disclosure is that, in practice, participants claim very few exemptions. The “data-base” that has to be maintained to keep track of commitments is therefore very small and easily manageable.

In spite of the broad agreement, some patent holders mention that the deadlines imposed for negative disclosure identifications can be very tight in practice, making it highly costly and difficult to identify potential candidates for exemption within the required time frame. This is a particular issue in large companies with huge patent portfolios. However, this issue is mostly raised in the context of SSOs which require royalty-free licensing rather than in a FRAND environment.

We only received two other types of negative comments about blanket disclosures. Both seem to be based on a confusion. These types of comment is well illustrated by the following quotes:

“Negative disclosure is too loose a regime: you do not know what you are getting”.

“Blanket disclosure really only works if you have “royalty-free”, because Lord knows how people will derive FRAND afterwards”.

"Specific disclosure is better, even if you have a methodology to calculate FRAND, because engineers can design around patents that are going to end up being expensive".

The fear of the first two respondent seems to be that, under a blanket disclosure approach, there would be no further information provided as to what implementers need to get licenses for. This would then also make it very hard to assess the royalty payments to which SEP-holders are entitled *ex post*. However, anticipating our assessment further below, these concerns might be misplaced, for two reasons. Firstly, negative and specific *ex ante* disclosure are not mutually exclusive. Secondly, even if *ex ante* disclosure was only negative, it can still be combined with a more specific "*ex post*" disclosure that would identify the IPRs that, in the IP-holder's opinion, might read on the *actual* standard chosen by the SSO. The third respondent also assumes that negative disclosure would be chosen *instead* of specific disclosure. On the other hand, the comment does point out to a clear weakness of the approach: it protects against ambush but fails to give engineers the information required to make not only technically efficient choices but also economically efficient ones. We will return to this theme below.

Specific disclosure is much more controversial, especially if it is made mandatory. Not surprisingly, there is a clear split between patent-holders and implementers. The main sources of disagreement seem to be cost and the usefulness of specific declarations. Implementers tend to favour specific disclosure, although a minority recognises that the implied transaction costs might be excessive. The main reasons cited for this position is that specific declarations help avoid hold-up by clarifying the scope of application of FRAND (and other) commitments. As we just saw above, a few respondents also mention that specific declarations help engineers avoid technical solutions that would prove to be too costly. On the issue of costs, the majority of implementers state rather forcefully that the costs of identifying relevant IP is part and parcel of trying to commercialise IPRs and would therefore have to be incurred at some stage even if licensing took place outside of a standard-setting process. Moreover some respondents point out that the costs involved in identifying patents for *ex ante* specific disclosure – where no analysis of how the patents relate to the standard is needed – should actually be rather minimal and would, in any event, only represent a very small proportion of the total cost of obtaining and monetising a patent.³⁶

Patent-holders are unanimously of the opinion that any specific disclosure that goes beyond a fairly unsystematic list of potentially relevant IPRs that there are "currently aware of" would be too onerous. Indeed they feel that making such disclosure mandatory and enforcing the rule through some form of sanction mechanism might lead patent-owners to reconsider their involvement in SSOs. Some patent-holders also question the usefulness of such declarations claiming that, in practice, there is no evidence for the existence of any systematic hold-up problem. Patent holders therefore question why one should create substantial transaction costs to create solutions in search of a problem. Finally, patent-holders also point out that SSO discussions are led by technical people (engineers) with a sometimes only very limited overview of a company's patent portfolio and no patent attorney skills. In their view

then, providing information about patents would only have a negligible impact on the choice of the standard anyway.

Where patent-holders and implementers agree is that specific declaration becomes less desirable when the number of patents declared becomes very large. The reasoning seems to be that large numbers of declared patents mean higher declaration costs while also drowning engineers in a mass of information that they cannot really usefully exploit. Respondents identify two reasons why the number of patents declared *ex ante* might be excessive. The first reason is industry-specific. There are simply “high patent density”³⁷ sectors where patents that can reasonably be expected to be relevant to the standard about to be developed are indeed quite numerous. A consequence of this is that some stake-holders argue that *ex ante* specific declarations are actually more useful where the potential number of SEPs is actually fairly limited. Indeed, stakeholders from industries outside mobile telephony often point out that a system of voluntary specific disclosure works well in their case, without any benefit from resorting to forced mechanisms or punishments. In their view, in SSOs other than ETSI, the more limited number of patents involved and reputational mechanisms suffice to ensure that members of the SSO voluntarily provide best efforts to make specific declarations.

The second reason for the proliferation of declared patents is “over-declaration”, i.e. a tendency for patent-holders to also declare patents others than those which can clearly be expected to be of relevance to the standard. According to the respondents, one of the causes of over-declaration is the patent-holder’s desire to protect themselves against later charged of patent-ambush. Any system trying to contain patent-ambush through some form of *ex post* punishment (like antitrust intervention) would therefore lead to even more over-declaration. Another reason mentioned by participants is the patent-holders’ desire to “stake a claim” on a share of the royalties that will eventually be paid by those intent on practicing the standard. This might be because (some) SEPs might eventually join a pool, where the number of patents declared tends to improve a SEP-holder’s share of the single royalty charged to licensee or because, even in bilateral licensing, the share of a firm in the total numbered of declared SEPs is still used as a point of reference. Clearly, this second cause for over-declaration is only relevant to *ex ante* specific declaration if it is not followed later by a more precise specific declaration once the standard has been chosen.

5.2.2. Ex-Post Disclosure

“Ex post” disclosure refers to the information about patents and also IPRs that is revealed by SSO members once the standard has been determined. Such disclosure is specific and can potentially include significantly more information than “ex ante”, including:

- Patent number
- Grouping of SEPs according to transparent criteria (e.g., patent families, continuation patents etc.)

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As noted in an earlier section, high patent-density sectors would be what economists refer to as “complex” industries – where many elements are required to build a commercially successful device – and where there is a high propensity to patent.

- Mapping of patents to a specific part of the standard
- Explanation of why the patent is an SEP for this aspect of the technology

Clearly, ex post disclosure plays no role in limiting hold up. Once the standard is chosen, the owners of patents that actually read on the standard (and are valid) enjoy increased bargaining power compared to the pre-standard situation and there is nothing that an ex-post declaration can do about this. The main purpose of an ex post declaration must therefore be to bring more transparency to the SEP licensing process, thereby reducing uncertainty, limiting possible excuses for hold out and – hopefully – also decreasing transaction costs.

Stakeholders Opinions

This is the aspect of the current SSO -based process that implementers are most dissatisfied with. Not only do they complain about the large number of declared SEPs which they have to get licenses for, there is also a widespread view that licensees “do not know what they pay for” and have no reasonable opportunity to assess the actual relevance of declared SEPs before having to sign a licensing agreement. This issue was also claimed to be especially important for SMEs – as well as for newcomers to the standardisation process, whatever their size:

“The big point is that small implementers have no choice of what they are paying for and how much they will pay”

In fact, some implementers go further and argue that better information about declared SEPs would lead to lower royalty payments as more knowledgeable licensees could strike a better bargain. Implementers also feel that, since patent-holders are those “selling” their IP, it is incumbent on them to provide a satisfactory description of what is actually for sale.

SEP-owners answer that, given the large number of patents involved, providing more information about how the declared SEPs actually relate to the standard and/or providing independent assessments of the essential character of declared patents would simply be prohibitively expensive. They feel that any increased requirement to provide such information would simply drive patent-holders away from the SSO-based standardisation process. More specifically, SEP-owners mention that internal control of essentiality would cost at least 2,000 EUR per patent while an external evaluation would cost about 9,000 EUR.

The opposite views of licensors and licensees might be best summarised by the following quotes:

“We are talking about a lot of patents, so the costs involved in additional requirements can be really huge”

“Patent-holders claim that it is costly to provide details on patents. We think that patent-holders collect this information anyway”

“If a firm thinks that it is worth getting a patent, then adding 10-20% to this cost to have a recognised SEP is worth it”

As expected, there is more agreement about measures which are clearly aimed solely at decreasing the costs of the SEP-licensing process. In particular, many respondents would be favourable to a greater involvement of the EPO in helping design and administer data-bases about standard-specific SEPs.

5.2.3. Our Assessment of Disclosure Policies

When assessing the various (combinations of) disclosure policies, it is worth recalling the various issues that such policies might be able to alleviate.

Hold Up and Ambush

The first issue is *hold up / ambush*. If FRAND commitments are made or royalty caps (individual or cumulative) are guaranteed, then one needs a list of the IPRs to which these commitments apply. In order to be effective, these commitments, and the list supporting them, must be available before the standard-setting process has truly begun, i.e. before some technical choices have already made.

Both ex ante negative disclosure and ex ante specific disclosure can be effective in this regard. In particular notice that negative disclosure is compatible with both FRAND commitments and some forms of royalty caps. With FRAND commitments, a blanket disclosure simply says that all non-declared patents that turn out to be essential should be licensed at a rate which does not exceed the rate that the patent could have commanded before the standard was set. Of course, this leaves the question of *how* FRAND rates would be calculated and whether the absence of a “number” of SEP declared would make such computations harder, but, as we shall see, these ex post issues might be handled more satisfactorily through other policies anyway. As for royalty caps, negative disclosure can work well as long as the caps are set either at the level of a firm’s portfolio and/or at the level of the total royalty stack charged by all SEP owners.

While specific and negative disclosure can both support ex ante commitments, it seems certain that negative disclosure is cheaper to implement than a meaningful specific disclosure. To be at all reliable specific disclosure can involve significant efforts on the patent-holder’s part to identify most of the potentially standard-relevant patents in its portfolio. It would seem that identifying the “jewels in the crowd” for which the patent-owner does not want to commit is a subset of this task and should therefore be significantly cheaper to execute. Moreover, the experience of standard-setting organisations that have relied on negative disclosure is that the number of exception claimed is actually very small. If true, then negative disclosure has the added benefit of yielding a much smaller dataset which would be cheaper to administer and peruse. We therefore conclude that *from the point of view of alleviating the problem of Hold-up/ambush, ex ante negative disclosure is superior to ex ante specific disclosure*.

Before concluding this section, we need to address the concerns expressed about the costs involved in finding patents to be exempted and the pressure due to deadlines seem somewhat difficult to understand. They appear to be based on an incorrect comparison. As a matter of fact, the vast majority of SSOs require some form of ex ante disclosure. The issue then should not be whether negative disclosure is costly and might put the firms under time pressure. What matters is the comparison between negative disclosure and the most likely alternative, which seems to be a blanket requirement to declare all patents that might end up reading on the yet undeveloped standard. In such a comparison, as explained above, it is hard to see why negative disclosure would be costlier to implement than a policy requiring an extensive list of specific patents. The idea that firms “have no idea” of what lies in their patent portfolios can be overplayed. Patent-holders are naturally much more aware of the

relatively few “great” patents that they own than of the hundreds or thousands of other patents that may or may not be of any relevance to a standard. Choosing patents for exemption should therefore be rather straightforward. As for deadlines, there are of course no reasons why the deadlines for negative disclosure should be tighter than those for specific disclosure.

In fact we believe that, overall, especially in light of the fact that few patents tend to be “exempted” in practice, ex ante negative disclosure should involve significantly lower transaction costs than a rule requiring the disclosure of all relevant patents. This should be true even under a royalty-free licensing rule. We understand of course that a firm would want to be absolutely sure that it does not make an overly valuable patent available for royalty free licensing and that the risk of doing so might be higher under negative disclosure. This concern could however be addressed easily by drawing a distinction between FRAND environments, where ex ante negative foreclosure seems to have the upper hand and royalty free environment where licensors could be given a choice between negative and specific declarations.

Economically Efficient Standards

Another issue that disclosure might help resolve is that of choosing an *economically* efficient standard. While there does not seem to be any reason to question the technical quality of standards produced by SSOs, there is a legitimate concern that the trade-off between technological merit and the implied total royalty cost might not be considered as seriously as it should. Indeed, many organisations implement a strict separation between technical discussions between engineers, aimed at coming up with a standard, and patent-licensing considerations. Whether such separation is actually desirable is not our concern here. What we want to point out is that whether or not engineers are exposed to patent and cost considerations is relevant for the assessment of ex ante specific disclosure.

Ex ante disclosure might have two benefits: it might help inform the engineers involved in designing the standards of technological solutions that they might otherwise not have been aware of and it might make it possible for engineer to “work around” technical solutions which are likely to be expensive either because they are patented (even under FRAND, a patented technology is more expensive than a royalty-free solution) or because they infringe a patent for which no commitment has been made. The first benefit only arises with specific disclosure since negative disclosure usually results in very few declarations. As for the second benefit, specific and negative disclosures have relative strengths and weaknesses. Negative disclosure clearly signals the patented technologies to avoid if possible but provides little information as to what might or might not be patented. By contrast, specific disclosure might give a better overall view of the patent landscape but it fails to flag important patents which are not available at committed terms. Clearly, however, *these benefits cannot be realised if the SSO maintain a strict separation between engineering activities and patent/royalties issues*. We therefore conclude that *in the presence of such a separation – and considering that other tools are available to deal with ex post licensing issues – negative disclosure appears to be the superior policy option*.

Now let us assume that the SSO actually let the engineers consider patents and royalty issues. The feedback that we got from the stakeholders strongly suggest that, in high density sectors, the number of patents and other IPRs involved in ex ante specific declarations is so large as to make the informational content of the declaration

close to nil: *"specific declaration is creating too much burden and is not helpful because there is too much declaration"*.

By contrast, stakeholders involved in smaller SSOs dealing with less patent-dense sectors are somewhat more positive:

"...you have to declare the specific patents and the engineers look at them".

This suggests the following overall recommendation. In fields/standards involving few patents, a negative ex ante declaration can be usefully – and cheaply – complemented by a specific ex ante declaration, even if engineers are not allowed to consider economic factors when setting the standard. This recommendation is only reinforced if engineering and economic considerations can be traded off against each other. For patent-dense sectors/SSOs however, the costs of ex ante specific declaration does not justify the benefits. In such a case, a negative ex ante declaration should suffice. This system keeps the ex-ante transaction costs of declaration to an absolute minimum, while providing broad assurance to licensees that FRAND or cap commitments will be honoured.

Transparency and Transaction Costs in SEP Licensing

In the previous section, we explained why we believe that negative disclosure might be a superior rule for ex ante declaration, either on its own or – for sectors with relatively few SEPs – together with a more specific declaration. However, ex ante disclosure, be it negative or specific, is clearly insufficient to provide implementer with the information needed to determine which licenses they should obtain once the standard has been set. This information can only be provided by *specific* disclosure, i.e. by a list of patent that each SEP-owner feels have been infringed by the implementer's application of the standard. Moreover, sufficiently detailed specification of likely SEPs *ex ante* is simply not feasible, for two main reasons. Firstly drawing close links between specific patents and a non-existent standard seems to be a wasteful exercise. For example, patent-holders cannot possibly provide detailed information about the area of the standard on which a given patent might read before the very structure of the standard is determined. Secondly, precisely because the potential number of SEPs can be vast at such an early stage, the transaction costs associated with such an exercise would be considerable. To fix ideas, even using a rock-bottom cost of £1000 for a quick internal revenue, the total cost of reviewing the number of patents declared for some ETSI standards would be in excess of 100 million dollars.

At the same time, to be informative, even *ex post* specific disclosure involves substantial transaction costs for patent holders. These transaction costs increase with the number of patents that need to be reviewed, the proportion of these patents which are declared as SEPs and the amount of information which needs to be provided. Moreover, if specific disclosure were to be made mandatory, then an enforcement mechanism would need to be designed adding enforcement costs to the total bill of the policy. A careful evaluation of the costs and benefit of *ex post* SEP declarations is therefore essential before one can make any policy recommendation.

Licensee Demands and Costs

Before we try to put some numbers on the trade-off involved and propose policies that might improve this trade-off, it is important to identify a number of issues and how

they might be related. Licensees are interested in ex post SEP disclosure for four main reasons:

- They want to know “where the patents are” and hence whom they should get licenses from.
- They also need to know “who owns what” to be able to anticipate what the total royalty stack might be and take this into account in their bilateral licensing negotiation.
- They want to understand how the patents proposed for licensing relate to the standard. This is especially important if a patent reads only on optional parts of the standard.
- They would like to get some idea of whether or not declared patents are truly essential.

On the other side of the equations, SEP-owners worry about the costs involved in meeting the licensees’ demands. These include:

- The cost of identifying the patents that might read on the standard
- The cost of linking patent or patent families to specific elements of the standard
- The cost of obtaining an independent assessment of the essential character of their patents

The first type of costs increases with the number of potentially standard-relevant patents in a given licensor’s portfolio. This cost is therefore likely to be high in high patent density environments. By contrast, the other two types of cost only increases with the number of patents that are *declared* ex post as standard essential. Such costs can therefore be decreased by policies aimed at limiting the number of declared patents.

Traditional Duties of the Licensor

Overall, then, a cost-benefit analysis of a more detailed ex post disclosure involves a comparison between the additional costs of gathering and communicating the information required against the cost savings from a potential decrease in litigation and the decrease in negotiation costs that more clarity is likely to entail. Such an analysis is concerned with the overall effect on costs. However, the distribution of these costs also matter. In this respect, it is important to evaluate any new policy with respect to the correct counterfactual. The purpose of policy measures aimed at SEP licensing is not to solve the difficulties that any licensing endeavour faces. It is to ensure that standard-related licensing is not more problematic than licensing outside of any standardisation context. The correct benchmark to evaluate the additional burden of SEP policies is therefore the set of costs (and benefits) that licensees and licensors would shoulder in a traditional licensing context. With this point of reference in mind, we can now proceed the costs and benefits of the increased “transparency”

championed by licensees and ask whether they are at all affected by the fact that SEP licensing occurs “in the shadow” of standardisation.

Identification of the Relevant Patents

Outside of standard-setting, companies are supposed to check whether their products and production processes violate existing IPRs, but it is also widely accepted that, especially in sectors with a large number of patents, a patent-holder is better placed to know whether its intellectual property might have been infringed. So, unless the user is aware from the start that it is using a protected technology, the burden of “finding the relevant patent” and then initiate licensing negotiations falls on the patent-holder. To do so then, the patent-holder has to incur whatever the cost of “finding the relevant patents in his portfolio” are as well as the cost of explaining to the potential licensee why he believes that the patent is being infringed. Overall then, compared to a more traditional licensing context, it seems to us that SEP-holders would not be disadvantaged by an obligation to (promptly) communicate to implementers that they hold standard-related patents *and* to provide some information as to why they actually believe that these patents would be violated by the implementers’ use of the standard.

If anything, one might believe that these two types of costs would be *lower* in a SEP context than with more traditional licenses. The first reason for this is that both SEP-owners and implementers are acutely aware of the need to license: standard has been set and SEPs have been declared so implementers should know that some IPRs will have to be paid for and licensors know that any firm claiming to produce standard-compatible devices is at least a potential licensee. The costs of “finding where the patents are” and “finding the infringers” should therefore be minimal. Moreover, at least for standards that are expected to be widely adopted, these costs can be made even lower by creating a *publicly available database* of declared SEPs. Such a database can reduce cost precisely because of the fact that patent licensing occurs in the context of standardisation: for popular standards at least, there is a sudden demand for information about *the same* set of patents by a large number of potential licensees. This provides the “economies of scale” required to make investment in the database worthwhile.

We also note that, under the recent *Huawei* decision, the Court has squarely placed the duty to initiate SEP licensing negotiations on the shoulders of the SEP-owners. In particular, the Court states quite clearly that it is the SEP owner’s obligation to make implementers aware that they might be violating their IPRs. Overall, then, it would seem that asking SEP-owners to shoulder the cost of creating and updating a database of declared SEPs whenever it is economical to do so (i.e. for popular standards) would be compatible with their current legal obligation and would in fact *lower* the cost of discharging their legal duty.

Linking the Patents to the Standard

In our opinion, the same reasoning also applies to the licensee’s demand that SEP-holders explain why their patents are actually relevant to the standard. The standard argument that: “my patents are SEPs, you are implementing the standard, hence you are violating my patents” is simply not enough. Outside of a standardisation context, patent-owners would have to at least make a *prima facie* case that the potential

licensee actually infringes the IPR. There are two issues here. Firstly, even in the absence of any evaluation of patents' "essential" character, it would seem that patent-holders have a duty to at least demonstrate some link between specific patent families and the chosen standard as they would need to take the equivalent step in a traditional licensing context. Indeed, once more, it would seem that the cost of providing this type of information should if anything be lower for SEPs.

The type of information that we – and some of the implementers – have in mind would simply be to identify the parts/paragraphs of the standard on which each declared patent family *might* read. This does not require any genuine "essentiality" evaluation. Indeed, such a requirement also stops short of the "claims maps" that are often used in bilateral licensing negotiations. Such claim maps explain of *specific claims* in each patent relates to the potential licensee's product or process. The equivalent in our case would be a link between individual claims in individual patents and paragraphs of the standard. Given that individual patents can include up to a hundred claims and more, the dimensionality of such "claim mapping" exercises far exceeds that of the type of declaration that we are considering. Since – in the context of a popular standard – the cost of gathering this information and making it public can be spread over a large number of licensing transaction, it is hard to see how this type of requirement would be more onerous than in a standard licensing setting.

We should add that, since many standards contain both "mandatory" and "optional" features, the simple type of mapping that we propose would also help potential licensees explain why they might not need access to all declared SEPs.

So, summarizing our discussion so far, the costs of providing information about the existence of potentially infringed patents as well as the costs of providing prima facie evidence of infringement are normally borne by the patent-holder. In fact, because of the additional visibility that the standard-setting context gives to the need for licenses and because of the potentially large number of licensees who are interested in obtaining access to a similar group of patents, the standard-setting process offers opportunities to discharge these duties at a lower cost than in non-standard-setting environments. Overall then, the SEP-holders' concerns about aspects of ex post declarations seems misplaced.

How High Are the Costs?

However, rather than dismiss the SEP-holders' position as simply self-interested, it is helpful to understand why they might actually feel that their concerns are genuine. The main issue here is the total cost that implementing our proposal might entail. Let us focus on the requirement to link patent families to specific parts of the standard. What do we know about the total cost that such a requirement might involve?

In the US at least, the cost of providing a *valuation* for a patent *family* appears to range from about \$1500 for a quick internal valuation to about \$40,000 per family for a full valuation required, for example³⁸, by banks or venture capitalists. Of course a valuation involves much more than simply establishing a link between a patent and a standard. It implies an assessment of the validity of the patent, an estimate of how broad the patent is (this is where essentiality comes into play) and an estimate of how commercially important the patent is likely to be. What we propose only involves a

light version of the second task and should therefore be achievable for significantly less money than implied by the numbers above.

If we look at estimates of the cost of whether a patent is actually infringed by a rival – which seems closer to assessing whether a patent is “infringed” by the implementation of a standard – we find estimates ranging from 1,800 EUR for a “quick look” review to between 2,600 EUR ; 4,400 EUR for an intermediate review (with preliminary assessment of validity, which is not required in our case) and up to 8,800 EUR or more for a “full review”.³⁹ On this basis it would seem that 2,600 EUR would be a very comfortable upper bound for the type of information gathering that we have in mind. Moreover, since most patents in a given family would read on the same aspects of a given standard, this cost should be seen as a cost per patent family. In any case, the estimates presented below can be readily adapted to determine what the cost would be if the cost of reviewing a patent family was deemed to be higher.

In a simple minded approach, one might then compute the total cost involved by multiplying 2,600 by the number of families currently declared as SEPs. For example, a recent study by the Cyber Creative Institute (2013)⁴⁰ indicates that the number of declared essential patent families for the LTE standard is about 6,000. The total cost involved would then be at most 15.6 million EUR.

Some other numbers are useful to put this total cost in perspective. We start with the cost of patenting. In the US the cost of filing a single patent application varies depending on the complexity of the underlying technology. The telecom and software sectors belong to the more complex areas, where attorney fees and search fees are higher. The total cost of filing a patent application in these areas is estimated to range from 14,500 EUR to 16,300 EUR and more.⁴¹ In Europe, one must count not only the cost of obtaining a patent but also the cost of renewing it for the period of time over which royalties would be received. As a patent is valid for 20 years we simply assume that SEP patents would be renewed for half of this legal lifetime, i.e. for ten years. Adding all relevant fees⁴², we arrive at a total of 15,380 to 15,570 EUR for a patent with fewer than 16 claims and 22,430 to 23,020 EUR for a patent with 30 claims. Renewing the patent for an additional 10 years would cost an extra 15,600 EUR. So, if one adds attorney fees of roughly the same magnitude as in the US (say 12,000 EUR), the cost of obtaining a EPO patent ranges from about 25,000 EUR to 35,000 EUR and more for a patent renewed for 10 years. These are estimates per patent so the cost per patent family would be even higher. This means that, in Europe at least, the cost of linking each patent family to the relevant parts of the standard would be at most 10% of the cost of obtaining patents in the first place.

There are also estimates of the royalty income received by SEP-holders. A recent estimate⁴³ puts the royalty income *actually earned* by SEP-holders for the 2G, 3G and 4G standards at a little less than 18 billion of EUR dollars per year. As far as possible this estimate is based on actual payments on the royalty rates officially demanded by patent-holders, which tend to be much higher. Indeed, this income figure represents only just below 5% of the income from the sales of the devices for which these

39 <http://olivergrimsley.com/patent-services-patent-infringement-assessment/>

40 <https://www.cybersoken.com/file/ite03EN.pdf>

41 <http://www.ipwatchdog.com/2015/04/04/the-cost-of-obtaining-a-patent-in-the-US/id=56485/>

42 <https://www.epo.org/law-practice/legal-texts/official-journal/2014/etc/se.3/2014-se3.pdf>

43 <http://www.ip.finance/2015/08/cumulative-mobile-sep-royalty-payment-html>

standards are relevant. We know that ETSI has received about 23,500 SEP declaration for the GSM + 3G standard and that 4G-LTE accounts for an additional 6000 patent families. We do not know however how many individual patents this refers to but let us assume an average of four patents per family so that the total number of LTE SEPs is essentially the same as the number of SEPs for GSM + 3G. This gives us a total of 47,500 patents yielding therefore a yearly income per patent equal to approximately 380,000 EUR. Assuming, conservatively we would argue, that such payments are received for just five years, this gives us about \$ 2 EUR per patent so that the cost of linking a patent to the relevant part of the standard would be at the very most equal to 0.15% of the expected reward from licensing.

Overall, we just cannot accept the claim that tying each declared SEP family to the appropriate part of the standard and making this information public as part of a well-organised data-base would be problematic. Not only is this part of the normal costs of licensing one's intellectual property, but the order of magnitude of the cost involved – while possibly impressive when added up over all patents – seems rather modest compared to other costs of patenting and to the rewards collected by patent-owners.⁴⁴

Establishing the Essentiality of Patents

We now turn to the last demand of potential SEP licensees: that the essentiality of the declared patents be assessed before licensing contracts are agreed. Contrary to the two previous ex post disclosure policies, such a requirement would go significantly beyond the usual duties of a licensor. In common bilateral licensing negotiations, it is up to the licensee to make up his mind about the likelihood that patents are infringed and valid. This does not mean that the licensor would not necessarily contribute information to help with this assessment – as it might be in his own self-interest to do so – but such information is not required. When provided at all, infringement information would usually take the form of “claim maps” explaining how specific patent claims might be infringed by the licensee's products and production processes. Such maps are one step up from the type of linkage between patent families and the standard that we discussed in the previous section. With or without such maps, potential licensees can then expend resources of their own to develop their own view. So, in a nutshell, both parties bear some costs of eliciting information about possible infringement.

The policy favoured by licensee would involve the evaluation of patent essentiality *by an independent third party*. Such an assessment does not need to be as thorough as the kind of evaluation that would take place in a litigation context. It does not even need to provide the type of “claim maps” that we have just discussed.⁴⁵ What is needed is a binary opinion as to whether a given patent or patent family is or is not essential to the implementation of the standard. Based on the range of estimates provided above, it would seem that a realistic range for such assessments would be between 4,500 EUR, which covers a “medium” assessment of essentiality plus a preliminary assessment of validity (which is not needed for our purpose) and 9,000 EUR which is

⁴⁴ We do not however claim that these rewards are necessarily ample or even adequate to properly compensate innovators for the expense and risk that they bear when they invest in research. This is a completely different issue. Our point here is that the cost of the proposed policy is so small that it is unlikely to have significant negative effects on incentives to innovate or on the incentives to patent.

⁴⁵ In fact, several respondents – and especially participants in the workshop – have a rather jaundiced view of claim maps, finding them labour intensive but not actually very useful to assess essentiality.

cited as the cost of a “full” essentiality assessment⁴⁶. Multiplying the higher bound by our estimate of the total number of declared SEPs for 2G, 3G and 4G (47,500) would give us a total cost of 427.5 million EUR, which is a quite considerable amount.

Since this payment comes from *adding* an additional task to the usual duties of a licensor, we can no longer rely on our previous argument that this part and parcel of licensing and is indeed likely to be cheaper than for licensing taking place outside of standardisation. In principle then, we would need to provide a reasonable estimation of the benefits from such an additional requirement. Comparing costs and benefits would then allow us to make an informed policy recommendation. This is not an easy task.

In order to determine the benefits of independent essentiality assessments we need an understanding of the relevant counterfactual where such declarations do not occur. In this counterfactual, as we have just explained, both parties would expand some to [provide information about/assess the essential character of the SEPs in the portfolio to be licensed. Define the total amount spent by the two parties in a given bilateral negotiation as E . Typically, parties mostly discuss the “jewels” in the licensor’s portfolio as these are the patents which have the biggest impact on the essentiality and validity of the portfolio as a whole. Let us therefore decompose this cost into a per patent cost e and the number of “jewels” in the portfolio j so that $E = ej$. Let us further distinguish between the cost incurred by the licensor and the cost incurred by the licensee, defined as e_1, e_2 , respectively. If negotiations fail, then the parties will litigate. Let us define the cost of litigation for the two parties as L . So, if the probability of litigation under this regime is p we have a total expected cost of $(e_1 + e_2)j + pL$ for each negotiation that the licensor is involved in. If there are N licensees, then the licensor can presumably re-use the information (e.g. claim maps) designed for one licensee in subsequent negotiations, so the total cost involved only rises up to $(e_1 + Ne_2)j + NpL$.

Let us now turn to the proposed policy alternative, where some of the patents of the SEP-holders are independently evaluated for essentiality and this independent assessment is made public (or at least is available to all licensees). Define the cost per patent of an assessment as f and the number of patents that are evaluated as S . Again, if there is disagreement, the parties litigate. The probability of litigation is now defined as q . The total cost of this system – for the licensing of one SEP portfolio – is then equal to $Sf + NqL$. The proposed policy therefore dominates the current system if $(e_1 + Ne_2)j - Sf > NL(q - p)$

Consider first a situation where the external evaluators would be asked to assess the very “jewels” that are typically discussed in bilateral negotiations. These “jewels” would be chosen by the patent-holder. Assume that the number of patent submitted is the same as the number of patents for which some assessment would occur in bilateral negotiations anyway, i.e. $j = S$. The condition becomes

$$(e_1 - f + Ne_2)j > NL(q - p)$$

This condition is rather informative. Let us first look at the left-hand side. It seems reasonable that providing the usual “claim maps” is cheaper than obtaining a decent external assessment of essentiality so that $e_1 < f$. This makes the new policy less

One of the companies interviewed mentions that: “For (us) a test by an attorney costs around 1,000 GBP to check essentiality. In a patent pool it may cost 10,000 GBP per patent”, which is broadly consistent with our estimates.

attractive than the status quo. However, based on the orders of magnitude that we have been relying upon, it seems reasonable to have $e_1 = 4,500 \text{ EUR}$ and $f = 9,000 \text{ EUR}$. This means that the left-hand side is positive as soon as $N e_2 > 4500 \text{ EUR}$. With at least five potential licensees, this only requires that licensees would spend at least 900 EUR per licensing agreement in time and resources to assess the essentiality of each of the licensors' "crown jewels". With ten licensees, this number drops to 450 EUR. It seems therefore reasonable to conclude that, for popular standards, the left-hand side of the condition is positive. Now consider the right-hand side. Because the information obtained from independent assessments would be trusted more than the information obtained partly from the patent-holder, it seems that external assessment should decrease the likelihood of litigation, so that $q < p$ and the right-hand side is negative. With the left-hand side positive and the right-hand side negative the condition for the proposed policy to dominate is satisfied. We therefore conclude that, *for popular standards, a policy of having the patent-holders' "jewels in the crown" assessed externally for essentiality would lower the overall cost of licensing compared to the current system.*

The benefits coming from a reduction in litigation can be significant. In the US, total fees for patent litigation range from 900,000 EUR to 5.4 million EUR depending on the amount at stake. Amounts at stake for SEP litigation relating to important standards are not small. In that sense, taking a litigation cost of 3,33M EUR (amount at stake between 1 and 25M). So, if we assume that the policy would reduce the probability of litigation from 0.1 to 0.05 and there are 40 potential licensees, the litigation -related cost savings would be equal to 6.66M EUR, which is enough to pay for a full essentiality assessment for 740 declared patent (families) or for an "intermediate" assessment for 1,480 patent (families). We should add that the figure that we use for litigation costs only refers to the *private* costs of litigation. If we were to add the costs to the judicial system, the total savings would only be bigger.

We have not said anything about who should pay for external assessment. However the previous analysis has some implications as to who should bear the additional costs implied by external assessments. The proposed policy can be more efficient than the current arrangement for two reasons. Firstly, it might reduce litigation. Since there is no a priori reason to assume that litigation costs are higher for one of the parties, we see this as a benefit that is equally shared between the licensor and the licensee. Secondly, the external testing system prevents the duplication of efforts by licensees: once the patents have been assessed, the relevant information is available to all potential licensees without further effort. On the other side, the licensor only saves the one-time investment required to produce the traditional "claim maps"-type of information. It would therefore seem reasonable to propose that, for popular standards – which are those where the policy makes sense anyway – licensees as a whole should bear more than half of the expense and that this share should be larger the more popular the standard is, i.e. the larger the number of potential licensees is. We now turn to a modified version of the proposed policy which might dovetail better with some other proposals – such as the commitment to a total royalty cap –. In this alternative system, external assessors would evaluate the essentiality of a *random sample* of the patent-holder's declared SEP portfolio. The review would then establish the *proportion* of patents in the sample which were found to be truly essential to the standard. That proportion could then be applied to the whole portfolio to provide an

estimate of the number of truly essential patent that it contains. Such an approach would be quite appealing in a variety of contexts. Most obviously, it would be useful for patent pools to assess how the unique royalty that they charge should be allocated between different members. An allocation based on the estimated share of *truly essential* patents would seem to be fairer than one based on patent numbers only. Indeed such an approach would go some way towards convincing patent-owners with stronger SEP portfolio to join patent-pools.⁴⁷

This random assessment would also provide a very useful benchmark if SSO member initially committed to a total royalty-cap or even if the SSO only stated an indicative maximum total royalty stack. This is clearest within the context of a pool where the allocation mechanism just mentioned could be formally implemented. Even if there is no formal allocation of this cap across SEP-holders according to the estimated numbers of true SEP held – as might happen in a pool – the proportional allocation based on random testing would provide a useful benchmark for licensees. Their initial bargaining position would naturally be that a given licensor gets at most a share of the cap equal to its estimated share of true SEPs. It would then be the licensor's job to convince the licensee that the image obtained from the random assessment underestimates the strength of its patents. In doing so, the licensor would be constrained by the threat of litigation as we believe that Courts and arbitrators would be a priori quite favourable to a method of allocation that relies on the independently estimated relative quality of patent portfolios.

Indeed, random assessment of essentiality might also be desirable even in the absence of a committed/indicative cap or a pool. Based on our own experience, the feedback from stakeholders and discussions with economists and lawyers involved in SEP licensing, we believe that licensees commonly try to assess what the "total royalty stack" is likely to be and then use their estimate of this stack as a reference point in bilateral negotiations, where the licensor's "share" of SEPs is then again applied to the "stack" to determine at least a point of departure for further negotiations.

Overall then, because we believe that there is a significant role for patent pools, because we are favourable to commitments on the total stacks and because, as we shall see below, random evaluation of SEPs is also useful in limiting the number of patents that are declared as essential in the first place, *we strongly prefer a system of random testing to one where the patent-holders choose the patents to be evaluated.*

Still, there is one additional issue to consider in a random testing environment: we have to ask how intensive the sampling of portfolios needs to be to provide us with a reliable estimated. There is a rigorous statistical answer to that question. Either a patent is essential, or it is not. Denote the proportion of essential patents in a portfolio of K patents by α . How many of the K patents do we need to test so that the proportion of patents found essential, defined as β is likely to be close enough to α ? Suppose for example that we test 30 patents and find that 30% of them are essential. Using the "normal approximation" approach to the distribution of a binomial sample mean, we would get that there is a 95% chance that the actual proportion of truly essential patents in the whole portfolio is between 27% and 33%. This is quite a good precision so that the method would not expose patent-holders to any considerable risk

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Some authors have proposed similar schemes, where that the result of some "evaluation sampling" would be used to determine the "share of the royalty pot" which should be obtained by a given patent-holder (see e.g. Jorge L. Contreras, "Fixing FRAND: A Pseudo-Pool Approach to Standards-Based Patent Licensing", 79 Antitrust L.J. 47 2013)

of error. Of course, the precision decreases with the number of patent tested. For example, with only 15 patents tested there would only be a 95% chance that the actual proportion of essential patents lies between 25% and 34.5%, a broader interval. Still, overall, these numbers indicate that, as long as patent portfolios are fairly large, only a rather small proportion of the portfolios would need to be tested to give us an accurate idea of what the overall quality of the portfolio is.

The quality and objectivity of the essentiality assessment also matters of course. This is why, when random evaluation was discussed, many stakeholders indicated that it might make sense to have such evaluations conducted by the EPO. Given that, as discussed in section 5.5., stakeholders are also in favour of involving the EPO in the creation and maintenance of SEP data-bases, this would seem like a natural fit.

5.3. The thorny issue of over-declaration

Implementers are unanimous in their opinions that too many patents are declared as standard essential. Indeed, many patent-holders also agree, explaining that this behaviour is dictated both by the desire to avoid charges of patent ambush and by the need to “stake out” a sufficient share of the total royalty stack that licensees end up agreeing to pay. The stakeholders’ opinion is supported by substantial evidence showing that, when rigorously tested, only between 10 and 50% of declared SEPs turn out to be actually essential.⁴⁸ But why would over-declaration be a problem?

A first possibility is that a baseless inflation in the number of declared SEPs simply increases the costs of reaching a licensing agreement. However, the direct impact of the number of SEPs on negotiation costs is not all that clear. For example, if negotiations mostly involve “counting” the patents in the various SEP portfolios to determine the share of total royalties that the owners of these portfolios are entitled too, there would be little reason for licensing costs to increase sharply if at all with the number of declared SEPs. In the same vein, if negotiations mostly involve looking at the licensors’ “jewels”, then the number of these jewels is not affected by including non-essential patents in the portfolio and, hence the costs of negotiations should not be much affected by SEP inflation. In fact, having consulted practitioners on both sides of the Atlantic, we have not been able to obtain any reliable evidence that licensing costs increase significantly if SEP owners over-declare. We conclude that, *per se* the negative impact of over-declaration is likely to be minimal.

On the other hand, over-declaration significantly increases the cost of implementing several of the policies that we have already endorsed. It certainly inflates the cost of linking each patent family to the relevant parts of the standard and to manage the corresponding data-base. It would also lead to a moderate increase in the number of patents that would need to be tested to establish the proportion of essential patents within a given portfolio within a reasonable margin of error. For these reasons, then, there is an interest in considering policies that would limit the number of patents that are declared as essential to a standard. How should this be done?

One approach is to make SEP declaration costly. That this would already be a side effect of requiring the establishment of a link between patent families and the appropriate part of the standard: a cost of \$3000 per family might already lead

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See for example http://frlicense.com/GSM_FINAL.pdf; <http://www.cybersoken.com/file/lte02EN.pdf>; <http://www.frlicense.com/WCDMA%202009%20Report%20for%20Web.pdf>; <http://www.frlicense.com/LTE%20Final%20Report.pdf>

patent-holders to declare fewer of their patents as SEPs. Notice that such a reduction in the number of patents declared would mean that our previous estimates of the cost of imposing such a “linkage” policy were too high since they took the number of patents declared under a regime that does not include such fees as a point of departure. One could of course go much farther and simply stipulate a fee that must be paid for each patent declared as essential. Since the idea is to deter patent-owners from over-declaring, this fee should clearly be paid by SEP-holders. But, do we have any idea of how high such a fee would need to be in order to effect a significant reduction in the number of declared SEPs?

One possible approach to getting a handle on the likely reduction in the total number of declared SEP families would be to rely on the change in patenting behaviour observed at the EPO (and other patent offices) when renewal fees are changed. The current renewal fees vary between E465 and E 1560. The recent increase in such fees is therefore just a fraction of this, so we are looking at “adding a fee” which is much smaller than the amounts that we have in mind (starting with the \$3000 cost of the linkage policy). So, to the extent that patent-holders might react much more dramatically to large additional fees than to relatively modest ones, the changes observed following changes in the PTO renewal fees is likely to *underestimate* the decrease in the number of declared patents that a substantial declaration fee would trigger.

If one relies on published estimates of the elasticity of patent renewal to changes in renewal fees obtained by authors such as Ariel Pakes and Mark Schankerman⁴⁹ such a doubling in renewal fees should lead to about a 20 to 30% decrease in the number of renewals⁵⁰. If we assume that the average patent is renewed for about 10 years, then a doubling in renewal fee (from the lower pre-change levels) would represent a fee increase of about 4,500 EUR. This would suggest that imposing a declaration fee of 9,000 EUR would likely reduce the number of declared essential patents by 50%. The proceeds from these fees could be usefully employed in financing the activities of the SSO. Not only does that mean that SEP-holders would then get back part of the fees that they pay but it might also help ensure broader participation in SSOs as the cost of attending and taking part might be subsidised⁵¹.

However, fees are not the only way of inducing a significant reduction in the size of the SEP portfolios which are declared. A main reason for the perceived “over-declaration” is that, both within pools and in bilateral negotiations, the share of the total number of SEP declared owned by a patent-holder matters. In other words, patent-holders would likely be happy to declare fewer patents provided that other patent-holders do the same. The challenge then is to design a mechanism which gives each patent holder a *unilateral* incentives to reduce the size of his portfolio while ensuring that, in equilibrium, his rivals also reduce their declarations accordingly.

A particular form of such a scheme is investigated more formally in Annex 1. In this system, patent-holders decide unilaterally on the proportion of their patent portfolios

49 Schankerman, M., Pakes, A., 1986. Estimates of the value of patent rights in European countries during the post-1950 period. *The Economic Journal*, 96(384), 1052-1076.

50 To be more precise, one should use the elasticity for renewals fairly early in the life of a patent as, in telecoms at least, a significant proportion of SEPs are actually rather recently obtained.

51 The revenues from the declaration fees would be best redistributed to SSO participants based on the extent of their participation in working groups. For the scheme to be effective, the proceeds from the fees should definitely not be divided based on the number of patents declared.

which they declare as essential. When trimming their portfolio, patent-holders of course retain the patents which are a priori more likely to be essential (and valid). Each declared portfolio is then sampled to establish the proportion of patents which are actually essential. This estimated proportion is what we call the “quality” of the declared portfolio. The official “weight” of the portfolio among all declared SEP is then estimated as a weighted geometric mean of this quality and the number of patents declared. By choosing the weights one can lead patent-holders to declare fewer patents (more weight on quality) or more patents (more weight on numbers). In fact, any arbitrary reduction in the size of declared portfolios can be achieved without having to impose fees. The only costs of the procedures are then the costs of sampling plus the patent-holder’s costs of choosing the patents to actually declare. As one might argue that the second cost must be incurred at some stage anyway, the cost of sampling would be the main item. In this approach, the share of a given royalty stack attributed to each SEP-holder is allocated based on a weighted average of the number of patents declared as essential and the proportion of essential patents revealed by external evaluation of a sample of the declared SEP portfolio. We show that, by varying the relative weight put on these two components, one can incentivise patent-holders to reduce the number of patents declared essential by any percentages that one wishes. The number of declared SEPs is reduced by omitting the weaker patents. Moreover, in equilibrium any arbitrary reduction in the number of declared patents can be achieved without changing the relative shares of patent-holders with portfolios of similar quality.

While such a scheme would work best within the confines of a pool or where a total royalty cap has been committed to, it would also form the basis for a rule that could be followed by licensee to evaluate the various SEP portfolios. Such a rule would get further credibility if it was also considered by the Courts when called upon to determine what FRAND payments ought to be. The advantage of this approach is does not rely on declaration fees and does not involve any additional cost. It should therefore be seen more favourably by SEP-owners.

5.4. Timing of declarations

Maintenance of declarations over time is really important. So maintenance of database is really important to make sure that portfolios of licenses can be assessed sensibly.

Ex Ante specific disclosure cannot possibly identify patents that are truly essential to the yet unknown standard with any precision. This is why, as explained above, we believe that some form of *ex post* specific declaration is needed. To facilitate SEP licensing, such disclosure must occur within a reasonable period of time after the standard has been made public. In this respect, several ICT implementers complain that some SEP-owners (with NPEs particularly singled out) tend to delay their declarations and then bring demands for high royalties once other bilateral licensing agreements have already been reached.

The timing of SEP declarations after the standard has been set involves an unavoidable trade-off. On the one hand, patent-holders need sufficient time to identify the patents that are relevant to the actual standard. If the time given to declare is too short, then patent-holders will fear that they might overlook a valuable patent and will therefore likely over-declare. Moreover, patent-holders might also need time to

provide the kind of link between SEP and sub-sections of the standard that we have discussed above. On the other hand, manufacturers are also eager to have licensing agreements in place as soon as possible as they prepare to introduce their standard-compliant devices into the market.

We would argue that, in the presence of FRAND commitments, one should err on the side of giving sufficient time to patent-holders. This is because FRAND includes a commitment to actually making the protected technologies available to implementers. Refusing to license is not an option. This provides implementers with a fair amount of certainty. As potential licensees know that access will eventually be granted, the cost of delaying licensing negotiation in order to ensure that SEP declarations are accurate seems relatively limited.⁵²

There is however a counter-effect to consider. It is hard for licensing negotiations to begin in earnest as long as SEPs have not been declared. This is particularly true if there was an ex ante commitment to a total royalty stack but this also holds in looser FRAND environment where, in practice, some notion of what the resulting stack might be and how it should be allocated between licensor seems to guide most bilateral negotiations. So late declarations also mean a late start to meaningful licensing negotiations. Once the standard has been set, however, companies' efforts to make their devices standard-compatible begins in earnest. A SEP-holder who only declares quite belatedly will then catch potential licensees in a situation where they have already sunk a significant portion of implementing the standard. In bargaining, large specific sunk costs means low bargaining power and hence a greater ability for SEP holders to extract higher royalties. This would not be much of an issue in presence of an ex ante commitment to a total royalty stack but it might well lead to higher total payments if FRAND is the only guarantee offered by SEP owners.

The stakeholders' feedback raises a second issue: the – possibly wilful – late declaration of SEPs. Is such lateness problematic? The potential harm comes from the enhanced bargaining power that a late SEP declarer might be able to obtain. Such increased "monopoly power" might come from two distinct economic mechanisms: complementarity and hold-up. Consider an environment where SEP-holders are constrained by some kind of "FRAND" commitment, which is vague enough to leave considerable room for bargaining about rate and conditions. Suppose that all SEP-holders but one enter negotiations with various implementers at approximately the same time. In economic terms this means that, for all intent and purposes, all of these licensing negotiations occur "simultaneously". Once these negotiations have concluded, the last SEP-holder begins its own bilateral negotiations. This set up is very similar to that of a very traditional economic problem. A gas company wants to build a pipeline from A to B. The pipeline would go through ten plots of land. The company needs to reach agreements with each of the ten owners in order to be able to build. Suppose that the company has already acquired nine out of the ten pieces of land. Its bargaining position with respect to the last landowner is not strong. The cost of acquiring the first nine pieces of land is now sunk and irrelevant to negotiations so that, as the last obstacle in front of the gas company, the tenth landowner can extract a significant portion of the total profits that the company expects to make from the

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With one potential caveat in case of competing standard-setting bodies: competition between standard-setting initiatives might generate time pressures for both licensor and implementers as delays may affect the chances of success of a standard (although of course no licensing agreement is not equivalent to no implementation).

pipeline. It is precisely to avoid finding itself in such dire straits that a sensible gas company would make its agreements with the previous nine owners *conditional on* reaching agreement with all landowners. The same logic applies with our late licensor. Being last to negotiate licensing agreements would only be beneficial to the SEP-owner if the licensing contracts with other SEP-owners were “unconditional”, i.e. if they implied payment by the licensee whether or not the licensee also reaches an agreement with the last SEP-owner. However, with output-related royalty payments at least, the very fact that all SEPs are strict complements for the implementation of the standard means that the earlier licensing agreements are effectively “conditional” on agreement also being reached with the last SEP-owner: if no agreement with the last SEP-owner can be reached then the implementer cannot practice the standard and hence no payments are due to other SEP-owners either. The last SEP-owner therefore finds itself in exactly the same bargaining position as those who reached licensing agreements earlier...and being last does not confer any strategic advantage.

However, unusually late declaration by a SEP-owner create serious practical problem when there is an ex ante commitment – or at least a strong reference – to a total royalty stack. To see this, compare two scenarios. In the first one, firm A declares its SEPs much later than other patent-holders, but other SEP-holders and implementers are aware that it holds a portfolio of relevant patents and have a reasonable idea of what the value of this portfolio is likely to be. In this case, bilateral negotiations with other SEP-holders can proceed normally as parties realise that some “room” must be made for the royalties that will eventually be due to firm A. Licensees can then also proceed with their product development plans with a good knowledge of what their variable licensing costs will be. Now consider a situation where other market participants are unaware that firm A has SEPs. If firm A revealed its SEPs early, then there would be no problem as all bilateral negotiations would adapt to this new information. If, however, firm A only reveals its SEP-holdings after all other negotiations have concluded, there might no longer be any “room under the cap” to accommodate this newly discovered SEP-owner and reopening all other negotiations to create such room would be prohibitively expensive.

Weighting all of these diverse considerations, *we would recommend that SEP-owners be given a significant of time (several months) to declare. This period should be longer the more extensive the requirements are (link between patents and standard, essentiality tests...).* *If there has been a commitment to a total royalty cap, then there should be a time limit within which SEPs should be declared if they want to be ensured to get some room under the cap. Even in the absence of such a cap, some (looser) time limit should be enforced to ensure that implementers can get an accurate idea of their costs as soon as possible.*

5.5. Standard Updates and Collaboration with patent offices

Even if made in a timely manner, declarations cannot be set in stone. There are various reasons why patents or patent applications disclosed as essential may later be deemed as nonessential: (1) the patent application was rejected, successfully opposed, or abandoned; (2) the relevant patents expired; (3) patents with essential claims were successfully challenged in court, or rescinded on re-examination by the relevant patent authority; (4) the scope of the issued patent was narrowed or modified and no longer contains claims that are essential to the standard; (5) new

technical alternatives have arisen, making it possible to implement the standard without infringing previously declared patents; and (6) the standard itself has evolved to a new version for which some previous SEPs are no longer essential. Conversely, some patents that are standard-essential might appear belatedly as patent-holders were not initially aware of them or because these patents read on later versions of the standard.

Both patent-holders and implementers realise that some mechanism to update SEP declarations is needed. However, the concerns expressed relate to rather mechanical issues such as the updating of a SEP data base, not to a substantial risk of misbehaviour by SEP-holders or implementers.

It seems reasonable to require that all relevant patents that have been granted at the time of the licensing agreement should be listed at the time the initial licensing agreement is struck. New patents reading on the existing standards could then be handled either by including "all relevant future patents" obtained within a specified time-horizon in the licensing agreement or by offering additional licenses *at FRAND terms*. In particular, the licensor would still be obliged to have a *total* royalty – computed over the various agreements with one licensee – which is FRAND-compatible.

A special situation arises for patents covering innovations that were obtained *within the SSO*. These are innovations that some SSO members come up with to "patch" the holes in the standard which cannot be dealt with using existing technology. Given the delays involved in obtaining a patent, the relevant IP protection will likely be obtained only after the initial wave of licensing has gone by. There might however be a fairly simple solution. By definition these are inventions that other SSO members are aware of and which have a high probability of reading on the standard (although validity is of course in doubt). It would therefore make sense to have the relevant innovator reveal either its patent applications or its intent to seek a patent on a given aspect of the standard. There are no reason why such declarations could not be made in time for the (would be) IP to be included in a licensing deal on the basis of the likelihood that the right be granted and valid.⁵³

The thornier issue concerns *updates* of the standard, especially in environment where such updates occur on a nearly ongoing basis. While updates could in principle lead to conflicts between owners of SEPs reading on the "old" and "new" versions of the standard, stakeholders seem to feel that the updating process would already be smoothed quite significantly by having a well-managed, easy to access data base:

"Maintenance of declarations over time is really important. So maintenance of database is really important to make sure that portfolios of licenses can be assessed sensibly"

"The ... database is done in a somewhat messy way. It's not straightforward how and what to declare. Eg if you declare a patent family, you select which project it is for. There is no structure in that. There are perhaps 50 projects for the standard, but it's hard to assign patents to projects. That makes it hard to declare but even harder to get the relevant data out. I do not trust what I get out of the database. The database is not really actively managed."

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There is one additional difficulty however if the innovator has not yet filed an application as disclosure might count as prior art and invalidate future attempts to file for patent protection. This is an issue that the EPO is currently considering.

"Another thing that could be done would be to have automatic updates. Eg transactions, inactivations etc. should be automatically updated. That would help to have better status on the database"

In that respect, most stakeholders were enthusiastic at the prospect of the EPO's involvement in running standard-specific patent data-base as the EPO has immediate access to much of the information needed and is recognised as having considerable expertise in building and managing this kind of database. Further synergies would of course arise if EPO experts were also involved in whatever essentiality tests might be performed.

6. Licensing practices

6.1. FRAND....again

Stakeholder opinions on common FRAND policies embedded in SSO IPR rules are divided. Licensors are unanimously against such a rule, as they perceive that such rules would limit their private right to define commercial policies within the scope of the law. In particular, it is perceived that any rule defined at SSO level might lead to lower effective royalties than would otherwise be rightfully obtainable. Moreover, it is frequently pointed out that FRAND may legitimately mean very different things under different circumstances. Some patent holders therefore consider that a hard general rule would undermine the flexibility of the FRAND system of adapting to case-specific circumstances, while such flexibility could be obtained through ex-post assessments on a case-by-case basis in court (if that should be necessary).

Implementers take a far more favourable view on SSO-based FRAND policies, as this is viewed as providing some protection against unreasonable royalty requests. However, among implementers this view is not held unanimously, as some implementers acknowledge the difficulty of defining an over-arching principle that takes into account all specific contingencies that may arise in a particular licensing context.

Both implementers and patent holders also appear to be somewhat concerned that majorities in different SSOs could be driven by the respective other constituency, thereby imposing the “wrong” FRAND rule on them.

6.1.1. FRAND, Contractual Conditions and the *Huawei* Ruling

As we have explained earlier, The “R” in FRAND is supposed to address the hold-up problem, i.e. the exploitation of an unearned increase in ex post bargaining power. Conceptually then, a FRAND licensing agreement is one that could have been struck ex ante before the standardisation process began.

Suppose that, instead of complex technologies such as telecom semiconductors or optics, the FRAND commitment applied to the supply of salt. Selling salt is a simple transaction which is quite well-defined by the price, the type of salt and the quantities delivered. Even in such a simple case figuring ex post what an ex ante price might have been is a tricky exercise that cannot be conducted with great precision. There would therefore still be a need for some form of conflict resolution mechanism such as arbitration and/or the judicial process. The forms that such conflict resolution mechanisms might take are discussed in section 7.

However, licensing contracts have a significant number of dimensions. Not only do they need to describe the technology licensed and the cost involved, they also specify the field of use, possible grant-back or non-challenge clauses, and provisions dealing with the inclusion of new technology in the licensing deal and so on. Because these clauses can matter a great deal to both licensors and licensees, they can also be used to defeat the purpose of a narrowly conceived FRAND commitment. If, for example, FRAND is seen as a commitment to making the technology available for a reasonable royalty payment, then this commitment can still be undermined by a licensor – or a licensee – threatening to impose other terms that are unpalatable to the other parties.

Unavoidably then, the notion of FRAND needs to be extended to other terms and conditions.

In *Huawei*, the Court made a step in this direction by clarifying that the licensor could not demand that the licensee sign some form of non-challenge clause renouncing his right to later dispute the validity or the essentiality of the patents included in the licensed portfolio. This, however, leaves a lot of contractual dimensions along which the parties can disagree. In the *Huawei* framework, disputes about dimensions would eventually be settled in Court or through arbitration: the licensee would make a complete offer that does not include non-challenge clauses, giving the licensee the choice between agreeing to the offer and agreeing to having the dispute settled through judicial process or – if both parties agree – through arbitration.

The question then is whether SSOs would want to impose more precise rules addressing other dimensions of the licensing contracts to reduce the parties' reliance on conflict resolution mechanisms. For example IEEE has recently expressed a strong preference for contracts where royalty payments are expressed in terms of the "smallest tradable component". Other SSOs have also set (or are considering setting) arbitration mechanisms that would be binding for their members. In other words, SSOs are considering restricting the freedom that contractual parties usually enjoy to find an arrangement that is best suited to their individual needs. Is this a good idea? This question simply cannot be answered in general terms as it is an unavoidable trade-off between preserving flexibility to improve the ex post efficiency of contractual arrangements and imposing some rules to ensure that "other conditions" cannot be used to undermine ex ante FRAND commitments. Accordingly, the rest of section 7 is devoted to a review of specific dimensions of licensing contracts, trying to establish for each of them whether, on balance, flexibility is or is not preferable to SSO-imposed rules.

6.1.2. ND

Though much less discussed in policy circles, a number of implementers complain that the "non-discriminatory" part of "FRAND" commitments could not possibly be enforced given the current lack of information about licensing terms. Stakeholders understand that, given that the precise set of clauses are likely to differ from one licensing contract to the next, "non-discrimination" does not mean that all users should pay exactly the same level of royalties. However, several implementers mentioned either that they were convinced that they did not always get "as good a deal" as their downstream rivals or that, at the very least, not knowing what rivals paid made it much harder to conduct their own licensing negotiation and to make informed decisions about the pricing of their own products.

The main issue here is that licensing agreements often contain confidentiality clauses that prevent either party from revealing the terms of the contract. Confidentiality clauses are common across the board. They are not a specific feature of FRAND licensing. Confidentiality about the terms at which an input is supplied is not in itself objectionable. Indeed, it would seem odd for public authorities to worry about the potentially anti-competitive effect of so-called "most-favoured nation" clauses, where suppliers commit not to sell at a higher price than the lowest price charged to any other input buyer, and then to object to confidentiality agreements which clearly undermine such clauses.

However, *if* policy-makers believe that the commitment to non-discrimination which is part of FRAND has any usefulness, then it would make sense to put some limits on confidentiality agreements. This could, as proposed by several stakeholders, take the extreme form of mandating the publication of SEP-licensing terms and their inclusion in the type of publicly accessible SEP- data-base that we have already discussed. Alternatively, one might want to stipulate that SEP-holders cannot insist on the inclusion of confidentiality clauses just as, per *Huawei*, they already cannot insist on the inclusion of non-challenge clauses. *This latter approach seems less costly, less disruptive and hence, overall, more sensible to us.*

6.2. Patent transfer rules

In recent years, it has increasingly often occurred that patent holders have sold all or part of their SEP portfolios to third parties, such as NPEs. One reason for this has been that some of the previous market leaders in mobile communication markets have lost commercial ground in the handheld market, being replaced by newcomers such as Apple and Samsung. These former leaders today earn significant revenues by licensing their upstream innovations rather than continuing to invest in downstream production. Against this background, it has sometimes been opportune for such pure licensors to sell all or part of their patent portfolios to NPEs or to downstream operators seeking to obtain strong upstream patents for defensive cross-licensing purposes.

A potential problem with such sales can arise when the purchaser of the patent portfolio may not feel bound by FRAND commitments given by the previous owner, instead opting to charge substantially higher royalties.

All stakeholders, including patent holders, generally agree that prior commitments should bind new purchasers. Some stakeholders, however, have voiced concerns over liability and enforceability of transferred commitments due to differing national laws. This claim has been disputed by other stakeholders, who have suggested that such problems can easily be handled through appropriate contractual provisions.

Parties also differ in their evaluation of whether in addition to the FRAND commitment, new owners should also be bound by the particular way in which the prior owner had interpreted FRAND. Some implementers have additionally suggested that new owners should never be able to charge more for the same patent than the previous owner did or announced that they would.

Preliminary evaluation

In our view, a FRAND commitment is not worth much if an SEP can be sold without transferring the commitment. For this reason, we believe that FRAND commitments should generally also bind new owners after the transfer of a patent. We also note that transfers of commitments also routinely exist in other contexts (e.g. real estate sales), suggesting that there must be practical solutions to the legal difficulties mentioned by some parties. Overall, then, we see no reason why SSOs should not impose rules that oblige members to transfer commitments.

Such rules do not of course resolve all possible conflicts. In particular, some acquirers of FRAND-committed SEPs have argued that “since FRAND is a range” the fact that they might charge higher rates than the original owner of the SEPs does not necessarily imply that their offering is not FRAND. While we do not think that the feedback from stakeholders, the available evidence and the available literature on the

subject give us a strong enough basis to make a recommendation on this aspect of FRAND-transfer, we still find it useful to mention two factors that should put some limits on the acquirer's ability to claim that "this is FRAND anyway". The first factor is that it is actually not quite clear why FRAND should be a "range". Presumably, if negotiations had indeed taken place *ex ante*, a single rate would have been chosen for any combinations of licensing clauses. In other words, while there might be a set of FRAND rates corresponding to different combinations of licensing conditions, the FRAND rate for a given set of conditions should be unique and should therefore be the same before and after the transfer took place. The second factor is that *ex ante* FRAND commitments are also there to enable implementers to form reasonable expectations as to what the total cost of implementing the standard might be. Even if there were good reasons for different SEP-owners to charge different rates and even if – something that we doubt – there were good reasons for considering each of these rates as "FRAND", the implementers' expectations would have been partly based on the identity of the firm making the initial FRAND commitments as well as on the other informal declarations that this firm would have made about this commitment. A transfer that goes against these reasonably formed expectations and leads to higher rates might then possibly be seen as effecting a mini hold-up of its own.

6.3. Portfolio licensing

6.3.1. Feedback from Stakeholders

In practice, patent holders usually do not license individual patents but an entire portfolio of patents to licensees. On the one hand, such portfolio licenses are clearly efficient in that they substantially reduce transaction costs for both licensors and licensees. On the other hand, there is a concern that patent holders might combine SEPs and non-SEPs in such portfolio packages, which might potentially permit circumventing FRAND obligations and exploiting *ex-post* market power generated through the inclusion of SEPs in the standard.

Similar concerns about transfer of market power from one set of patents to another can arise in complex cross-licensing negotiations, where the reciprocal nature of interaction makes it difficult to verify whether a given licensing offer is still compliant with FRAND obligations.

Contrary to a number of recent or ongoing antitrust cases, notably in China and South Korea, where authorities have complained about the potential anticompetitive effects of "bundling" SEPs and non-essential patents together, the feedback that we received from stakeholders does not indicate that this is a major issue. Not only have we failed to encounter a SEP-holder who does not claim to always be ready to make separate offers for licensing SEPs separately from non-SEPs, but implementers themselves seem to appreciate the efficiencies of portfolio licensing as long as they are satisfied that they have enough information about the content of the portfolio. To use a typical quote:

"(Our company) has been in 73 cases of alleged infringement. In 72 cases validity has been partially or fully dismissed by court. So, a special problem with portfolio license, is that crap is put in there. But we also see that portfolio licensing has practical advantages. Portfolio licensing is great to avoid patent stacking, but only if we have greater confidence in the portfolio of SEPs."

Some implementers also emphasise the greater flexibility offered by portfolio licensing as an agreement can be written not only for the current SEP portfolio of the licensor but also for any future addition to this portfolio. As one respondent put it:

"Portfolios are not a collection of patents. They are dynamic. There are new features and patents. Portfolio licenses allow dynamic adoption and then implementers have peace of mind. People do not want to find out that they have to come back the next day to get new licenses"

6.3.2. Our Assessment

Even though the feedback received clearly indicates that portfolio licensing is well accepted and is not generally seen as a threat, it is worth briefly reviewing the possible theoretical basis for being concerned about the possible bundling of SEP and non-SEPs in licensing agreements.

From an economic perspective, tying is often unproblematic and valid theories of harm are hard to substantiate in practice. In particular exclusionary theories of Harm (such as in Whinston, 1990⁵⁴ or Carlton and Waldman, 2002⁵⁵), which have been used successfully in cases such as *Microsoft* would appear to be of little relevance for SEPs. Carlton and Waldman describe a mechanism where dominance in one market is used to weaken rival in another markets *because a rival from this second market could eventually challenge the firm's dominance in the first market*. Translated in terms of licensing, a SEP-holder would bundle SEPs and Non-SEPs in order to weaken non-SEP holders because those non-SEP patents pose a threat to the dominance of the SEPs. This makes little sense. The story told by Whinston differs in that the benefits from bundling are reaped in the market where the tying firm is not dominant: by committing to tying its dominant product with another product, the dominant firm credibly commits to price aggressively in the market for the more competitive product, forcing rivals in that market to exit or to give up on plans to enter that market. Let us again translate this in terms of SEP and non-SEP bundling. By bundling SEPs and non-SEPs, the patent-owner would credibly commit to pricing the non-SEPs quite aggressively...inducing the exit or lack of entry of rival non-SEP owners? How does one induce the "exit" of an existing rival patent? As for deterring entry, would a rival firm really decide to change its current R&D program because it thinks that a rival with patents on substitute technologies might have SEPs and bundle these with the non-SEP patents? This seems implausible.

The only analysis of tying that applies directly to FRAND-encumbered IPRs is that of Layne-Farrar and Salinger (2015)⁵⁶. Their concern is that bundling SEPs and non-SEPs together might allow the patent-holder to evade his FRAND commitment on the SEPs. They show that this issue does not arise as long as the patent-holder makes a "mixed bundling" offer, i.e. as long as potential licensees can get both an offer on the SEP-non-SEP bundle and a separate offer on the portfolio of SEPs only. Matters are less straightforward if the licensor only makes an offer on the SEP-Non-SEP bundle. While such "pure bundling" does not imply that the rand commitment on SEP is necessarily violated, the SEP-specific royalty used to assess whether the FRAND obligation has

54 Whinston, M.D., 1990, "Tying, Foreclosure and Exclusion", *American Economic Review*, 80, 837-859.

55 Carlton, D.W. And M. Waldman, 2002, "The Strategic Use of Tying to Preserve and Create Market power in Evolving Industries", *Rand Journal of Economics*, 33:2, pp. 194 – 220.

56 Layne-Farrar, A. and M. A. Salinger, 2015, "Bundling and Rand-Committed Patents", SSRN 2585528.

been fulfilled cannot be computed by simply deducting the stand alone value of the non-SEPs from the royalties demanded for the whole portfolio. Assessing whether the FRAND commitment has been met does therefore become more difficult in practice.

Overall, then, *given the relaxed attitude of most stakeholders and the lack of strong theories of harm, we conclude that there is no need for SSOs, or anybody else, to impose rules regarding the bundling of SEPs and Non-SEPs. However, as SEP-holders claim that unbundled offers are always available in principle at least, there would be little harm in requiring that such unbundled offers be made if requested by the potential licensee.*

A similar reasoning can be applied to the issue of the cross-licensing of patent portfolios. The concern here is that, if part of the “payment” for accessing a FRAND-encumbered portfolio is granting reciprocal access to another portfolio, determining whether the licensing occurs at FRAND terms also requires valuing the portfolio which is given in “part exchange”. While this issue has had some prominence in the early debate about SEPs, FRAND and competition Law, very few of the respondents to either the consultation or the interviews mentioned it at all. Participants in our workshop stated clearly that they do not see cross-licensing as a problem. If anything there is a feeling that it can considerably facilitate negotiations.

Clearly, cross licensing cannot be a concern if it only involves portfolios of SEPs. In order to implement a FRAND commitment on each of these portfolios, one must have an idea of what a reasonable “cash-only” rate would be. But if one knows such a cash value for each of the portfolio, then it is also easy to check whether the cross-licensing agreement itself occurred at reasonable terms: it should include a net payment equal to the difference between the cash-only FRAND rates of the two SEP portfolios. Hence, very much as with SEP-non-SEP bundling, there can only be a problem if the cross-licensing involves both essential and non-essential patents⁵⁷. In this case, recommending or requiring that a cash-only offer be at least available on request is the equivalent of asking for a mixed bundling offer.

6.4. Patent pools

Patent pools typically charge a single overall royalty to licensees seeking access. The patents in the pool are then centrally marketed, which reduces transaction costs for both the licensors, who do not have to duplicate the effort of finding firms that need to obtain a license and for the licensees who benefit from “one-stop” shopping⁵⁸.

Patent pools are widely considered to work well among stakeholders. However, many stakeholders emphasize that so far only a small minority of technologies has been successfully licensed via pools. They also point out that pools rarely involve all SEP-holders. This attribute this lack of complete participation to two main factors. Firstly,

⁵⁷ If a SEP-owner asks for a license to a portfolio made only of non-SEPs, the transparency of the FRAND commitment is preserved since the value of this non-SEP portfolio can presumably be assessed.

⁵⁸ Notice that the total number of transactions is reduced even if one takes into account the need for patent holders to agree on a single royalty. Suppose that there are M patent-holders and N potential licensees. Without the pool, there need be $M \times N$ bilateral negotiations. With the pool, there are N negotiations between the pool and the licensees plus the internal negotiations between licensors to agree on a rate or at least on rules that the pool management would follow to reach agreements. In the worst possible case where each licensor would have to negotiate bilaterally with each other licensor, this would add $M \times (M-1)$ bilateral negotiations. The total number of transactions is then $N + N \times (M-1) = M \times N + (N-M)(1-M)$ which is lower than without a pool as long as there are at least as many licensees as licensors. Moreover, the art of pool management is precisely to avoid needing $M \times (M-1)$ bilateral negotiations between pool members so that, in most realistic settings, a pool does save on the total number of bilateral negotiations required.

potential pool members differ significantly in the quality – or perceived quality” of their patent portfolios. Unless the poor devises sharing rules that take such differences into account, the SEP-holders with the stronger portfolios prefer to keep licensing separately. Secondly, even if there is agreement about sharing, pool members might disagree as to what would constitute the “right” royalty to charge for access to the pool.

These two points deserve some elaboration. In order for pools to device sharing rules that adequately reward high quality portfolios, some objective valuation of SEP “quality” is needed. We have already discussed in section 7 the advantages and costs of having independent evaluations of the essential character of declared SEPs. The same analysis applies here. In particular, one would think that a scheme involving the testing of a random sample of each pool member’s portfolio would be the most efficient manner to proceed. Moreover, to avoid having to deal with too large a total number of declared SEPs, a patent pool could easily rely on the type of sharing rule discussed in Appendix 1 since, as we have shown, such a rule can be device to effect any arbitrary reduction in the total number of declared patents without affecting the relative quality ranking of the declared portfolios. There is an added difficulty however: the relative “quality” of a declared SEP depends both on its essential character and on the probability that the patent would be found valid in Court. In order to apply a sharing rule that fully reflects quality differences, one would therefore have to test not only essentiality but validity for a sample of patents. This can increase the cost of the procedure quite significantly. Therefore, without the use of incentive schemes limiting the number of declared SEPs, fine-tuned sharing rules that would ensure the greatest possible participation in a pool might be prohibitively expensive.

The divergences between the incentives of pool members can also make finding an agreeable single total royalty problematic. Assume, to begin with, that the SEP owners are not involved in the downstream market, i.e. there is a strict separation between SEP owners and implementers. SEP owners would then agree to set the total royalty rate at the level that maximises their joint profit. As we know from our discussion in section 3, this is also the level that eliminates the “royalty stacking” problem completely. Now introduce an additional pool member who is also an implementer. Indeed, assume that it is the only implementer. If the total royalty increases, this implementer has to pay this increase while only getting part of the increased proceeds as a SEP-owner. This new member would therefore prefer to have a total royalty set equal to zero. In the same vein, it should be clear that any member of the pool who is “more an implementer than a SEP-owner” would favour the lowest possible royalty while any member who is “more of a SEP-owner than an implementer” would prefer to have the jointly profit-maximising royalty. Having a broad mix of SEP-oriented and implementation oriented SEP-owners within the same pool is therefore difficult. Now, introduce some pure implementers. Those firms of course do not belong to the pool but their presence affects the incentives of the implementers in the pool. This is because an increase in the total royalty increases the costs of these outside implementers relative to the effective cost of the implementers who are part of the pool (since these get some of the cost back as licensing revenues). Raising the relative costs of downstream rivals is attractive since it reduces the intensity of downstream competition. So, as the number of implementers outside the pool increases, some of the implementers within the pool switch to preferring to set a significant royalty.

Overall then, the likelihood of finding an agreement between pool members about the level of the total royalty depends crucially on the distribution of SEP-holdings between NPEs and practicing entities but also between different types of practicing entities. This implies that, *even if the pool could design a sharing scheme that reflects accurately the relative quality of its members' portfolios we should not generally expect that all SEP members would agree to join the same pool.*

We therefore conclude that, while pools are a potentially powerful arrangement that can limit or even resolve the stacking issue and can save on transaction costs, they are not a panacea. Moreover, since pools involve significant set-up costs, they can only be a realistic solution for standards that are expected to be successful enough. Accordingly we do not recommend that SEP-holders be required to join a pool, even for very profitable standards. However, it would make sense for SSOs to at least *encourage* the voluntary formation of pools, maybe by appointing a pool management company early in the process and giving it a mandate to try to gain the interest of SSO participants.

6.5. The royalty base and the “vertical level” of licensing

Recently, the IEEE changed its rule to strongly recommend the use of the “smallest tradable component” as a base for computing royalties in SEP licensing. Moreover, several jurisdictions (some US Courts, China, and Korea) are in the process of setting rules – or at least judicial precedent – on the topic. Because of this recent spate of activity, several stakeholders mentioned the royalty base as a dimension of licensing that should be discussed.

The majority of the respondents who spontaneously raised the issue felt that the choice of a royalty base was an aspect of licensing contract that was best left to the parties. Still, some implementers expressed a strong preference for regulating – or at least strongly guiding – the type of royalty based used in SEP licensing contracts. However, different implementers hold different views in this respect. Confirming their publicly held position, some large ICT implementers complained that allowing royalties to be paid on the total sales of the relevant devices amounts to a “tax on the implementers’ innovation”. By contrasts, some implementers from outside the ICT sector found it odd that SEP holders requested the same total payment for a range of products despite the fact that the retail price of these products could differ by a factor of five or more.

Some implementers from sectors outside of ICT, where standardised technologies have so far had less importance, were also taken aback by the demand from ICT SEP-owners that the royalty be charged directly to the producer of the device that was sold to final consumers. Managers in these implementing firms explained that, since they rely of hundreds if not thousands of suppliers to deliver thousands of components, they are used to relying on each supplier to settle any property right licensing that is required and deliver the components “free of IP issues”. This seems efficient since most upstream suppliers are specialists with good knowledge of the technologies that might read on the component that they produce. Moreover, since these specialists often supply more than one downstream producers transaction costs would be minimised by having clear the rights once rather than requiring each downstream firm to get a license for each component.

6.5.1. The royalty base

Our assessment of this issue relies on simple, fundamental economic principles. The first principle is that a given total payment from an implementer to a SEP owner can be expressed in terms of a broad base (with a low rate) just as well as in terms of a narrow base (with a high rate).⁵⁹

The second principle is that, in terms of economic efficiency, it is in fact better *for both parties* to choose a base which is closely related to the part of the final good's value which is affected by the technology included in the SEPs. Hence, if one believes that telecom standards "enable" most of the smart phones functions valued by the consumers, then a broad base is called for. By contrast, if one feels that most of the phone's functionalities would still be greatly valued in the absence of better telecom standards, then a narrow base would make more sense.

The fact that the efficient choice of royalty base depends on the characteristics of the products involved is even clearer if one compares smart phones – where telecom technologies do appear to influence a number of important functionalities – to other industries such as car manufacturing. While the importance of wireless technology has increased dramatically (think satnav, remote control of several functionalities), it would be rash to argue that SEPs reading on standards like 2G, 3G or LTE contribute to a very substantial share of the value that consumers place on specific cars. It would then seem to make little sense to base royalty payments on anything resembling the "whole value" of the cars.

In economic terms, therefore, there would seem to be little sense in mandating the type of royalty base that should be used in SEP licensing. In particular, imposing a "smallest tradable component" rule would be hard to justify. It is true of course that the Commission has never officially supported such a rule. However, given that other jurisdictions – and some SSOs, seem to be moving in this direction, further clarification and communication by the Commission on this question may be useful.

6.5.2. The vertical level of licensing

Because of the doctrine of patent rights exhaustion, IP owners must choose the level of the vertical chain at which licensing occurs. So a SEP owner cannot license its technology to a chip maker and then also require companies making devices which include the chip to obtain their own licence. So, are there any reasons to favour licensing at one level rather than the other?

On this issue, there is a fairly clear split between SEP holders and implementers. Not surprisingly SEP holders are keen to keep their options open and therefore favour a "live and let live" approach which lets them choose the vertical stage at which their SEPs get licensed. By contrast, many implementers seem to find a system where licensing occurs as far upstream as possible (e.g. to chipmakers) more advantageous. The more cogent argument in favour of the SEP-holders' position relies on the fact that IPR-holders traditionally have the right to discriminate by field of use. SEP holders should therefore be able to discriminate based on the type of devices in which the chip

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Unfortunately, the consensus seems to be that, with the US jury system, this principle apparently fails: juries are simply reluctant to grant high royalty rates so that the total payments awarded tend to be smaller if the discussion can be couched in terms of a narrow base. Hence implementers favour a narrow base while SEP holders argue for a broad one. There are of course no reason for the Commission to take this type of considerations into account as the European judicial systems do not rely on juries to decide patent cases.

which incorporates their SEPs is included. While one could in principle think of a system where SEP licensing occurs at the chip-making level and chip-makers pay different rates depending on the products of their downstream clients, such a scheme would be critically undermined by arbitrage: tracking chips and their actual use is just too hard. A second argument arises when, as seems to be the case for smart phones, major SEP owners hold both patents which read “on the chip” and patent which read on other aspects of the final product. In such a situation, there might be significant “one stop shop” benefits from licensing only the manufacturer of the final device.

Implementers also offer two main arguments to justify their preference for licensing high up in the vertical chain. The first argument is essentially indistinguishable from the implementers’ position on the issue of the royalty base: if licensing occurs at the chip-making level than, it is argued, the “natural” royalty base is the value of the chip itself. Since implementers tend to favour such a narrow base anyway, they also prefer licensing to occur as far upstream as possible. A second, more novel, argument emerges strongly from the concerns expressed by implementers outside of the telecom sector. As already mentioned above, other users, such as car manufacturers or makers of industrial robots for example, increasingly include remote digital feature into their products and this requires conformity with some standards. However, these “digital” components still represent a small share of the value of the end product and, importantly, the implementers have little expertise in the related technical fields. Indeed, precisely because their own products involve the assembly of a large number of components that can come from very different technological areas, these manufacturers have long relied on a business model where they expect their component suppliers to guarantee that they have acquired access to all relevant intellectual property rights. Such businesses find it very hard to suddenly have to deal with telecom SEP holders who insist on licensing directly to them rather than to their suppliers. They feel that they simply do not have the expertise required to ensure that they can obtain a fair deal.

Since there is little serious economic analysis of this “vertical” issue, our own assessment is per force rather tentative. Still it seems to us that the SEP-holders’ “field of use” argument and the difficulties that licensing the end user creates in several non-telecom industries both deserve serious attention. At this stage, we believe that it would be premature for the Commission to take a position on this issue. Indeed, as the balance between the different factors just discussed is likely to be very specific to particular sectors and particular standards, it is not clear at all that any kind of overarching rule would be useful. One can however offer two guiding principles that Courts might use when determining whether a licensor’s insistence on licensing at a specific level of the vertical chain might be seen as a breach of FRAND commitments.

A first guiding principle relates to discrimination by field of use. Specifically, one should consider whether licensing upstream does in fact significantly affect the licensor’s ability to discriminate by field of use. For example, if the chips used in cars are the same as the chips used in smart phones, then licensing chip makers makes it difficult to charge different rates (corresponding to different value added) for use in phones or cars. In this case, one might think that the efficiencies which stem from the ability to charge royalty rates that reflect the contribution of the licensed technology in each of its use would trump the practical difficulties that downstream licensing create for some manufacturers. On the other hand, if the chips used in different sectors

differ, then there is little efficiency loss in licensing upstream and insisting on licensing the final manufacturer would be harder to understand.

A second guiding principle would be that the level of licensing should also aim at minimising transaction costs. If, for example, SEPs read on a car component which is produced by two main companies and then shipped to dozens of car manufacturers who have to deal with thousands of components, negotiations and enforcement costs are clearly minimised by licensing the component manufacturers rather than the final users. Combining our two criteria, then, licensing upstream would seem to make sense when upstream suppliers are relatively more concentrated than downstream users and do not sell similar components to very different types of users

6.6. SSO policies on dispute resolution

6.6.1. Arbitration and the Courts

Even with additional policies in place to increase the transparency standard-setting process and smooth the process of SEP licensing, disagreements between licensees and licensors are bound to arise. This should not be surprising. As long as FRAND commitments – and the implied obligation to make the standard-related technologies available – are a mainstay of SEP-licensing and remain ill-defined, there will be licensors and licensees that feel that the other party is trying to impose unjustifiable licensing terms. When all else fails, Courts are the only authority that can “put content” into the notion of FRAND and determine whether commitments have been honoured or not. Moreover, even in the absence of FRAND commitments, Courts have the last say in ruling whether patents are infringed and/or are valid. So, the Courts will always remain the dispute resolution mechanism of last resort.

Judicial recourse can of course be complemented by other institutions. In certain SSOs and consortia (or in, patent pools), members have tried to achieve faster, cheaper and potentially more effective resolutions of licensing disputes through the use of private mechanisms such as mediation and arbitration, hoping that such “private courts” can arrive at sensible solutions at lower transaction costs and in a shorter period of time.

Stakeholder opinions on alternative dispute resolution mechanisms are divided. While the majority of respondents seem to be favourable to the introduction of arbitration mechanisms, few appear ready to support making them mandatory. Stakeholders also express reservation about the very idea of relying on arbitration at all. Given the danger of hold-out as well as hold-up, both implementers and licensors are concerned about whether their rightful interests will be legally protected if need be. Among some stakeholders, there is a perception that mandatory internal dispute resolution mechanisms may deprive them of their legal right to go to court. There is also a perception that, while arbitration – for example – might be well-suited to resolve conflicts about the level of royalty-payments, it is ill-equipped to deal with other, more complex, contractual clauses and should definitely not usurp the role of the Courts in establishing infringement and/or validity.

6.6.2. Our Assessment

It is worth remembering that, for good or for ill, the recent EU investigations into SEP licensing and the General Court’s decision in *Huawei* have shifted the balance of power between licensors and licensees within the judicial process by restricting the licensors’

ability to obtain preliminary injunctions. At the same time, some US judges have recently tried to develop a more systematic – and hence a more predictable – approach to determining what FRAND royalty levels (and conditions) might be in specific cases. In particular, judge Robart⁶⁰ has tried to adapt the traditional list of criterion based on the well-known *Georgia Pacific* case⁶¹ to the special case of FRAND-encumbered SEP licensing. There are therefore reasons to believe that as these decisions are applied, clarified and expanded over time, the Court's dealing with FRAND-related disputes is likely to become more efficient. In our opinion, this argues for not tinkering significantly with dispute-resolution mechanisms at this time. We would therefore not support the introduction of mandatory arbitration procedures.

However, we believe that there is a role for mediation in helping resolve at least the simpler SEP licensing disputes, where the main issue is the level of royalties demanded. There are two important caveats to this endorsement though. The first one is that one needs to choose the right kind of arbitration. The right kind of arbitration is one where the two parties have incentives to defend reasonable rather than extreme positions. Put slightly differently, a good arbitration procedure should give incentives to reveal some of their "private" information about what a FRAND deal actually is.

Let us use a pure royalty dispute as an example. There are several traditional forms of arbitration. In "High-Low" arbitration, each party proposes a level or royalty and the arbitrator is free to choose any level within these two bounds. The incentives properties are poor as the parties have no incentives to show any restraint. The licensor, for example, is better off asking for an implausibly high royalty since offering something lower only reduces the chances that it might benefit from a very favourable decision by the arbitrator. Correspondingly, a licensee would clearly want to offer an implausibly low rate. The scheme also fails to give the arbitrator strong incentives to work hard on the case as there is a strong temptation to "take the average" of the parties' proposals.

So called "baseball" arbitration is more attractive. In this approach, each party makes a proposal and the arbitrator can only choose one of them. Each party has therefore an incentive not to overstate its case as there is a trade-off between trying to "push the envelope" and the probability of prevailing. Also, since the arbitrator will have to justify why one offer was chosen over the other, it is reasonable to expect that the issue will be given some thought. In a modified version often called "night baseball", the offers made by the parties are not revealed to the arbitrator who then chooses a royalty level based on his/her own independent assessment of the case. The chosen royalty level is then the parties' offer that is closest to the arbitrator's choice. This third approach has the additional benefit of forcing the arbitrator to conduct a fully independent evaluation of the case.

The second caveat is that the result of licensing arbitration is often kept private. This is a drawback compared to the recourse to the Court system which eventually leads to the construction of a coherent jurisprudence that can guide later licensing negotiations. We would therefore recommend that, if a SSO invites its members to use arbitration procedures, the results of such arbitrations should be made public and included in the type of database that we have already discussed.

60 *Microsoft v Motorola*. W.D. Washington District Court.

61 See Annex 4 for a list of the *Georgia Pacific Criteria* and Judge Robart's approach to them.

7. A Coherent set of policy proposals

Having examined, in sections 5 and 6, the pros and cons of a number of individual policy interventions suggested by the consultation exercise, our further interviews and the literature we now discuss how some of these policies might be articulated in order to form a coherent reform package. We begin by describing and (briefly) justifying the type of system that we have in mind, following the same “chronological” approach that was used in section 3. We then explain why we think that the proposed “system” would have a good chance of addressing (if not fully resolving) a number of the issues identified in section 3. Once the internal logic of our policy proposal is clear we then turn to the important practical issue of how such a package might be made palatable for all parties.

7.1. A proposal

At the start, it is important to remember that the disputes that have marred the standard-setting process in some subfields of ICT are atypical, both historically and in terms of the sectors involved. It remains true today that the overwhelming majority of standard-setting efforts operate reasonably smoothly and are not in need of any further intervention from public-policy makers. On the other side, it appears likely that the emergence of the “internet of things” is likely to spread the conditions that have triggered the current wave of disputes and controversies to a much larger number of sectors. This makes the case for intervention more appealing: first, some relatively simple policies might help this crucial standardisation exercise to run smoothly and avoid the disputes and controversies that have recently marred standard-setting in some parts of the ICT sector. Second, the internet of things will also greatly extend the number of sectors that will have to participate in the determination of standards or, at least, obtain the relevant licensing rights to implement the required standards. Ensuring that the standard-setting and SEP licensing procedures are simple, transparent, economical and are perceived to be fair is therefore even more crucial than in the recent past.

In this proposal, we try to strike a balance between these two considerations by distinguishing between two types of sectors of activities and two types of standards. Sectors of activities are distinguished by their *complexity* and their *patent-intensity*. As explained at the beginning of this report, complex industries are those where a large number of components must be assembled in order to make a product that can be sold to the final customer. They include sectors such as telecoms and information technologies. Patent-intensive industries are those where a significant portion of the technologies that might be needed to achieve standardisation are protected by patents or other IPRs. These include some complex industries like telecoms but also industries like pharmaceuticals, where each product is covered by relatively few patents but patents are used to protect that vast majority of innovations. We will call sectors that are both complex and patent-intensive “problematic sectors”. These are sectors for which a number of reforms should be considered. Other sectors are labelled as “unproblematic” and, therefore, not in need for further policy intervention. However, for the sake of harmonisation, we will still identify a “minimum” package of policy rules that might also help such sectors slightly and would at worst be rather innocuous.

We categorise standards as a function of their likely “importance”, where importance is a function of the likelihood of adoption and of the overall value of the business transactions that would be affected by the standard. So called “valuable” standards are those for which further regulation might be both useful – as they affect a significant part of the economy – and affordable – as the higher costs from more regulations can be spread about considerable royalty income for licensors and a significant improvement in sales for implementers.

It should be clear at the outset that this section only presents a coherent set of proposals. Even though we believe that this specific bundle of policies is attractive, we do not mean to provide strict guidance to public policy-makers as to what their chosen package of reform should necessarily look like. What we do want to insist upon however is that, there needs to be some internal consistency in the sense that the various measures should combine to address the main problems discussed in this report without overly increasing the burden of both SEP-holders and potential implementers. Any proposal for policy reform should therefore be seen as a “package” which cannot be modified in a piece-wise manner without jeopardising its effectiveness.

7.1.1. Valuable Standards in Problematic Sectors

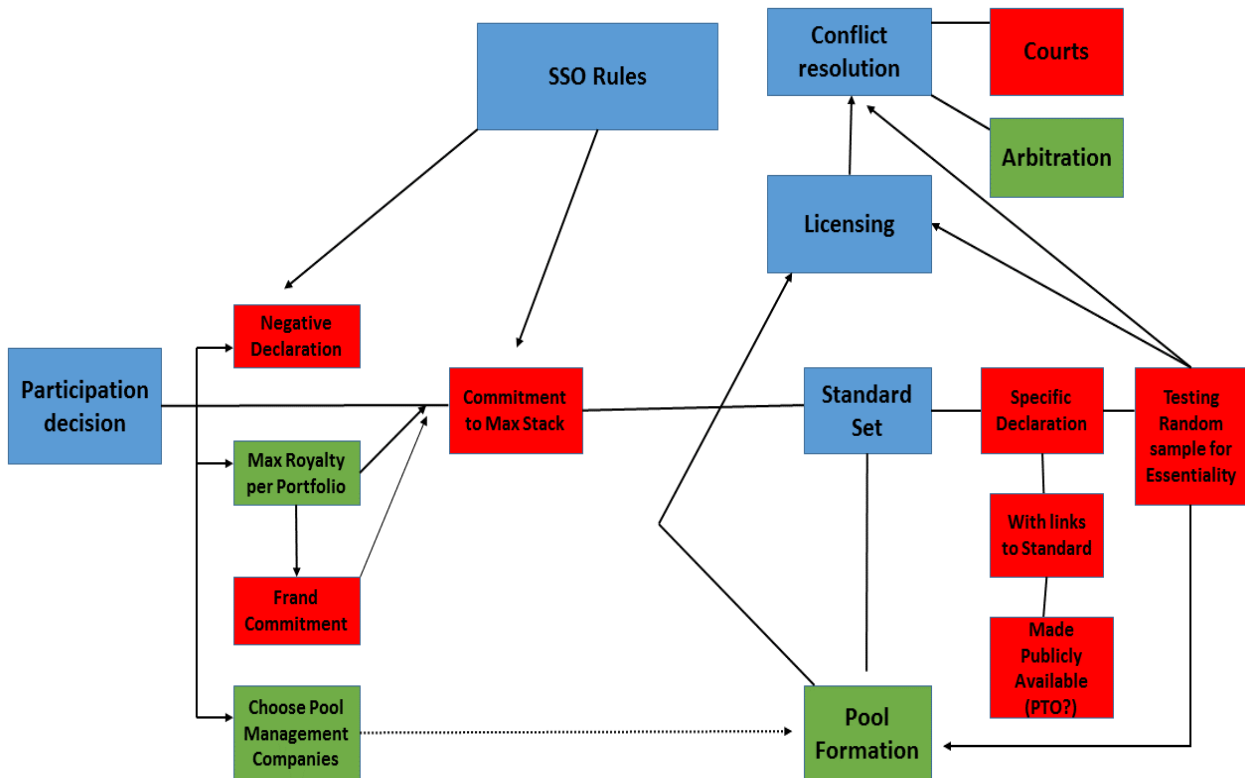
(Potentially) problematic sectors are sectors where standards involve the combination of many patented technologies held by a variety of actors. Broadly speaking then, these are the “complex” and “patent-intensive” industries we have referred to in this report. Clearly the most prominent example of such a sector currently is the ICT/smart-phone sector, where most open disputes have been concentrated. However, other sectors such as optics, or medical equipment also have features likely to make standardisation efforts and the subsequent licensing of SEPs difficult. Moreover, the gradual emergence of the “Internet of Things” is likely to draw many currently “non-problematic” sectors into choppy waters.

Our proposal is illustrated in Figure 3 (red = highly desirable; green = to also be considered). This figure adopts the same chronological ordering as Figure 1 in section 3.

We do not have specific proposals about the phase which comes before the identification of the need for a given standard. This does not mean that this phase is not important. Without sufficient incentives for firms to invest enough in research to produce a set of technologies on which SSOs can rely, the whole standard process would be stillborn. Moreover it might well be that, once other policy changes are implemented, some policy intervention aimed at maintaining incentives to innovate in the kind of areas that support standards might be necessary. For example, if other policy changes prove onerous to SEP-holders, some ex ante R&D subsidies or some ex post subsidies for technologies that are indeed included in the standard might be useful. We will briefly return to such considerations in section 7.3.

So we start at the point where the need for a standard has been widely recognised and a SSO has offered to see the standardisation effort through. It is at this stage that the SSO can set a number of rules to which participants must subscribe. The first set of rules concerns IPR declarations and FRAND commitments. While, as we have discussed above, declarations and commitments can in principle be separated, we are in favour of tying them to each other. In particular, we would suggest that SSO

participants should be required to make a *negative Ex Ante Declaration* of their patents and patent applications, with the understanding that all IPRs which are not singled out for exception are available on FRAND terms.

Figure 3: Illustration of Proposed Policies

This leaves us with the thorny question of “what is FRAND”? While we do not have anything to add to the conceptual debate on this issue, we believe that the meaning of FRAND can be clarified for practical purposes. We would proceed in two stages. Firstly, IPR owners might be invited to voluntarily declare a maximum royalty rate at which their IPRs would be licensed if they were to actually read on the chosen standard. In order to decrease transaction costs at this stage, and to be consistent with negative declaration, these maximum rates would apply to the portfolio of patents held by each SSO participants, under the understanding that the quoted royalty rate only applies to licensing agreements restricted to the implementation of the standard. Furthermore, these royalty rates should be seen as maxima which are unlikely to apply in practice as most IPR holders will only see a modest proportion of their potential SEPs turn into actual SEPs. If, for some reason, such portfolio-based maximum rates were not forthcoming, then one would return to the current requirement that individual rates reflect what could have been charged *ex ante*, i.e. before a particular piece of IP was included into the standard.

To complete the “royalty commitment” picture we propose that, maybe after an initial period of early work to allow parties to get a better idea of the costs of the task ahead and of the type of IPRs on which a standard might rely, SSO members would agree on a *maximum total royalty* to get access to all IPRs which were not singled out for

exception and end up reading on the standard. This ceiling on the cumulative royalty would have the same nature as a traditional FRAND Commitment on individual royalty rates: it should reflect the ex-ante value of the standard, i.e. the value of the standard at a time where rival standardisation efforts could have been undertaken if the total royalty declared was judged to be excessive. As discussed previously, such a total royalty declaration can be helpful even if it is not seen as legally binding. As we have also seen the SSO itself would be best placed to make such an early declaration but this would require unambiguous assurances from Competition Authorities that such “joint” price-setting behaviour would not be construed as abusive. Overall then, FRAND would become a combination of commitments on individual portfolios and on the total royalty stack involved. If choices have to be made, we believe that a commitment to a total royalty stack is more important than maximum royalties on individual portfolios.⁶²

This approach would be significantly strengthened if the Courts could be convinced to use a FRAND-setting methodology that explicitly starts from what a reasonable total royalty stack is. Referring to such a stack would not otherwise limit the set of methods on which the Courts have relied. For example they could still use reliable comparators – when those are available – to assess both what the FRAND stack ought to be and how it ought to be divided. We would also hope that the Courts would use available information about “quick” random essentiality testing to inform their decisions about the royalties due to individual portfolio holders as this would further legitimise an approach which – in this report – is currently meant mostly as a way to facilitate licensing negotiations and reduce transaction costs. We do understand however, that the Courts themselves have a duty to come up with a legal, in depth, assessment of the essential character of patents in trial if asked to do so by one of the parties. In that sense, the Courts could be informed by information about essentiality obtained through random assessment but they are unlikely to be able to rely on this methodology to conduct their own random trials.

While moving the Courts in this direction is likely to be a slow process, depending in part on the arguments presented to them in specific cases, we believe that the Commission itself could enhance the profile of such methodology by encouraging the participation of IP and Competition judges in workshops on FRAND-setting rules as well as by preparing another – more narrowly focussed – paper on such rules. The Commission could also make such an approach much more practical by taking steps to ensure that reliable estimates of the royalty “stacks” related to various standards become available. This involves going against the current practice of keeping licensing terms confidential. However, this practice itself seems hard to reconcile with the need to enforce the “non-discrimination” part of FRAND. Moreover, one could settle for an intermediate regime where individual licensing deals are reported to the SSO (or the Commission) under the seal of confidentiality, but these individual reports can then be combined to provide ranges for the total royalty stack involved.

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Note that the total royalty cap can effectively address the stacking issue even if there is no ex-ante competition among standards and SSOs do not take into account economic considerations. The effectiveness of such caps will however depend on the internal governance of the (potential) standard setting organizations – as explained in section 5.1.2 a workable option may be to have ex ante royalty caps set by SSO members with a significant number of potentially relevant patents (in complement to classic FRAND commitments).

The declaration of a maximum royalty stack does not imply that SSO members should be obliged to join a standard-specific patent pool once the standard is set. While such a pool might indeed be the simplest way to implement the ex-ante commitment on the total royalty stack, such a commitment is also useful – as a benchmark – even if SEP holders keep negotiating access to their portfolios independently from each other. However, because of the clarity and convenience of a pool, we would also suggest that SSOs should be encouraged to at the very least select one or two patent pool management companies. These companies would be hired at the beginning of the process in order to give them time to convince SEP holders to join.

We now turn our sights to the period after the standard is chosen. Clearly behaviour in this period would already be affected by the various ex ante commitments and rules that we have just discussed. We would however add additional declarations and data-handling measures designed to decrease the transaction costs of SEP licensing as well as a few proposals aimed at streamlining conflict resolution.

Once the standard is agreed, patent-holder should be given a sufficient (but limited) amount of time to produce a list of the patents (and patent applications) which, they believe, read on some aspects of the standard. While a detailed “claim map” would not be required, each identified SEP family should also specify aspect(s) of the standard for which it is relevant. In addition, we would recommend that this information be entered in a database administered by the EPO.

We also favour some random testing of a portion of each portfolio of declared SEPs to determine the share of the patents which are indeed essential to the standard. The results of such testing should then be made public. This offers two distinct advantages. Firstly, some assessment of the likely essentiality (and validity) of the patents contained in a given portfolio is an unavoidable part of the licensing process. As these costs must be incurred anyway, one might as well avoid duplication by ensuring that the assessment is made only once. Secondly, by making the results available for all portfolios of declared SEPs, such an assessment provide useful information as to how royalty payments should be allocated across SEP holders. This advantage is especially striking when, as we propose, the policy is implemented together with some declaration or commitment on the total royalty stack involved: once the stack is determined, the relative performance of SEP portfolios in the essentiality evaluation exercise would seem to be a solid base to allocate the total royalty payments between IPR holders. This is true not only within patent pools where formal sharing rules based on the results of the evaluation can be established but also in less systematic context such as bilateral negotiations where essentiality information combined with a total stack would provide a powerful benchmark. We also suspect that this is the kind of information that Courts or arbitrators would be eager to use, were conflicts to arise.

SEP licensing also raises issues about what the appropriate “royalty base” might be and about the level of the “vertical chain” at which licensing should occur. Economic analysis does not suggest that there is a type of royalty base (broad or narrow) which is most efficient in all contexts. Rather, broad bases are likely to be preferable when the licensed technology affects a significant proportion of the value-inducing functionalities of the downstream devices, while narrow bases should perform better when the impact of the technology is limited to a few well-defined aspects of the downstream product. In our opinion then, it would be important for the Commission to

re-state its basic agnosticism on the matter and to communicate it sees efforts to bind SEP holders and implementers to specific royalty bases as misguided.

The most efficient “vertical” level of licensing is similarly dependent on the specific sector and the specific standard involved. Sill, two guiding principles should be observed. On the one hand, where the downstream uses of the standard differ significantly (e.g. different fields of use) and licensing upstream would prevent the SEP-owner to charge different rates for different uses, there is an efficiency reason for licensing only the final implementers. By contrast, licensing upstream suppliers is more efficient if each supplier serves a large number of final implementers and final implementers deal with a large number of suppliers.

We have three, rather mild, suggestions as regards the conflict resolution process.

First, on the judicial side, we believe that recent rulings have, in principle at least, struck a reasonable balance between the concerns of licensors and licensees. In particular, we are sceptical of claims that the framework set out by these decisions still leave ample room for harmful “hold out” on the part of potential licensees. Given this favourable prior, it would appear reasonable to give the new judicial approach time and only engage in further tinkering if the practice reveals continuing flaws.

Second, we would encourage the Courts to further explore the type of “criteria-based” approach attempted by Judge Robart in *Microsoft v Motorola*. Indeed, hold up and hold out are only one relevant aspect of the judicial process and the whole standardisation process relies on the ability of Courts to make a sensible determination of royalty rates if called upon to do so. In this respect, exploring how the “Georgia Pacific” framework on which he relies could be enriched by the additional information on total stacks and essentiality that our other proposed reforms would supply seems to be a potentially fruitful exercise.

Third, we believe that arbitration procedures have a role as a *complement* to the judicial route. In particular, Arbitration procedures that force the arbitrator to choose between discrete deals put forward by each party have nice incentive properties as they force parties to each make reasonable proposal instead of staking extreme positions. Among arbitration mechanisms, we prefer a system where the parties themselves must provide a proposal which is instrumental in reaching the arbitration outcome. In particular, systems where the arbitrator can only choose between the proposal of each of the two parties or where the proposal of the party which is closest to the arbitrator’s own evaluation prevails have good incentive properties as they induce each side to make reasonable proposals in the first place. We would however much prefer that arbitration procedures remain optional: SSOs could act to encourage their use but making them mandatory would not be desirable as it would prevent the emergence of a publically available jurisprudence. Such jurisprudence is useful in guiding further cases, thereby decreasing uncertainty and reducing transaction costs.

As explained in section 7, reducing the number of declared SEPs would have the advantage of decreasing the implementation cost of several of the policies that we have just suggested. As we discussed then, the number of declared SEPs could be decreased through one of two mechanisms. The first one is to impose a significant declaration fee. This is a direction that we do not recommend. To be effective, such a fee might have to be rather significant and would necessarily have to be paid by SEP-owners. This runs the risk that the policy might make SEP-owners worse off even though the induced reduction in declared SEPs might well increase the *joint* welfare of

SEP-holders and implementers. In the absence of some form of redistribution mechanism, then, it would be hard to get SEP-holders to support the policy. And indeed, following the recent changes in injunction rules that have changed the balance of bargaining power in favour of implementers, such an added burden would certainly be regarded as unfair. We do therefore prefer the alternative approach – an example of which is given in the appendix – which provides SEP-holders with incentives to reduce the number of declared SEPs without imposing any additional costs on them. The idea of this approach is to have a rule that identifies the legitimate share of a SEP-holder in total royalty payments – whatever these might be – as a function of the number of SEP declared and of the proportion of essential patents that random tests identify in the declared portfolio.

The reader might have noticed that our proposal does not touch upon a number of “licensing practices”, such as the choice of the royalty base or portfolio licensing, which have been at the centre of some recent controversies and even some Court cases. This reflects our belief that, as explained in section 7, those practices are not inherently harmful and that different licensing practices are appropriate depending on the technologies and products involved. We therefore recommend that those dimensions of SEP licensing should be left to the discretion of the parties. If there is to be any policy intervention in this area, it should be limited to relatively non-intrusive recommendations such as the availability of offers that are restricted to SEPs or where the payment is specified in cash terms. One should also consider stipulating that – in the spirit of *Huawei* a licensee could not be found to be “unwilling” if the licensor insists on including a confidentiality requirement in the proposed “full” contract that is supposed to discharge him of its FRAND obligations. Such a policy would appear useful in order to enforce the “ND” part of FRAND.

7.1.2. Valuable Standards, Other Sectors

As discussed above, we do not believe that other sectors call for any significant reform of the standard-setting process, even if the standards involved are valuable enough to be able to absorb the costs of further policing. There are however two recommendations that would still be usefully applied as they involve very little costs and might still have some positive effects. The first policy is FRAND. Even if few aspects of a standard are likely to be covered by patents, hold-up remains a potential issue. A single firm with a patent reading on a single aspect of the standards still sees its bargaining power greatly enhanced if its technology is chosen over some alternative technologies which were also available *ex ante*. FRAND provides some protection against some opportunism. Moreover, in an environment where not many patents are involved, choosing the patents that are or are not subject to FRAND cannot be very onerous. Finally if, as we were given to understand, many sectors simply overcome the hold-up problem because of repeated interaction and reputation mechanisms, then those mechanisms can still work and FRAND commitment is just a cheap irrelevance, not a hindrance.

The second policy that we would also recommend for valuable standards in all sectors is negative disclosure. Again, when coupled with FRAND, it provides significant protection against ambush and hold up, cannot possibly be expensive in an environment which is not patent-dense, and would at worst be irrelevant.

7.2. How does it fit together?

At the beginning of this report, we reviewed the main issues facing the SSO-based standardisation process today. We concluded that the main issues were hold-up/hold out, royalty stacking and the transaction costs of SEP licensing.

In our proposal, Hold-up is addressed through the combination of FRAND commitment, negative ex ante declaration, ex ante commitment to a total royalty cap, the possible addition of an effective arbitration mechanism and recommendations as to the kind of rules that the Courts might develop for the determination of FRAND (mainly a Robart-like approach based on traditional criteria augmented by the type of “royalty” sharing rule that we have discussed). The possibility of royalty-stacking would be minimised through an ex ante commitment to a total royalty cap as well as through the encouragement of SEP-specific patent pools.

Transparency would be improved by ex post specific declarations that would link declared patent families to the relevant part(s) of the standard as well as by random independent tests of essentiality. This information would be public and available on a data-base that would benefit from the EPO’s expertise in this domain. Transparency would be further enhanced if royalty rates determined through arbitration were made public and if confidentiality clauses could not be unilaterally imposed by one of the contracting parties.

Transaction costs would be minimised by the performance of essentiality tests and their publication, as this would avoid duplication of essentiality evaluation by each licensee. The availability of SEP-related information, including the links between SEPs and the standard, would further reduce the “due diligence” costs incurred by implementers. Finally, encouraging the use of patent pools would also increase cost savings by providing “one stop” shopping for a substantial proportion of the relevant SEPs.

While none of the specific policy recommendations that we have made directly addresses the issue of hold out, we still believe that our policy package would help in this respect simply because it is harder for a licensee to “play dead” without being labelled as “unwilling” when a good deal of the information relevant to the licensing contract is publicly available.

7.3. Getting the parties on board

Our proposal aims at significantly improving the standard-setting process in sectors where policy intervention appears to be needed. We also believe that, as a package, our proposal offers something to SEP-holders as well as to implementers.

7.3.1. SEP-Holders

In terms of ex ante declarations, a negative declaration is clearly less onerous than the specific declarations that some SSOs currently ask for and, provided that members are given enough time, does not seem to involve large costs on patent-holders compared to a system with no declaration. After all, in order to license, patent-holders must have a broad look at their portfolios at some point anyway.

To us, the specific ex post declaration of patents that are claimed to be essential to the actual standard – including a simple link between patent families (not claims) and sections of the standard does not seem very different from the obligations that

normally fall on the shoulders of a licensor anyway. What does is the recommendation that a sample of patents be independently tested for essentiality. However, the cost of such testing does not need to be shouldered only or even mostly by patent-holders. Implementers could also, for example, be asked to pay a fee to the SSOs in order to be allowed to start negotiations with SEP-holders. Alternatively, or as a complementary source of funding, public authorities could offer some subsidies to help finance these essentiality checks. After all, the design of a standard creates a common good, the full benefits of which are unlikely to be appropriated by implementers and patent-owners. Because standards have at least a partial “public good” character, some amount of subsidisation would actually make economic sense. In particular, if policy-makers believe that ensuring the smooth emergence of the “internet of things” would bring large benefits to the European economy that go beyond the royalties that SEP owners might obtain and the additional profits that implementers might reap, public subsidies would make a lot of sense. Note in this respect that, as shown in section 7, the total cost of implementing an efficient random assessment of essentiality remains fairly low, even for standards involving a large number of SEPs. As the number of standards that are essential to the good development of the internet of things is likely to be limited, the total size of the subsidy involved would remain modest. For example, we estimated that performing a “mid-level” essentiality test on all 2G, 3G and 4G SEPs would cost \$475M. But a rather precise assessment of the average essentiality of SEP portfolios can be obtained by testing as little as 2% of the SEPs. Let us even assume that it takes 5%. This brings the total cost down to \$23.75 M. So even if smoothing the emergence of the internet of things were to require subsidising essentiality tests for 20 standards of the same importance as 2G to 4G jointly, the total cost involved would be less than half a billion dollars.

The idea of choosing a maximum total royalty cap near the beginning of the standardisation process might initially strike patent-holders as just one more costly and impractical requirement. However, the main positive effect of such a policy would be to minimise the royalty stacking issue. As explained in section 3, royalty-stacking does not just hurt implementers it also leads to lower total revenues for SEP-holders. Once well understood, this policy is therefore squarely to the advantage of patent-owners.

The increase in transparency and decrease in transaction costs that the proposed measures are supposed to yield would also bring benefits to patent-holders. In particular, as discussed above, it might make it easier to identify truly unwilling licensee, thereby reducing “hold out”. Finally, patent-holders should be relieved that we do not recommend any systematic policy interventions in terms of a number of “licensing practices” about which some implementers have been complaining quite bitterly.

Overall then, we believe that our policy proposal is a balanced package that both patent-owners and implementers should consider seriously.

7.3.2. Implementers

There is much in our proposal for implementers to like. They get good protection against hold-up and ambush through negative declarations, more transparency about SEPs through ex post specific declarations linked to the standard, an essentiality test and even possibly a commitment to a total royalty stack which should make licensing

negotiations much less troublesome. They also get an encouragement of patent pools and arbitration mechanism that they generally favour. It is therefore quite natural that implementers would also bear some of the costs of reform. For example, since essentiality tests reduce transaction costs mostly for implementers, not SEP-holders, it would seem natural that implementers bear some of the costs involved, at least if policy-makers do not feel that the case for complete public subsidisation is strong enough.

Moreover, given that the economic arguments about some of the licensing practices that some implementers have been complaining about are not strong anyway, accepting that policy-makers would leave these practices to be chosen or rejected through bilateral negotiation would not seem a high price to pay for the benefits brought by the proposed package of policies as a whole.

7.3.3. SSOs

Since both Patent-holders and Implementers are represented in SSOs, one may in principle expect that policy packages that are on balance beneficial to both parties should also gain support from- and find their way into – SSOs.

In particular, one would expect that policies that might lower transaction costs for all parties would be a natural field of activity for SSOs. Still, the existing *modus operandi* and governance of SSOs in Europe, combined with the fact that standard setting was seen historically as an engineering task with little economic relevance beyond the establishment of the standard, leave open the possibility that policies reducing transaction costs may be readily and independently adopted by existing SSOs.

A variety of intervention levels may be therefore considered - ranging from general recommendations to more specific regulatory guidance and rules - in case less interventionist approaches do not bear fruit despite the expected overall gains.

Independently of the specific instrument used however, the policy packages presented in this report provide a menu of policy options that would in our view reduce transaction costs, increase transparency, and generally make the standardization process more efficient.

7.3.4. New Principles

In this report, we have tried to develop a coherent policy proposal by combining well-known arguments with the available evidence but also by adding a few new insights or, at least, by providing a few different perspectives. The most important of these “newish” principles are:

- Moving the emphasis from individual royalties to the royalty-stack for the standard as a whole. This shift in emphasis matters at three levels: at the level of the initial commitment, to help licensee have a better idea of what reasonable rates for specific SEP portfolios might be and to guide the Courts in their determination of FRAND rates in case of dispute.
- Improving the availability and organisation of relevant information. This includes a greater involvement of PTOs in managing SEP data-bases, as well as the collection of data about the range of “total royalty stacks” involved.

- A greater reliance on incentives. For example, this principle involves placing the cost of new transparency-inducing measures on the parties that most benefit from them, explains our preference for forms of arbitration where the parties' own suggestions have an impact on the actual outcome, and is the basis for the type of "self-enforcing" mechanism that we suggest to deal with the issue of over-declaration.
- Preserving flexibility along dimensions where economic analysis is inconclusive and/or suggests that there is no "one size fits all" solution. This includes the issues of the royalty base and the "appropriate" vertical level of licensing.

Annex 1: Stacking

There are N products. They are perfect complements in the sense that consumers are only interested in a bundle that includes these various components in equal proportions. Each product is sold by a separate profit-maximising. The demand for this bundle is linear:

$$Q = 1 - bP$$

Where P is the price of the bundle. This price is of course equal to the sum of the individual prices p_i charged by each firm. There are no costs. So each firm chooses its price to maximise

$$p_i [1 - b(\sum_{j=1}^N p_j)]$$

Solving for the first order conditions and imposing symmetry we get

$$p_i^* = \frac{1}{b(N+1)}$$

$$P^* = \frac{N}{b(N+1)}$$

If a single firm sold all components ($N = 1$), we get

$$P_M^* = \frac{1}{2b}$$

So that

$$\frac{P^*}{P_M^*} = \frac{2N}{N+1}$$

Annex 2: Effect of random SEP assessment

We provide a more formal analysis of schemes that could be deployed in order to limit the number of patents which are declared as essentials without biasing the distribution of SEPs across various patent holders. In other words, the goal is to reduce patent-holders' incentives to "declare a lot because others will declare a lot". We first consider a scheme which does not rely on the use of SEP declaration fees. We then turn to schemes that require the use of such fees.

Consider n symmetric patent holders, each with a number of SEPs equal to z . Without loss of generality, standardise this individual portfolio size to be equal to one. The portfolio of each firm contains patents of different quality. Concretely, the patents are distributed according to the probability that they are both infringed and valid. The corresponding density function is $h(p)$. gives us the "number" (density) of patents associated with any given probability of being both valid and infringed.

We envisage a system where SEP-Holders choose what proportion of their patent portfolio to declare as SEP. This is done by choosing a critical probability x below which patents are not declared. Once the declaration is made, the declared portfolio is sampled and the quality of the patents in the sample is assessed. This assessment is unbiased so, in expectations, the assessed quality is equal to the true quality. The weight of any patent holder in the "pool" of SEP patents is then determined by a formula which puts some weight on the assessed quality and the number of patents in the declared portfolio and some weight on the total number of patents declared.

There is a simple system which would seem to be rather appealing. Rather than base the share of each patent-holder in the total royalty payment of implementers based on the share of SEPs that they own, one would "resize" each patent-holder's declared portfolio based on its average quality. Suppose, for example that a firm declares 1000 SEPs and that the evaluation of a random sample of these patents (or patent families) reveals that only one in four seems likely to be valid and essential (or just essential if one does not want to deal with validity at this stage). Then the weight carried by the declared portfolio would be scaled back by dividing the number of declared patents by four, i.e. it would be equal to 250.

Such a scheme appears to present the patent-holders with a clear trade -off: declare too many patents and the assessed quality will be low, reducing your effective portfolio...but declaring (or having) too few patents would also be counterproductive. One would therefore expect such a scheme to result in a reduction in the number of patents declared, with the extent of the reduction depending on the distribution of patent quality in the patent-owner's portfolio.

Unfortunately, this intuition is incorrect. In fact, *under this simple scheme, patent-holder would still declare their full portfolio*. To see this, let us first define $d(x)$ as the

total number of patents declared when the patent-holder only chooses patents such that $p \geq x$. We have:

$$d(x) = \int_x^1 h(p) dp$$

The average quality of the declared patents, which is also equal to the proportion of patents in a random sample which would pass a random essentiality/validity test, is equal to

$$E[p : x] = \frac{\int_x^1 ph(p) dp}{d(x)}$$

Hence. If we simply resize the declared portfolio according to this expected quality we get a weight equal to

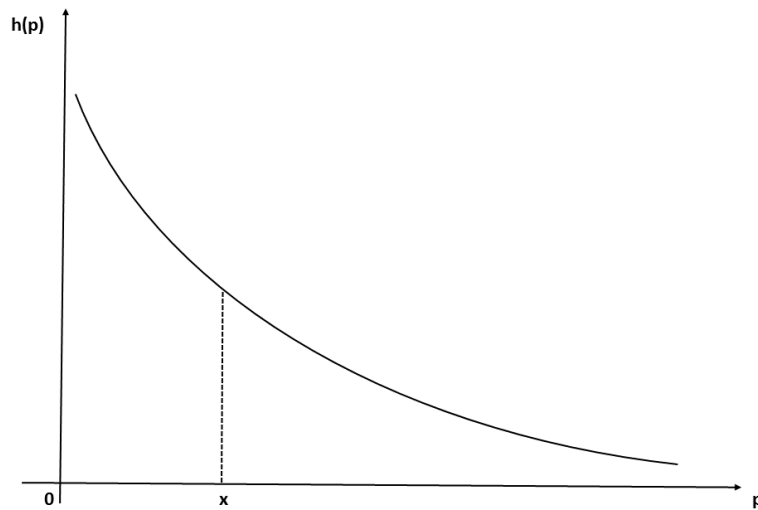
$$W = d(x)E[p : x] = \int_x^1 ph(p) dp$$

But, this weight is maximised by setting $x = 0$, i.e. by declaring the whole portfolio.

So, in order to provide effective incentives to reduce declarations, we need another criterion. The simplest such criterion that we have found consists in setting the weight of a given declared portfolio in the following fashion:

$$W = E[p : x]^\theta [d(x)]^{1-\theta}, \theta \in [0,1]$$

In order to get a feeling for the extent of declaration reduction that such a scheme might entail, we consider the following specific density function $h(p) = Ap^{-\alpha}$.



For $\alpha = 0$ and $A = 1$, this is the uniform distribution, i.e. there are as many “bad” patents as there are good patents. For $\alpha > 0$, the density function is decreasing and convex in p : there are more bad patents than good patents. To ensure that the densities sum up to one over the interval $x \in [0,1]$ we need

$$\int_0^1 A p^{-\alpha} dp = 1 \rightarrow A = 1 - \alpha \rightarrow h(p) = (1 - \alpha) p^{-\alpha}$$

Hence our density function is only well defined for $\alpha < 1$. This gives us

$$d(x) = \int_x^1 A p^{-\alpha} dp = (1 - x^{1-\alpha})$$

And

$$E[p : x] = \frac{\int_x^1 h(p) dp}{d(x)} = \frac{\int_x^1 A p^{1-\alpha} dp}{1 - x^{1-\alpha}} = \frac{(1 - \alpha) (1 - x^{2-\alpha})}{(2 - \alpha) (1 - x^{1-\alpha})}$$

Hence the weight attributed to a declared portfolio of size $1-x$ is

$$W = \left[\frac{1 - \alpha}{2 - \alpha} \right] \left[\frac{1 - x^{2-\alpha}}{1 - x^{1-\alpha}} \right]^\theta [1 - x^{1-\alpha}]^{1-\theta}$$

The following table summarises how the proportion of the portfolio declared changes as we change the weight θ for different shapes of the density function (i.e. different values of α).

Table 6: Proportion of the portfolio declared (1-x)

α	$\theta = 1$	$\theta = 0.9$	$\theta = 0.75$	$\theta = 0.6$	$\theta = 0.5$
0	0	0.2	0.5	0.8	1
0.25	0	0.2	0.508	0.8	1
0.5	0	0.2	0.515	0.8	1
0.75	0	0.21	0.525	0.8	1
0.9	0	0.21	0.53	0.8	1

From the table we see that, *by varying the relative weight put on average quality and number of patents declared one can achieve any desired size of declared portfolio between 1 patent and the whole initial portfolio*. We also note that the result of a given policy depends very little on the actual shape of the density function (within this class of convex functions at least), which is comforting. We should also point out that the type of density function that we consider here is likely to be a passable approximation of what the link between patent numbers and quality is.

In the economic literature, the cites received by a patent are often taken as a sign of patent quality⁶³. The distribution of cites has therefore been studied extensively. The general conclusion is that, there are a lot of patents “in the left tail”, i.e. a lot of poor quality patents. This is precisely the type of scenario that our chosen density function captures.

Notice also that, not surprisingly, the patent-holder would only declare his/her best patent if all the weight is put on average quality ($\theta = 1$) and, as we have seen, would declare the whole portfolio if we assigned the same weight to both criteria.

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Hall, B.H., A.B. Jaffe and M. Trajtenberg, 2005, “Market Value and Patent Citations”, *Rand Journal of Economics*, 36:1, pp. 16 – 38; Hall, B.H., A.B. Jaffe and M. Trajtenberg, 2001, “The NBER Patent Citation data File: lessons, Insights and Methodological Tools”, *NBER Working Paper No 8498*.

Annex 3: “complex” and “discrete” industries

The following classification of sectors into “complex” sectors where a product requires the combination of many components protected by IPRs and “discrete” sectors, where final products do not involve such a multiplicity of components is drawn from Von Graevenitz, G., S. Wagner and D. Harhoff, 2013, “Incidence and Growth of Patent Thickets – The Impact of Technological Opportunities and Complexity”, *Journal of Industrial Economics*, 61:3, pp. 521 – 563.

Classification of technology areas according to OST-INPI/FhG-ISI

1. Electrical machinery, electrical energy - Complex
2. Audio-visual technology - Complex
3. Telecommunications - Complex
4. Information technology - Complex
5. Semiconductors - Complex
6. Optics - Complex
7. Analysis, measurement, control technology - Complex
8. Medical technology - Complex
9. Nuclear engineering - Complex
10. Organic fine chemistry - Discrete
11. Macromolecular chemistry, polymers - Discrete
12. Pharmaceuticals, cosmetics - Discrete
13. Biotechnology - Discrete
14. Agriculture, food chemistry - Discrete
15. Chemical and petrol industry, basic materials chemistry - Discrete
16. Chemical engineering - Discrete
17. Surface technology, coating - Discrete
18. Materials, metallurgy - Discrete
19. Materials processing, textiles paper - Discrete
20. Handling, printing - Discrete
21. Agricultural and food processing, machinery and apparatus - Discrete
22. Environmental technology - Complex
23. Machine tools - Complex
24. Engines, pumps and turbines - Complex
25. Thermal processes and apparatus - Complex
26. Mechanical elements - Complex
27. Transport - Complex
28. Space technology, weapons - Complex
29. Consumer goods and equipments - Complex
30. Civil engineering, building, mining - Complex

Description of the 30 technology areas contained in the OST-INPI/FhG-ISI technology nomenclature.

Annex 4: The “Georgia Pacific” criteria and recent judicial decisions

Georgia-Pacific is a major US decision about the awarding of damages for patent infringement. Following Judge Robart’s attempt to adapt the methodology laid down in the case to a situation with FRAND commitments, it is now an important part of the debate about the judicial determination of FRAND terms for SEP licensing.

The court used these 15 factors to determine the type of monetary payments that would compensate for a patent infringement in *Georgia-Pacific Corp. v. United States Plywood Corp.*, 318 FSupp 1116, 6 USPQ 235 (SD NY 1970):⁶⁴

1. The royalties received by Georgia-Pacific for licensing the patent, proving or tending to prove an established royalty.
2. The rates paid by the licensee for the use of other similar patents.
3. The nature and scope of the license, such as whether it is exclusive or nonexclusive, restricted or nonrestricted in terms of territory or customers.
4. Georgia-Pacific’s policy of maintaining its patent monopoly by licensing the use of the invention only under special conditions designed to preserve the monopoly.
5. The commercial relationship between Georgia-Pacific and licensees, such as whether they are competitors in the same territory in the same line of business or whether they are inventor and promoter.
6. The effect of selling the patented specialty in promoting sales of other Georgia-Pacific products; the existing value of the invention to Georgia-Pacific as a generator of sales of nonpatented items; and the extent of such derivative or “convoyed” sales.
7. The duration of the patent and the term of the license.
8. The established profitability of the patented product, its commercial success and its current popularity.
9. The utility and advantages of the patent property over any old modes or devices that had been used.

64 Source: BVR’s Intellectual Property Management, <http://www.ipvalue-site.com/index.php/2010/09/15/here-are-the-15-georgia-pacific-factors-considered-for-patent-infringement/>.

10. The nature of the patented invention, its character in the commercial embodiment owned and produced by the licensor, and the benefits to those who used it.
11. The extent to which the infringer used the invention and any evidence probative of the value of that use.
12. The portion of the profit or selling price that is customary in the particular business or in comparable businesses.
13. The portion of the realizable profit that should be credited to the invention as distinguished from any nonpatented elements, manufacturing process, business risks or significant features or improvements added by the infringer.
14. The opinion testimony of qualified experts.

The amount that Georgia-Pacific and a licensee would have agreed upon at the time the infringement began if they had reasonably and voluntarily tried to reach an agreement.

Judge Robart takes this criteria as a point of departure but considers that, under FRAND, the licensor has an obligation to license and the licensee has no choice but to get a license from all SEP-owners. From this specific context, judge Robart modifies the the *Georgia-Pacific approach in the following manner*:

- The licensor has an obligation to license at a rate which is consistent with the SSO's goal of ensuring a wide diffusion of the technology. This not only involves charging rates which do not exploit the "hold up" that inclusion in the standard creates but it also creates an obligation to consider the total royalty-stack that would result from the royalties charged by all SEP-owners.
- The level of royalty should reflect the contribution of the technology to the economic value of the product but without consideration for the added value coming from the technology's inclusion in the standard.
- "*Ex ante* examination of the incremental contribution of the patented technology to the standard can be helpful in determining a [F]RAND rate in the context of a dispute over a [F]RAND rate". In that sense, the correct point of reference is not the beginning of infringement as in *Georgia-Pacific* but the pre-standard-setting situation.
- Because the SEP-holder must consider the total potential royalty stack, Judge Robart considered patent pool rates (where stacking issues are eliminated or at least minimised) as potent comparators.