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Open Standards in Government IT: A Review of the Evidence

An independent report for the Cabinet Office
by the Centre for Intellectual Property & Policy Management
at Bournemouth University

OPEN STANDARDS IN GOVERNMENT IT:

A REVIEW OF THE EVIDENCE

Centre for Intellectual Property Policy & Management (CIPPM)

Bournemouth University

An independent report commissioned by the UK Cabinet Office,
prepared by Sally Weston and Martin Kretschmer
(with economic advice by Jenifer Piesse)[1]

Open Standards: A Review of the Evidence – http://www.cippm.org.uk/publications.html – 25 October 2012

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Executive Summary

The UK ICT Strategy published on 30 March 2011 committed the Government to create a common and secure IT infrastructure based on open standards. From 9 February to 4 June 2012, the Government consulted on options for mandating open standards for software interoperability and data and document formats. The current research contributes to an economic appraisal of the proposed policy by:

1. Introducing open standards as a policy field;
2. Reviewing the evidence on the competition and innovation effects of standardisation in IT systems;
3. Assessing the regulatory constraints of mandating open standards under EU competition and procurement law;
4. Considering certain options for the implementation of an open standards policy;
5. Evaluating the costs and benefits of specific aspects of these options for government departments, delivery partners and supply chains.

This review of evidence reported in the literature on open standards concludes that adoption of an open standards policy to encourage interoperability and more competition in the procurement process is likely to be advantageous. Advantages include potential cost savings as well as social benefits such as allowing greater access to and transparency of information. There remain areas requiring careful consideration, particularly in the manner of implementation of the policy, for example whether to adopt FRAND (Fair Reasonable and Non-Discriminatory)[2] or to prefer RF (Royalty Free)[3] licensing terms. The literature calls into question the rationale for software patents and therefore the argument that FRAND is necessary to incentivise innovation. The decision to include FRAND could be justified on the ground that it gives the greatest range of options, but it may also reduce choice and competition when the main potential competitor is open source software because of incompatibility between patents and some open source licence terms. It is not clear that a level playing field exists between proprietary and open source software. If FRAND is accepted, policies to ensure competition from open source suppliers, including pilot projects and dissemination of information to encourage uptake of open source software by government agencies may be needed.

Specific benefits identified include a reduction in lock-in and associated switching costs; a reduction in the size and duration of IT projects and the sharing and reuse of IT across departments; encouraging innovation and opportunities for smaller companies to participate in contracts; and improving business and consumer interface with government.

[2] The acronym FRAND (Fair Reasonable and Non-discriminatory) is used in Europe while RAND is used in the US. FRAND will be used here unless referring to US literature.

[3] The term Royalty Free (RF) has been ascribed various meanings including the unilateral or reciprocal non-assertion of IPR and royalty free licenses which are in other respects subject to FRAND terms. While the precise RF terms can be important in specific cases, particularly when open source software is involved, for the purposes of this review of the evidence the important aspect of RF is that no royalty is charged for the use of the standard.

Contents

Glossary

API	Application Programming Interfaces (APIs) are a type of software interface in the form of a specification provided to encourage developers to write applications to enable software components to communicate and often to gain network effects.
CAMSS	Common Assessment Method for Standards and Specifications, an initiative of the European Commission's IDABC programme to initiate, support and coordinate the collaboration between volunteer Member States in defining and to share the assessment study results for the development of eGovernment services.
Data File Formats	These specify how the data is encoded and stored in computer files.
De Facto Standards	Proprietary interfaces which due to market share take the form of standards, an example is Microsoft's ".doc" document format.
EIF2	The European Interoperability Framework v.2
FRAND	Acronym of Fair Reasonable and Non-Discriminatory is a principle for assessing royalties. FRAND is used in Europe while RAND is used in the US.
IPR	Intellectual Property Rights.
IT	Information Technology, a subset of ICT (Information Communication Technology) and associated with software rather than telecoms.
NPEs	Non-Practicing Entities have a business model intended to generate or acquire patents to licence the IPR to others rather than exploit the technology itself.
Open Source Software	Software that is developed collaboratively and distributed under a license that gives the user freedom to run, copy, distribute, study, change and improve the software including access to the source code. The freedom refers to liberty not price. Other descriptors include FOSS (free

	and open source) and FLOSS (free, libre and open source).
Patent Ambush	Withholding information about patent rights from a standard setting organisation with the intention of asserting the patent when the standard has adopted the patented technology.
Patent Thickets	Overlapping patent rights over an item of technology that requires innovators have to take several licenses.
Protocols	Protocols define and specify rules for exchanging information such as how to format and indentify messages to enable code to be written to the protocol. The protocols enable the code to operate on more than one computer.
Royalty Free	Has various meanings including the unilateral or reciprocal non-assertion of IPR and royalty free licenses which are in other respects subject to FRAND terms.
SSO	Standard Setting Associations are organisations with the purpose of developing, coordinating, setting and revising technical standards. They can be recognised on an international basis, e.g. International Telecommunication Union (ITU), a regional base, e.g. European Committee for Standardization (CEN), or national, e.g. British Standards Organisation (BSO) or a more informal models known as fora and consortia, e.g. OASIS.

1 Introduction

Spending on software and related services is worth around €258 billion to the European economy, or around 2.6% of GDP.[4] Software is the largest and fastest-growing segment of the ICT market.[5] As well as making a significant contribution to the European economy, software is a key driver of innovation and change.

The public service is by far the largest single procurer of ICT services in Europe with an estimated annual spend of over £50 billion.[6] In 2009 the UK Government acknowledged that it spends more on ICT than any other government, but had a history of projects with budget overruns, delays and functional failures.[7] Government IT projects were considered too big, lengthy, risky and complex, and departments had independently developed systems which often did not communicate easily with one another. A number of initiatives have been introduced starting with the review of existing contracts and the tightening of procurement controls. Another initiative was the introduction of shared services, but its manner of implementation, often overly complex with limited standardisation, resulted in cost overruns and failure to achieve the expected savings.[8] Most recently, on 30 March 2011, a new IT Strategy was published, committing the Government to create a common and secure IT infrastructure based on open standards.

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[4] Report of an Industry Expert Group "Towards a European Software Strategy" (March 2009) DG Information Society and Media . http://www.ictregie.nl/publicaties/nl_TowardsAEuropeanSoftwareStrategy_ViewsOfIndustry_v20.pdf

[5] IT (Information Technology) is a subset of ICT (Information Communication Technology) and associated with software rather than telecoms. This paper concentrates on IT although some of the literature reviewed covers both IT & ICT. Some consider there is convergence between software and telecoms, for example Mallinson J., "Artificial Distinction between Software and Telecoms for Essential IP Disclosure" (*ipfinance.blogspot.com*, 2 September 2011). In email correspondence with the authors (13 September 2012) Graham Taylor (OpenForum Europe) highlights a substantial difference between the business models of telecoms and IT where the former continues to extract a return on investment from within the standard while the later see standards as a catalyst on which to build value.

[6] Susannah Sheppard, "The new European interoperability framework: opening competition in public procurement to both proprietary and open source software solutions and reinstating compliance with European Union procurement and competition law" (2012) 2 Public Procurement Law Review 47-67.

[7] Rt. Hon. Francis Maude, Minister for the Cabinet Office, speaking in 2009 as reported in, "Information Technology in Government, Landscape Review" (HC 757, National Audit Office, 17 February 2011).

[8] National Audit Office "Efficiency and reform in government corporate functions through shared service centres" (7 March 2012) HC 1790.

Open standards are those standards created by standard setting organisations, including fora and consortia, which meet the requirement for openness. The European Commission EIF version 2.0, which is referred to in the 2012 Cabinet Office Consultation,[9] defines "openness" in relation to the specification of standards thus: "All stakeholders have the same possibility of contributing to the development of the specification and public review is part of the decision-making process; the specification is available for everybody to study; intellectual property rights related to the specification are licensed on FRAND terms or on a royalty-free basis in a way that allows implementation in both proprietary and open source software".

There are many definitions of open and closed standards. On the one hand "closed" standards have no regulation of ownership or licensing of intellectual property rights IPRs. This could be a de facto standard[10] or where one member of a Standard Setting Organisation (SSO) owns the IPR and effectively controls the standard. On the other hand "open" standards have been defined as those in which the members provide their IPR so that anyone is free to use it.[11] Krechmer suggests 10 criteria for assessing the openness of standards including requirements that all stakeholders may participate and that there are low or no charges for IPR.[12] In fact most SSOs occupy a middle ground somewhere between these open and closed standard definitions, permitting their members to own IPRs but requiring the licensing of the IPR on specified terms.[13] They are open in that the standard can be used, but proprietary in that the IPR holder may demand some form of payment which is said to offer a "third way", where the IPR has some value but does not obstruct the standard.[14]

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[9] Cabinet Office, "Open Standards: Open Opportunities" (formal public consultation, February 2012). Björn Lundell (University of Skövde) in email correspondence with the authors (27 September 2012) points out that licensing on a FRAND term does not allow implementation of both proprietary and open source software as FRAND is incompatible with most open source software licences such as those based on the GPL.

[10] An example of a de facto standard is ".doc".

[11] The Internet is an open, non-proprietary standard as the SSO which controls the TCP and IP protocols the (IETF) had a policy of not adopting proprietary standards. The policy is now to prefer technologies with no known IPR claims or, for technologies with IPR claims, to offer a royalty-free licence. Memo on best practice on IPR in IETF Technology from S Brader to Network Working Group (March 2005). http://www.ietf.org/rfc/rfc3979.txt

[12] Ken Krechmer, "Open Standards: A Call for Change" (2009) May IEEE Communications Magazine 88. For further discussion on the definition of openness see Concurrences N° 1-2010 I Tendances I Open Standards & Antitrust; and G Bird "The Business Benefits of Standards" Standards View (1998) 6(2) 76-80.

[13] Mark Lemley "Intellectual Property Rights and Standard-Setting Organizations" (2002) 90 California Law Review 1889, 1902.

[14] Ibid.

Open standards are adopted by public administrations with the aim of increasing interoperability and avoiding lock-in. The intention is to achieve a more diverse and competitive market, enabling IT to interoperate and share information both inside and outside government departments and to achieve more economic efficiency in the delivery of IT. Projects can be smaller and more manageable, and may be reused in other departments to avoid duplicating the commissioning of new solutions where one already exists. Standardisation of data and document formats should give citizens and businesses a choice in the software they use when accessing government information services.

The current report first gives a brief overview of the evolution of both the proprietary and open source suppliers of IT systems. It then considers the main goal for open standards, which is to achieve greater interoperability, avoid lock-in, and lead to improved competition and hence innovation. The presence of IPRs in standards is then introduced, for although the rationale for IPRs is to encourage innovation, the grant of exclusive rights can interfere with achieving interoperability. Patents are particularly relevant as an important means of protecting the value of software but they may affect the successful operation of open standards. They are also the apotheosis of the divergent business models of proprietary software and open source software suppliers. The legal framework for the implementation of an open standards policy is reviewed, considering both competition law and public procurement regulations. The literature on implementation options is then considered, looking at whether single standards should be mandated and whether an RF or FRAND policy should be adopted. Finally there is a synopsis of costs and benefits drawing on previous case studies. The report concludes that the evidence as reported in the literature supports open standards in principle, and identifies certain methods of implementation which require further consideration.

1.1 Background of IT Suppliers

When computers first entered the market from the 1950s, software was bundled with the hardware and it was not until the early 1980s that IBM moved to supplying software on an object code only policy. By this time the cost of hardware had declined, while software became more valuable and in order to maintain revenue the source code was no longer disclosed.[15] Proprietary software companies such as Microsoft, Oracle and Computer Associates expanded rapidly from nascent software developers in the 1970s to public quoted companies in the 1980s, specialising almost exclusively in computer software. Alongside these companies were system suppliers such as IBM and ICL which provided both hardware and software

[15] Martin Campbell-Kelly and Daniel Garcia-Swartz, “Pragmatism, not ideology: Historical perspectives on IBM’s adoption of open-source software” (2009) 21 (3) Information Economics and Policy 229, 237-9.

solutions. The norm at that time was for there to be little compatibility between the software systems of the various proprietary suppliers.

The 1980s also saw the introduction of the open source software licence. Open source software is defined by its collaborative development, accessibility of code and distribution models. In the academic software community that had pioneered the Internet, a belief grew that commercial imperatives were destroying the cooperative environment in which programmers worked. As software increased in complexity (and higher level programming made use of obfuscation techniques), decompilation and reimplementation of a programme from the binary object code (in which it is distributed and executed) became more difficult. In order to understand a programme fully, access to the source code (including symbolic labels and annotations) was indispensable. Richard Stallman left MIT in 1984, and pioneered an open approach to software development and distribution in the GNU Project, launched to develop a complete Unix-like operating system. In 1988, Stallman issued the first version of the General Public License (GPL) forcing derivatives of GNU software to keep their source code free from proprietary claims. In a radical spirit, which has been described as the constitution of the Free Software/Open Source movement, copyright law was used to subvert itself.[16]

The GNU General Public License (GPL), as with all open source software, gives the user certain freedoms to run, copy, distribute, study, change and improve the software. To make this meaningful users must have access to the source code. It is these freedoms that give the software the prefix "free". Free software is a matter of liberty not price.[17] The GPL is a copyleft licence in that the copyright holder "leaves" what would otherwise be exclusive rights available to others. GPL v.2 contains a "liberty or death" clause making patent restrictions a breach of the licence and prohibiting further distribution of the software.[18] GPL v.3 more directly addresses patents, granting licences of software patents in added source code for downstream users.[19] Other open source software licences such as BSD, MIT and Apache are more "permissive". GPL v.2 is however the most widely used licence.[20] The most popular open source licences have a built-in termination clause that prevents distribution of the software if it is associated with any obligations such as patent

[16] Martin Kretschmer, "Software as Text and Machine", introduction to special issue on Software-related Inventions (2003) 1 Journal of Information, Law & Technology, 1-23. http://www2.warwick.ac.uk/fac/soc/law/elj/jilt/2003_1/kretschmer/

[17] http://www.gnu.org/philosophy/free-sw.html

[18] GPL v.2, section 7.

[19] GPL v.3, section 11.

[20] http://osrc.blackducksoftware.com/data/licenses/
GPL v.2 licence is used for roughly 40% of open source software projects and over 60% of all projects use GPL including the Linux project.

licences that would not permit redistribution.[21] It does not mean that all software that reads on the OSS code must be RF but code that is licensed, for example under GPL, cannot be combined with an implementation of a FRAND standard without losing the ability to distribute the code.[22]

Although incompatibility between proprietary software systems still exists there have been improvements in recent years. There has also been "co-mingling" with many software users and developers using both proprietary and open source software.[23] Both proprietary and open source software can be compatible with open standards. It has been said that open source can benefit the implementation of open standards, as adoption of an open standard under an open source development model can sometimes drive or accelerate standard adoption,[24] but standards do not have to use open source software to be open.

[21] Mikko Valimaki and Ville Oksanen, "Patents on Compatibility Standards and Open Source – Do Patent Law Exceptions and Royalty Free Requirements Make Sense?" (Sept 2005) 2 (3) SCRIPT-ed. The latest versions of Apache license and Open Software License have similar clauses.

[22] Jay Kesan, "The Fallacy of OSS Discrimination by FRAND Licensing: An Empirical Analysis" (2011) Illinois Public Law l Research Paper number 10-14. http://papers.ssrn.com/abstract=1767083

[23] Josh Lerner and Mark Schankerman, *The Comingled Code: Open Source and Economic Development* (MIT Press 2010).

[24] Ibid.

2 The Relationship Between Open Standards, Competition and Innovation

2.1 Interoperability

Interoperability requires two or more programs to exchange and use information. It does not require the programmes to use the same code or perform identical or similar functions but they must be able to exchange and use the exchanged information. The exchange of information between programmes takes place through interfaces which can take various forms: application programming interfaces (APIs), protocols, and data file formats.

APIs disclose to other developers the standard means of requesting the platform to carry out tasks for their application. Platforms provide APIs to encourage developers to write applications for their programme to gain network effects. They are outward looking and do not reveal the details of how the task is accomplished. Protocols define and specify rules for exchanging information such as how to format and identify messages. Code compliant with the protocols enables IT systems to work together. While APIs usually run on only one computer, protocols enable code to be written to work on two or more computers. The code should comply with the protocol but will not normally be written in an identical way. Data file formats specify how the data is encoded and stored in the files. Some of these are made public but many data file formats do not even have written specifications.

Each interface can exist in more than one form. The original form can be in source code which is then compiled into machine code. Many interfaces are then recorded as a specification in a word processed document. The intellectual property rights (IPRs) that have been used to protect these various forms include copyright, trade secrets and patents.

Standards in interfaces include standard document formats and protocol specifications. These may include IPRs in the form of copyright and patents. De facto standards are normally proprietary interfaces that have become standards due to the market share enjoyed by the proprietary software. An example is Microsoft's ".doc" document format. Open Standards by contrast are created by standard-setting organisations (SSOs) which can be either formal standards bodies such as the International Standards Organisation (ISO) or consortia such as the Internet Engineering Task Force (IETF) or World Wide Web Consortium (W3C).

It is widely believed that interoperability promotes socially desirable goals.[25] Intuitively it would seem that interoperability should create an expansion in use, enabling competition and encouraging innovation.[26] The innovations thus stimulated would be more likely to be of the "follow on" type rather than "breakthroughs".[27] While there is no systematic body of empirical evidence of a link between interoperability, and competition and innovation, the claim is often supported by illustrative examples.[28]

It is certain that lack of interoperability causes expense and wastage. The National Institute of Standards & Technology estimated that imperfect interoperability cost the US automotive supply chain at least $1 billion per year in 1999.[29] Incompatibility between two versions of Dassault Systemes' CATIA 3D CAD software delayed the delivery of the A380 and resulted in a $6 billion loss for Airbus.[30]

Perhaps the earliest and most notable impact of interoperability and open systems was the driving down of the quality adjusted price of the personal computer system when IBM, perhaps by accident, first introduced a personal computer using an open architecture.[31] The industry moved from the closed business systems adopted

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[25] Pamela Samuelson, "Are Patents on Interfaces Impeding Interoperability?" (2008) Berkeley Centre for Law & Technology 1. http://ssrn.com/abstract=1323838

[26] Commentators including Mark Lemley, "Antitrust and the Internet Standardization Problem" (1996) 28 Connecticut Law Review, recognise the benefits of interoperability while others consider the position is more ambiguous, *see e.g.* Mario Gil-Moto, "Economic aspects of the Microsoft case: networks, interoperability and competition", in Luca Rubini , "Microsoft on Trial" 344 at 359 *et seq.* (Edward Elgar, Cheltenham, 2010).

[27] Follow on innovation is dynamic rather than static competition *e.g.* coming within the description of dynamic competition advocated by Gregory Sidak and David Teece, "Dynamic competition in antitrust law" (2009) 5(4) Journal of Competition Law and Economics 581-631, 594 *et seq*.

[28] Urs Gasser and John Palfrey, "When and how interoperability drives innovation" (31 October 2007). http://cyber.law.harvard.edu/sites/cyber.law.harvard.edu/files/interop-breaking-barriers_1.pdf

[29] Smita Brunnermeier and Sheila Martin, Research Triangle Institute, Center for Economics Research for NIST, "Interoperability Cost Analysis of the U.S. Automotive Supply Chain" Final Report, (March 1999).

[30] Mel Duvall and Doug Bartholomew, "PLM: Boeing's Dream, Airbus' Nightmare". http://www.tgstech.com/releases/BoeingsDream_AirbusNightmare.pdf

[31] Joseph Farrell & Philip Weiser, "Modularity, Vertical Integration, and Open Access Policies: Toward a Convergence of Antitrust and Regulation in the Internet Age" (2003) 17 Harvard Journal of Law and Technology 85 also Richard Langlois, "Modularity in Technology and Organization" (2002) 49 Journal of Economic Behaviour and Organisation 19, 19. IBM was vertically integrated based around its mainframe computers. When it introduced personal computers it relied on Microsoft and Intel for key components including software and allowed them to license these to other computer makers. The specialisation that followed saw rapid innovation in chips, peripheral devices such as modems and software.

initially by IBM and Apple to a modular structure which encouraged specialisation and innovation. Innovation in components such as disk drives and modems as well as applications software proliferated. As IBM and Apple's market share declined the average price of computers fell by 40 per cent in 1992 alone.[32]

Interoperability has now been accepted as an essential virtue by most governments. The European Commission has accepted the benefits of interoperability in its competition law policy and policies for enterprise, industry and standardisation.[33]

Network effects appear to magnify the benefits of interoperability. Developers of platforms encourage the development of applications to work on the platform which attracts more customers to the platform. This will encourage others to develop complementary products and generate an ever larger customer base – a virtuous cycle due to network effects.[34]

2.2 Standards

Standards are the accepted method of providing compatibility in traditional engineering, and in recent decades software standards have been developed to enable software interoperability. Standards have well recognised benefits such as improving economic efficiency and promoting growth.[35] Several studies have found that standards contribute nearly one percentage point per year in productivity and growth in some developed economies.[36] The relationship between standards and innovation is more nuanced. Standards can aid innovation by reducing time to market and codifying and disseminating the state of the art technology.[37] It appears that standards can increase product variety by increasing the number of value-added combinations and this is seen as more valuable than their impact on procurement or

[32] David Angel and James Engstrom, "Manufacturing Systems and Technological Change: The U.S. Personal Computer Industry", (1995) 71 Economic Geography 79, 81. IBM and Apple's market share fell from 52% to 21% between 1984 and 1992 to firms such as Compaq and low-cost system assemblers such as Dell who took advantage of the modularisation of the personal computer market.

[33] For example the ISA Interoperability Solutions for European Public Administration programme and decision in merger cases including Case COMP/M.5669, *Cisco Systems, Inc. And Tandberg ASA.,* [2010] OJ L-2985.

[34] Pamela Samuelson (n 25) 7.

[35] Marcus Glader, "Open Standards: Public Policy Aspects and Competition Law Requirements" (2010) 6(3) European Competition Journal 611–643; The Economics of Standardization: An Update, G.M.P. Swann, Report for the UK Department of Business, Innovation and Skills (BIS) by Innovative Economics Ltd, 2010 and Mark Lemley (n 13) 1889.

[36] Studies reported in Swann ibid, 4-6.

[37] Swann ibid, 9 -12; Knut Blind, "Standardisation: A Catalyst for Innovation" (August 2009) Inaugural Address, Rotterdam School of Management, Erasmus Universiteit. http://repub.eur.nl/res/pub/17558/EIA-2009-039-LIS.pdf

production costs. There is also a perception that standards do not level the playing field but may favour dominant firms.[38] Standards play an important role in network industries as they help the adoption of new technologies by enabling forward and backward compatibility.[39] There are concerns however that "over-standardisation" can restrict product differentiation and can decrease competition and innovation.[40] The level of constraint appears to vary with the nature of the standard and its user. There may be more constraint with old standards, associated with lock-in to legacy systems, rather than with new standards, however early standardisation may constrain innovation.[41] Some standards mainly codify knowledge and are informative and more likely to have a direct benefit to innovation than constraining standards concerned with such matters as health and safety. The perception of the user also varies, with more innovative users taking knowledge from the standard and then pushing the boundaries of innovation so that innovation is not prevented.[42] Standards in software must cope with lock-in, network effects and arguably a less than optimal IPR regime but overall can offer advantages from improved interoperability.

2.3 Lock-in

A lack of interoperability can result in users who have bought a platform or software being unable to join a network or to move their data and being "locked in".[43] There are two aspects to this lock-in: firstly "network" lock-in where, if they have not chosen the emergent market standard, users are faced with the additional costs of changing to the market standard, and secondly "vendor" lock-in which may cause users to lose the use of their expensively acquired data. Vendor lock-in is caused by incompatibility between the user's existing data and alternative forms of software, and is differentiated by the scale of switching costs per user and unquantifiable factors such as legacy issues and risk of undetected errors in data. User lock-in has

[38] Knut Blind, Stephen Gauch and Richard Hawkins, "How stakeholders view the impact of international ICT standards" (2010) 34 Telecommunications Policy 162-174.

[39] Blind (n 37) 30.

[40] Glader (n 35) 615.

[41] "The Empirical Economics of Standards", (June 2005) DTI Economics Paper 12, Department of Trade and Industry. www.bis.gov.uk/files/file9655.pdf

[42] Swann (n 35) referring to Peter Swann and RJ Lambert, "Why do Standards Enable and Constrain Innovation?" unpublished paper, Nottingham University Business School April (2010).

[43] Carl Shapiro and Hal Varian, *Information Rules - a strategic guide to the network economy* (Harvard Business School Press, Harvard, 1998) 107. Björn Lundell describes various types of lock-in in "Why do we need Open Standards?", M Orviska and K Jakobs (Eds) Proceedings 17th EURAS 2012 Annual Standardisation Conference 'Standards and Innovation' The EURAS Board Series, Aachen 227-240.

existed for many decades when capital equipment was only physically compatible with the original vendor's equipment. This branch of lock-in can now be caused by lack of interoperability between computer programs.

Lock-in can be caused by a variety of switching costs: damages due to contractual commitments, the cost of replacement equipment, loyalty programmes, search costs, transaction costs and uncertainty about alternative suppliers, retraining and compatibility.[44] The costs of switching from one proprietary software program to another can include new hardware, software customisation, training and implementation. Training alone is significant, and business processes may have to be changed to meet the needs of the new software. Existing data may have to be converted with the risk that it is corrupted or even lost in the process. An industry estimate is that all of these costs are about eleven times the cost of the software itself.[45]

Some suppliers have adopted a more open approach to encourage interoperability, but many still have interfaces that are strongly protected by IPRs, secrecy and constant changes or upgrades. Standards are one approach to preventing lock-in by providing compatibility, but the role of IPRs in interfaces and the consequent standards requires careful attention.

2.4 Intellectual Property Rights in Interfaces

Proprietary software companies protect their software by copyright, trade secrets and patents. These IPRs prevent the code or function being copied, and give the company control over whether other suppliers can design products which are compatible with and interoperate with each other. Depending on their business strategy, firms may be open and non-proprietary with interface information, as some may benefit from network effects for their systems. Developers of platforms have an incentive to allow other developers to create applications to work on their platforms but may not be open to potential rival platforms.[46] Others will have a proprietary closed approach. The plan can change over time and an interface is always

[44] Types of lock-in and switching costs are suggested by Shapiro and Varian and also by Paul Klemperer "Competition when Consumers have Switching Costs: An Overview with Applications to Industrial Organizations, Macroeconomics, and International Trade, (1995) 62 (4) Review of Economic Studies 515-539.

[45] Hal Varian, Economics of Information Technology (2003) revision of Raffaele Mattioli Lecture, University, Milano, Italy, 15-16 November 2001 http://people.ischool.berkeley.edu/~hal/Papers/mattioli/mattioli.html; also Ian Larkin "Bargain-then-Ripoffs: Innovation, Pricing and Lock-in in Enterprise Software" Academy of Management Annual Meeting Proceedings. 2008: 1-6

[46] Apple's strategy is normally for a closed proprietary system although it encourages applications to be written for its platform. Urs Gasser *and* John Palfrey "DRM-protected Music Interoperability and *e*Innovation" (November 2007) Berkman Publication Series. http://cyber.law.harvard.edu/interop

vulnerable and could change and become unavailable unless it is adopted as a standard.[47]

The main purpose of software standards is to increase interoperability. Software interoperability is achieved through software interfaces, particularly the data formats but also APIs and protocols. Proprietary software interfaces are not readily available (because they are not published or even properly recorded) and are often protected by IPRs. Adopting standards for the interfaces helps to record and publish the interfaces but the adoption of standards incorporating IPRs raises several issues as to how the demands of both interests can be met. The nature and justification for IPRs will be considered next.

2.5 Is there Copyright in Software Interfaces?

Copyright endows the creator with exclusive rights over its original creations for a period of time. This is done to raise the supply of works closer to a socially desirable level. Copyright is not unconditional but there must be trade-offs with other objectives and values. The law attempts to strike a balance between protecting the creator and the costs imposed on other creators, such as the cost of obtaining permission to use copyright protected work.[48] Legal exceptions have arisen for these socially desirable purposes, such as to enable interoperability.

The Software Directive gave copyright protection to computer programs, but interfaces are considered an exception.[49] The status and limits of the exception have not yet been finally established but a recent judgement in the English Courts considered that interfaces were not copyright protected.[50] The case was referred to the European Court of Justice (ECJ) for a determination of several points, including the copyright status of data formats. The Advocate General's opinion did not answer this particular question directly but he did say that the Directive "does not exclude interfaces from copyright protection", merely the ideas and principles underlying the interface.[51] The ECJ ruled that as the format of data files is used to exploit certain

[47] For example when Microsoft first entered the work-group server operating systems market it disclosed interface information to enter, catch up and then dominate that market. It then introduced new software, Windows 2000, and did not disclose equivalent information. Case COMP/C-3/37.792 Microsoft, Commission Decision of 24 March 2004 relating to proceedings under Art 82 EC, para.780.

[48] Christian Handke, "The Economics of Copyright and Digitisation" (2010) (03) UK Strategic Advisory Board for Intellectual Property Policy (SABIP).

[49] Council Directive 2009/24/EC on the legal protection of computer programs (hereinafter "Software Directive" or "Directive" as case requires) [2009] OJ L111/16. See first paragraphs of section 2.1 for an explanation of what constitutes an interface.

[50] *SAS Institute Inc v World Programming Ltd* EWHC 1829 (Ch) [2010].

[51] Case C-406/10 *SAS Institute Inc. v World Programming Ltd* [2011] ECR I -1, Opinion of AG Bot.

functions they do not constitute a form of expression and, as such, are not protected by copyright.[52] So while the source code and machine code of interfaces may not *per se* be outside the protection of copyright, there are certain aspects, such as specifications and protocols (the aspects relevant to standards) which are not expressions but ideas and principles and thus not copyright protected. When interpreting the Software Directive the ECJ must take account of TRIPS which gives copyright protection to expressions but not to "ideas, procedures, *methods of operation* or mathematical concepts as such" (emphasis added). Interfaces have been interpreted as methods of operation[53] and hence not copyright protected.

Copyright is a weak protection intended for literary and artistic expression that is normally exposed to numerous competing expressions. Unlike a work of art or the words of a book, the copyright protected material in software is not normally visible or readable. The supplier usually only distributes the program in machine code and not in human readable source code.[54] This gives a much stronger protection than is normally associated with copyright protection and creates a unique form of IPR.[55] Not only is the source code not distributed but the supplier may also claim to protect it as a trade secret. This means that while the interface may not be copyright protected it is inaccessible, and thus interoperability is hindered.

The Software Directive attempts to address this by permitting certain acts that would normally contravene copyright. One such act is to decompile machine code to re-create a higher level, human readable language. This form of reverse engineering is only permitted to obtain information for the purpose of interoperability. Subject to such restrictions in the Directive, reverse engineering is permitted even though the supplier claims trade secrets in the source code. Reverse engineering is common and often an effective means of achieving compatibility. While it is not a complete remedy, as software systems are complex and interfaces can change when new versions are released, it is difficult to see how a supplier could justify royalty payment on interfaces based on trade secrets when there is a lawful way to discover the information.[56] Indeed it has been found that copyright is rarely claimed in standards.[57]

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[52] Case C-406/10 *SAS Institute Inc. v World Programming Ltd* [2012] Judgement of the Court (Grand Chamber) 2 May 2012.

[53] Sega Enterprises, Ltd v Accolade, 977 F.2d 1510 (9th Cir. 1992).

[54] This is not the case for open source software where the source code is normally available.

[55] Decompilation can only be used to access interface information so "in essence, the Council made copyright law into a super-strong trade secrecy law as to every aspect of program internals – except interfaces" Pamela Samuelson (n 25) 21 -22.

[56] In *Microsoft, Case T-201/04 Microsoft v Commission* 5 C.M.L.R. 11 [2007] neither the Commission nor the ECJ were impressed by the trade secret argument as the protection afforded to trade secrets can be more limited than copyright or patent protections, and they exist as a result of a unilateral

In 1992 the decision in *Sega Enterprises, Ltd v Accolade, Inc.*[58] reined-in copyright and trade secret protection of interfaces in the USA. Interfaces were spoken of as "functional requirements for achieving compatibility with other programmes"[59] and so excluded from copyright protection. Copying code when reverse engineering for the purpose of extracting interface information for interoperability amounted to fair use and did not infringe copyright.[60] To enjoy a lawful monopoly over the idea or functional principle underlying a work, the creator must meet the more stringent test required for patent protection.[61] Following *Sega*, developers are unable to protect interfaces in the USA by copyright. The case also approved decompilation of code to extract interface information, and so put trade secrets at risk. This approach was followed in the recent decision in the US District Court in the dispute between Google and Oracle. The Java APIs were held not to be copyrightable, as provided the new code is different from the original, when there is only one way to express an idea or function everyone is free to do so (although this was expressly limited to the facts of the case).[62]

Since *Sega* there has been an increase in patent applications in the USA for software interfaces,[63] as although being first to market may be an incentive to innovate, particularly where there are switching costs, without some form of protection software is by its nature easy to copy, either by outright pirating or by copying the code into new products, which eliminates the first mover benefit.

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business decision dependant on its facts and the interests at stake. Here the value of the secret was not its innovative nature but the fact that it belonged to a dominant undertaking. *See* also Pamela Samuelson and Suzanne Scotchmer "The Law and Economics of Reverse Engineering", (2002) Vol. 111, The Yale Law Journal, 1575 at 1620, if reverse engineering is both lawful and feasible, trade secrecy protection for platform APIs is vulnerable.

[57] Knut Blind and others, "Study on the Interplay between Standards and Intellectual Property Rights" (OJEU S136 of 18/07/2009) Final Report, 11.

[58] 977 F.2d 1510 (9th Cir. 1992).

[59] Ibid, at 1525-26.

[60] Ibid, 1527-28.

[61] Ibid, 1525.

[62] Oracle America, Inc. v Google Inc. US District Court (31 May 2012, C10-03561 WHA) .

[63] Pamela Samuelson (n 25) 13 – there may be many thousands of patents on interfaces; Lerner J, and Zhu F, "What is the Impact of Software Patent Shifts?: Evidence from Lotus v Borland" (2005) NBER Working Paper 11168 http://www.nber.org/papers/w11168 provides empirical evidence of a surge in patenting of software dating from the mid-1990s.

2.6 Can the Purpose and Benefits of Patents be Reconciled with Standards?

The rationale for patents is to encourage innovation by excluding others. This would appear to be at odds with the aims of standards which enable interoperability and competition to encourage innovation. This sub-section explores this conflict and the professed link between patents and innovation identified in the literature, and starts with a brief overview of the law and growth in software patents.

Patents protect ideas and function, unlike copyright which just protects the expression of those ideas. Software, along with mathematical and business methods, is not patentable "as such" under the European Patent Convention and the Patents Act 1977. To be patentable it has to have a "technical contribution" which is new and non-obvious, and which is generally referred to as a computer implemented invention.[64] The USPTO has required a useful, concrete and tangible result[65] even if only on the computer screen, but with no "as such" statutory exclusion the "enablement" requirement for software inventions has been eliminated. Software patents now make up 15% of all patents granted in the USA, where about 20,000 software patents are granted each year.[66] The propensity to apply for software patents increased by 16% per annum in the 20 years to 1996 while spending on R&D grew by only 4.4%. The reason for the low relative growth in R&D spending is not clear and it may be due to R&D being more efficient and taking place in promising and expanding fields rather than a fall in innovation.[67]

The literature gives a stated justification for patent protection as the desire to stop others appropriating the work of an innovator, as this would prevent the innovator recouping a return on his R&D costs.[68] The use of patents to stop others

[64] The UKIPO adopted a four-step test first applied in Aerotel Ltd v Telco Holdings Ltd, Macrossan's Patent Application EWCA Civ [2006] 1371. The proposed patent directive was intended to provide that interfaces essential to interoperability are "ideas" or "principles" should be unpatentable. The proposed Art 6a "MS shall ensure that wherever the use of a patented technique is needed for the sole purpose of ensuring conversion of the conventions used in two different computer systems or networks so as to allow communication and exchange of data content between them, such use is not considered to be patent infringement." See Robert Bray "The European Union "Software Patents Directive: What is it? Where is it? Where are we now?" (2005) 11 Duke Law & Technology Review 28 but there may be some difficulty justifying an interoperability exception under TRIPS because normal exploitation of patents includes licensing them, Samuelson (n 25) 26.

[65] In re Alappa (33 F. 3d 1526, (1994).

[66] James Bessen and Robert Hunt, "An Empirical Look at Software Patents" (2007) 16 (1) Journal of Economics and Management Strategy, 157-189, 158-160.

[67] Ibid. 173.

[68] Kenneth Dam, "Some Economic Considerations in the Intellectual Property Protection of Software" (1995) 24 Journal of Legal Studies 321.

appropriating innovations in software has three potential economic consequences - monopolies, rent seeking and favouring current over future innovation. The right to try to exclude others may result in market power which is considered a social cost that is necessary to stimulate innovation and provide a return on R&D expenditures. Debatably, although patents rarely give monopolies in any economic market and patent doctrines can avoid unnecessary rent seeking[69], there is an acknowledged impact on competition caused by a lack of interoperability and lock-in in software markets.[70] There can also be a lack of choice in patents in standards where a distinction is drawn between patents in similarity standards and patents in compatibility standards as they have a different economic impact. FRAND rules are appropriate for similarity standards where the user can choose whether to take advantage of the patented technology. Where compatibility standards define interfaces, all who wish to use the system must pay for the patent without any decision on their part about the value of the patent to them. This is seen as an unplanned expansion of the patent system that greatly impacts the rights of others and which should be recognised and addressed.[71]

The desire to generate a stream of innovation over time means that it can be counterproductive to raise the level of protection too high. Inventors and creators want to benefit from previous works. While failure to give any protection might be a disincentive to R&D, the pace of technological change and progress could be slowed if the appropriate balance is not achieved.[72] The software sector is one where innovation tends to be cumulative and therefore the impact of patents can be negative for innovation. While patents reduce the prospects of imitation in a static world, software development is dynamic and sequential and patent protection may

[69] Ibid, 337 – economic rent is in one sense the incentive accorded to the innovator by IPR which should not be excessive. Copyright does not exclude independently created works and various patent doctrines reduce the extent of any economic rent for most technologies and see also Kenneth Dam, "The Economic Underpinnings of Patent Law, (1995) 23 Journal of Legal Studies 247, 253.

[70] In *Microsoft v Commission* Microsoft enjoyed a dominant (quasi-monopoly) on the pc operating systems market and used the lack of interoperability to leverage an increasing market share of the work group server operating system market. The impact of lack of interoperability was also recognised in merger cases such as Intel and McAfee, COMP/M.5984 *Intel Corporation and McAfee, Inc.,* [2011] OJ L. Copyright doctrine does not give protection to interfaces but there appears to be a trend to seek patent protection of interfaces.

[71] Ken Krechmer (n 12) 90-91.

[72] William Landes and Richard Posner, "An Economic Analysis of Copyright Law, 18 (1989) Journal of Legal Studies 325 at 332 "From an ex ante viewpoint, every author is both an author from whom a later author might want to borrow material and the later author himself." Copyright protection of software can be stronger than other forms of literary copyright as the source code is normally not available and the machine code cannot be read as the words of a book. Patents are disclosed to encourage later follow on innovation but do not reveal all of the know-how, Samuelson (n 26) 28.

inhibit complementary innovation.[73] This may explain why, as patent protection of software became accepted,[74] firms in the computer and electronics hardware industries, which obtained the most software patents, actually reduced their R&D spend relative to sales.[75] Most software patents in the USA were obtained by manufacturing firms, especially in the electronics and machinery industries (which include computers), with only 5% in the hands of software publishers and other software service firms, excluding IBM which accounted for an additional 2%. Patents tend to benefit the larger firms more as they have the resources to apply for, maintain and defend patents. Smaller firms are ambiguous about the advantages of patents. Although some find patents are strategically important and can help secure finance[76] they can be deterred because of expense and the fear of patent disputes with wealthier firms.[77] There has been an increase in patenting by large firms such as Adobe, Microsoft and Oracle, while most software firms hold no patents.[78] Although large firms may engage in patent portfolio races it has been concluded that software patentability has "no particular positive impact on software innovation *per se*".[79]

[73] James Bessen and Eric Maskin, "Sequential innovation, patents, and imitation" (2009) (4) RAND Journal of Economics, Winter, 611-635 – explain "sequential," as successive invention builds on the preceding one eg Microsoft's Excel built on Lotus, and "complementary," means each potential innovator takes a different research line which increases the overall probability that a particular goal is reached within a given time e.g the many different approaches taken to voice-recognition software hastened the availability of commercially viable packages. They consider that "when innovation is sequential and complementary, standard conclusions about patents and imitation may get turned on their heads. Imitation becomes a *spur* to innovation, whereas strong patents become an *impediment*."

[74] The line of cases following the ruling of the Supreme Court in the case of *Diamond v Diehr* (450 US 175) 1981.

[75] James Bessen and Eric Maskin (n 73)

[76] Andrés Guadamuz González, "The software patent debate" (2006) 1 (3) Journal of Intellectual Property Law and Practice 196, at 203-4 – venture capitalists favour firms with IPRs; Ronald Mann, "Do Patents Facilitate Financing in the Software Industry?" (2005) 83 (4) Texas Law Review 961. In email correspondence with the authors (29 August 2012) Jacques Crémer and Mark Schankerman make the case that some small firms place huge emphasis on patents both to protect their inventions from expropriation and for access to finance.

[77] Ibid Gonzalez 203-204 and Mann, 1009 and Bakels and Hugenholtz supra at 25; Puay Tang, John Adams, and Daniel Pare, "Patent Protection of Computer Programmes" (2001, INNO-99-04) European Commission Report.

[78] Bronwyn Hall and Dietmar Harhoff, "Recent Review on the Economics of Patents", (2012) National Bureau of Economic Research, Working Paper 17773.

[79] Ibid 24.

Patents granted on technologies that were already known or were obvious means the resulting patents cause social costs without offsetting benefits.[80] A serious criticism of software patents is not the concept but its "abysmal implementation."[81] Particularly in the USA, patents are being granted for processes and ideas that are obvious and not inventive.[82] This problem is recognised and there have been calls to reinvigorate the non-obviousness standard for obtaining patent protection for software interfaces.[83] The present software environment is said to be "polluted by bad software patents" which have a particular effect on open source developers who lack the resources to challenge a patent's validity or defend themselves against allegations of infringement.[84] Patents are granted on a national basis and there is variance in the legal position. It cannot be certain that the problems at the USPTO have affected Europe and the UK patent practice but criticism exists of European patents, and examples that are not innovative and where prior art exists have been identified.[85] The patent system may be national, but standards in software interfaces tend to be international, and policy on standards in the UK cannot assume that the UK is isolated from these problems.

The acknowledged drawbacks to software patents for interfaces, including insufficient rigour in the standard for non-obviousness and lack of adequate cost effective post grant review,[86] has made organisations such as OASIS and W3C sufficiently wary of patents to adopt RF policies to avoid patent hold ups.[87]

In addition to incentivising innovation, patents are granted in return for early publication of the invention. Software patents do not however have to disclose the

[80] Mark Lemley and Carl Shapiro, "Probabilistic Patents" (2005) 19 (2) Journal of Economic Perspectives, Spring, 75-98 – they note that roughly half of all litigated patents (less than 1% of all patents granted) are found to be invalid.

[81] A Jaffe and J Lerner, "Innovation and its discontents" (2004) 202 referred to by Gonzalez (n 76) 205.

[82] Gonzalez (n 76) 205 provides a quote that as much as 95% of software patents may be invalid due to the existence of prior art; Samuelson (n 25).

[83] Samuelson (n 25) 28-29; David Evans and Anne Layne-Farrar "Software Patents and Open Source" (2004) 9(10) Virginia Journal of Law & Technology, also call for reforms but consider abolishing patents for software altogether is too drastic a step.

[84] Gonzalez (n 76) 205; Samuelson (n 25) 29 believes a more cost effective way to challenge invalid patents is needed than the current litigation and re-examination procedures.

[85] Gonzalez (n 76) 205 and see: http://eupat.ffii.org/patents/samples/index.en.html

[86] Samuelson (n 25) 29.

[87] OASIS has also adopted a FRAND option.

source code or object code or even detailed descriptions of the patented program.[88] As patents can be narrower than the interface they do not necessarily require the revelation of all the "trade secrets" necessary for full compatibility. Patent protection can be available in addition to trade secret protection, but as the patentable element of software is often not visible, other than by reverse engineering, trade secrecy is an alternative to patenting. As patenting requires some disclosure it is feared that adverse selection may occur where more innovative ideas are kept secret and only the obvious ideas are there for all to see.[89]

In the Guidelines on Horizontal Agreements,[90] firms were categorised by their use and ownership of patents which would affect their interests in the outcome of the standard setting process.[91] There were the upstream-only companies that only develop and market IPR, and their incentive is to maximise royalties. There are the downstream-only companies which make or supply services based on IPR owned by others and which want to minimise royalties. The third group is vertically integrated companies which both own IPR and make goods or supply services and have mixed incentives. There is a concern that RF standards could foreclose the business for the upstream-only firms. This business model of non-practicing entities (NPEs) includes universities and research centres and patent "trolls".[92]

NPEs acquire patents in order to license them to others, although some also conduct research themselves. NPEs are very active in software patents (although not specifically standards) as software patents can be vague. NPEs are said to account for about 41% of patent litigation involving software patents.[93] The loss to defendants as a result of this litigation has been assessed at half a trillion dollars

[88] James Bessen and Robert Hunt (n 66); Courts in the USA have accepted high-level functional descriptions.

[89] Christian Koboldt, "Much Pain for Little Gain? A Critical View of Software Patents" (2003) (1) Journal of Information Law and Technology.

[90] Guidelines on the applicability of Article 101 of the TFEU to Horizontal Co-operation Agreements OJ [2011] C 11/1.

[91] Ibid para. 267.

[92] Tom Ewing and Robin Feldman, "The Giants Among Us" (2012) Stanford Technology Law Review 1 – in a little more than five years, the largest of the NPEs have accumulated 30,000-60,000 patents worldwide, which would make it the 5th largest patent portfolio of any domestic US company and the 15th largest of any company in the world. http://stlr.stanford.edu/pdf/feldman-giants-among-us.pdf but see also Damien Geradin "What's wrong with royalties in high technology industries?" (December 2009) TILC Discussion Paper DP 2009-045 who presents the case for royalties for upstream only firms.

[93] James Bessen, "The Private and Social Costs of Patent Trolls" (2011) Regulation, Winter, 26 - 35, 34.

while the benefit to the original patent inventor was only 2 percent of that amount.[94] The threat of this litigation, which for software is often for an inadvertent infringement, can be a disincentive to innovate.[95] There is concern that the incentive flow to small inventors does not offset the very much larger disincentive imposed on technology firms. This shortfall is considered a social cost of NPEs.

The aim of preventing imitation is the traditional patent motive, but there is evidence of other strategic motives. These include blocking competitors by patenting in adjoining fields with no intention of exploiting the patent, and for the purpose of exchanging and cross licensing.[96] "Patent thickets" are cited as a disadvantage of patenting of software as they may require complex cross-licensing to allow newcomers to enter the market, but are said not to effect research and development spending.[97]

2.7 Patents and Standards

Patents in standards are said to aid investment in and diffusion of the standard as well as encouraging patents to be committed to a standard.[98] Further, while patents may not be well suited to software inventions, there is said to presently be insufficient empirical evidence that patents are such a major impediment to interoperability that the exclusion of interfaces from patent protection is justified.[99] There are however several examples of established firms with strong market positions taking patents on interfaces, possibly with the aim of controlling the development of competing and complementary products.[100] Patents are considered most threatening to competition when they are held by established firms with market power which may use them to leverage their dominant position in one market into an adjacent market.[101]

[94] Ibid 31-32.

[95] Ibid 33.

[96] Knut Blind, "Motives to patent: Empirical evidence from Germany" (2006) Research Policy 35, 655-672.

[97] Mann (n 76) 999-1004.

[98] Blind (n 57).

[99] Pamela Samuelson (n 25) 48, reached this conclusion after talking at length to industry experts and being surprised at the lack of examples of patents as an impediment to interoperability.

[100] Ibid 19.

[101] Ibid 3.

The exclusionary power of patents in interfaces is considered strong[102] as infringements are easier to detect than other software patent infringements and as patents protect the function and not just the way the code is written, thus potentially making it impossible to work around the patent.[103] In the absence of an SSO imposing a FRAND or RF obligation, firms can often charge higher royalty rates for licensing interface patents than other patents, regardless of the intrinsic degree of innovation.[104] This practice known as "patent hold up" should be alleviated where the SSO successfully adopts a FRAND or RF policy.[105]

Patent ambushes are another potential problem in standards where members of SSOs are deceptive and only assert their patents after the standard is set. A similar risk comes from non-members who subsequently assert patents without any FRAND obligation. These incidences are not common but significant when they do occur. Standards in some parts of the ICT industry have also suffered from royalty stacking where multiple royalties impose a burden that is inefficient or even obstructive as individual rights holders do not take account of the negative effect on downstream sales. Again it is argued that excessive cumulative royalties are uncommon and whether royalties are passed downstream to end customers depends on a number of market factors.[106]

A further concern is that the royalty that can be imposed may be due to the nature of the standard rather than the value in the IPR. The IPR holder may try to profit from the standard's strategic position and extract excessive rents.[107]

Participants in the process of adopting a new interface standard tend to accept the IPR of others if its own IPR is also accepted. Although the participants benefit, this is unfair to those who do not participate and to the end user who ultimately bears the cost.[108]

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[102] Maureen O' Rourke, "Towards a Doctrine of Fair Use in Patent Law" (2000) 100 Columbia Law Review 117, 1218 – noting that many interfaces are arbitrary, obvious and /or of low intrinsic value.

[103] Mark Lemley and Carl Shapiro, "Patent Holdup and Royalty Stacking", (2007) 85 Texas Law Review 1991, 2016.

[104] Ibid; O'Rourke (n 102) 1218.

[105] Damien Geradin "Reverse Hold-ups: The (Often Ignored) Risks Faced by Innovators in Standardized Area" The Pros and Cons of Standard Setting, 2010 Konkurrensverket, Swedish Competition Authority, in which it is argued that the risk of patent hold-ups is exaggerated and the real risk is of under compensation for patent holders.

[106] Damien Geradin, "What's wrong with royalties in high technology industries?" (December 2009) TILEC Discussion Paper DP 2009-043. http://ssrn.com/abstract=1104315

[107] Knut Blind and others (n 57).

[108] Ken Krechmer (n 12) 91.

Patents may not be the only IPR in interfaces, but patents appear more likely to attract licence fees than other IPRs. Following the *Microsoft* case and the settlement in 2009, Microsoft still continued to charge royalties for its interface patents but not for non-patented interface information.[109] Microsoft's willingness to license protocols including to SAMBA on GPL-friendly terms may not have occurred but for the Commission's enforcement action.[110]

2.8 How do SSOs Approach IPR?

While the terms adopted by SSOs vary, the majority require or encourage members to disclose essential patents, and sometimes all IPRs of which they are aware. It is not usually required for participants to disclose pending patents or to conduct searches. Some SSOs do not require disclosure provided the patent holder is willing to commit to licence on FRAND or RF terms. An empirical study found that mandating RF licensing is negatively associated with a disclosure requirement, but that FRAND is strongly associated with such a requirement.[111]

The W3C requires patents necessary for interoperability to be licensed RF, although there is a procedure for getting an exclusion from RF.[112] OASIS adopted RF licensing options but also allows for some licensing of patented technologies for standards on RAND terms. Apparently the RF terms have proved more popular and the overwhelming majority have adopted RF policies for application and web services approved by OASIS.[113]

Patents remain enforceable even where an RF policy for interface patents is adopted, but it is thought that this policy reduces their leverage and economic value. This will dampen incentives to acquire patents. Even so, some open source developers do not agree with W3C and similar RF policies as the license may still include restrictions that are not acceptable to some members of the open source community.[114]

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[109] http://www.microsoft.com/openspecifications/en/us/programs/default.aspx

[110] William Page and Seldon Childers, "Bargaining in the Shadow of the European Microsoft Decision: The Microsoft-Samba Protocol License" (2008) 102 Northwestern University Law Review 332 – 354.

[111] Benjamin Chiao, Josh Lerner, and Jean Tirole, "The Rules of Standard Setting Organizations: An Empirical Analysis"(February 9, 2005) http://www.people.hbs.edu/jlerner/ssoempirical.pdf

[112] http://www.w3.org/2004/10/patents-standards-innovation.html

[113] Samuelson (n 25) 43. http://www.oasis-open.org/standards
Carl Mair in correspondence with the authors (1 October 2012) points out that software standards adopted under FRAND are uncommon and there is a move towards more Web-based applications that use RF standards, such as W3C.

[114] Samuelson (n 25) 43.

When a sample of SSOs policies was reviewed in 2002,[115] the majority adopted standards which included IPRs, but two SSOs prohibited the continued ownership of any IPRs adopted by a standard, and one required members to give up patent rights. The policy of at least one of those SSOs, the ISO, has changed and members can now continue to own patents with a policy of disclosure and licence of patents on RF or RAND terms.[116] Four SSOs permitted members to own the patents but only if they licensed them RF.[117] A further survey recorded in 2005 found a majority of SSOs (63%) used RAND in the patent licensing rules and only 9% used RF rules.[118] More recently there are signs of a shift towards RF licensing as Google and web standards bring competitive pressure to adopt RF licensing models.[119]

One thing most SSOs have in common is that while they may require patents to be licensed on FRAND terms, the negotiations on converting that principle into actual figures and words must take place between the parties. The 2005 survey found that only 9% of organisations have a dispute resolution mechanism. Most SSOs are not involved in agreeing what may constitute a reasonable fee or other terms.[120]

2.9 Is There a Failure in the Market due to IPRs in Standards?

Most commentators agree that there should be a market for standards with minimal government interference. IPRs are however by their nature interference, as they give exclusive rights of self-interest in return for benefits that give public economic welfare in the form of incentives to innovate and publication of past innovations. IPRs are granted in the expectation that the deadweight loss caused by the grant of exclusivity is lower than the value of increased inventiveness that follows.

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[115] Mark Lemley (n 13) 1902, the rules of 43 different SSOs setting standards in telecommunications and computer-networking industries were surveyed in 2002.

[116] The ISO policy, along with the ITU and IES was changed in 2007, see http://isotc.iso.org/livelink/livelink/fetch/2000/2122/3770791/Common_Policy.htm and http://www.iso.org/iso/newsandmedia/pressrelease.htm?refid=Ref1052

The ISO members can make a declaration whether they will license on RF/RAND or just RAND terms, or not at all. If they do not agree to license on RAND/RF terms then the patent should not be included in the standard. ANSI and ETSI have similar policies.

[117] (I20 SIG, RosettaNet, MWIF and Wired for Management). Allowing them to keep the patent but license on royalty free basis allows them to use the patent to challenge infringement which is not related to the standard.

[118] Benjamin Chiao (n 111) 19.

[119] Carl Mair, "Openness, Intellectual Property and Standardization in the European ICT Sector" (2012) 2 (2) IP Theory, Indiana University.

[120] See eg the ISO/ITU/IEC policy that "negotiations are left to the parties concerned and are performed outside ITU-T/ITU-R/ISO/IEC", http://isotc.iso.org/livelink/livelink/fetch/2000/2122/3770791/Common_Policy.htm

Market failures are not limited to actual failures of markets to appear, but also occur when markets fail to align private and social economic welfare and arguably socio-economic goals.[121]

Lerner and Schankerman acknowledge that there are shortcomings in both patent policy and the functioning of SSOs with externalities due to network effects and a lack of information about the market, particularly open source software. They do not however consider that governments should exploit their purchasing power to compensate for distortions, and change the nature of the market. They propose that market failure in the form of abuse of network dominance should be addressed by competition law.[122] A lack of interoperability, lock-in and high switching costs do not always justify intervention, even when the results are strong network effects. Innovation can still happen in other ways, such as the "gale of creative destruction" or the "killer app" rather than evolution.[123]

However the IPR regime for software, which is arguably not fit for purpose, gives an additional barrier to entry by giving monopoly rights that may not efficiently incentivise innovation. For competition law to intervene there must be both dominance and evidence of abuse, and the remedy invariably gives only a slow ex-post remedy. But due to lack of interoperability and the resulting lock-in and high switching costs there can be little competition in some software markets even where there is no obvious monopoly.[124] Lack of interoperability means the market is not contestable, but as there is no single dominant supplier a normal remedy under competition law is unavailable.

In some software markets there appears to be a dominant supplier. It is claimed that the desktop PCs of Europe's governments are completely locked in to a single

[121] Wendy Gordon, "Fair Use as Market Failure: A Structural and Economic Analysis of the Betamax Case and its Predecessors" (82) 1982 Columbia Law Review 1600-1657; and "Market Failure and Intellectual Property: A Response to Professor Lunney" (82) 2002 Boston University Law Review 1031-2002.

[122] Josh Lerner and Mark Schankerman (n 23). In email correspondence with the authors (29 August 2012) Jacques Crémer and Mark Schankerman propose that procurement power should not be used to address any perceived market failure which should be addressed instead by competition law or by drafting exceptions to patent protection into patent law.

[123] Joseph Schumpeter, "Capitalism, Socialism, and Democracy" 81 *et seq*. (George Allen, London, 1976) first published 1942.

[124] An example is the 3D computer aided design market see Cyon Research, *Intellectual Capital and Interoperability* Cyon Research Corporation, 2003. The supply of IT to the UK Government has been described as an oligopoly with evidence of barriers to entry and lock-in. Public Administration Committee *Government and IT- "A Recipe For Rip-Offs": Time For A New Approach Twelfth Report,* (HC) March 2011, 715-II.

proprietary software vendor due to high switching costs.[125] The market is tipped "towards a certain technology or standard, not necessarily the one offering the highest user benefits, creating a monopoly position for the seller of that technology."[126]

Vendor lock-in and high switching costs are said to give a first-mover advantage leading to higher prices and entry barriers for suppliers of new software products. "In software markets, the implication is not necessarily that production by a single firm is the most efficient outcome. The resulting high monopoly price creates a deadweight loss, that is, a loss in welfare that occurs when demand is reduced due to a mark-up in the price."[127] By "welfare", economists mean consumer and producer surplus.[128]

The dependence on a single IT vendor has been described as "a waste of public money that public bodies can no longer afford",[129] a waste not only of public money but also of the private money of the citizen who has to use a specific product (rather than any product compliant with an applicable standard), to use a public service.

Market failure also occurs due to asymmetric information. IT systems are sufficiently complex that, while the producer may have an advanced understanding of the system, the user does not, until it is too late. There are several examples in the UK of software system procurement that have gone badly wrong. The notorious FiReControl Project was intended to introduce a new IT system linking nine purpose-built regional centres. It was terminated after seven years at a cost of £469 million, with no IT system delivered and eight of the nine new regional control centres remaining empty and costly to maintain.[130] Although management failings in that project went beyond the IT system, less complex IT projects such as the attempt to

[125] It is said that less than ten thousand of Europe's civil servants use a desktop system that does not depend on this proprietary software vendor which equates to one fifteen-hundredth (0.0007) of the total of fifteen million desktops; Gijs Hillenius, "Governments could save millions by reducing their dependence on a single desktop PC software vendor" (11 March 2011) European Journal of ePractice, www.epracticejournal.eu.

[126] Michiel Bijlsma, Paul De Bijl, and Viktoria Kocsis (2009). CPB Document 181, Competition, innovation and intellectual property rights in software markets, Communications & Strategies, no. 74, 2nd quarter.

[127] Ibid.

[128] Gijs Hillenius (n 125).

[129] Neelie Kroes Address at Open Forum Europe 2010 Summit: "Openness at the heart of the EU Digital Agenda" Brussels 10th June 2010. http://europa.eu/rapid/pressReleasesAction.do?reference=SPEECH/10/300&format=HTML&aged=0&language=EN&guiLanguage=en

[130] National Audit Office "The failure of the FiReControl project" (1 JULY 2011) HC 1272 SESSION 2010–2012.

improve shared service centres have also failed to achieve the expected cost savings in part due to imperfect information about complex software and costs. The projects indicate an imperfect market and are expensive for the taxpayer, underlining the need for government to improve all aspects of IT procurement, including taking steps to improve interoperability.

Interim Conclusion

The law has recognised that software interfaces should be exempted from copyright protection. The law on software patents has developed separately and there is no exemption for interfaces. There is evidence that the concept and implementation of software patents is flawed, does not incentivise innovation and could restrict the operation of standards and interoperability. This raises the question of whether there is any economic justification in encouraging patent protection of interfaces and whether there is a failure of the market which has not been corrected by the SSOs' adoption of FRAND policies. Further research is required before this question can be resolved. This research could investigate the liberalisation of interface information, exempting interfaces from patent protection, and could consider whether conventional competition rules can adequately regulate markets characterised by a lack of interoperability and lock-in. In any event the role of government when acting as a procurer of software should not primarily be one of market intervention. Governments should however be aware that arguments suggesting that royalties on standards are essential to reward and encourage innovation are not clear cut and the balance of interests is in fact far more nuanced.

3 Regulatory Implications of Mandating open Standards Under EU Competition and Procurement Law

3.1 Guidelines on Horizontal Agreements

Setting of standards creates an exclusive market position which can easily be abused. The co-operation between competitors and the setting of detailed specifications can exclude competing technologies.[131] For this reason the behaviour of firms participating in standard setting can infringe Art 101 and 102, competition law provisions of the TFEU.

The benefits of standards are well recognised as improving economic efficiency and promoting growth[132] and for this reason are encouraged despite the possible restriction on competition. For a standard to be beneficial, it must not only have technical merit, but the rules, process and procedures of adoption on which it is available for implementation must also be sound and in particular must not infringe competition law. The Commission has issued guidance in the form of the "Guidelines on Horizontal Agreements" to assist SSOs and other interested parties in shaping the standard setting process, to comply with European competition law.[133]

The Guidelines cover all standards, but this document is concerned with standardisation agreements covering technical specifications in markets where compatibility and interoperability with other products or systems is essential.[134]

In the past decade the level of essential IPRs in standards has increased.[135] The Commission has dealt with some high profile disputes including *Rambus,* a "patent ambush" case, where Rambus did not reveal an essential patent until the industry was locked-in.[136] It has been said that attention has shifted in recent years from

[131] Sven Sattler, "Standardisation under EU competition rules – the Commission's new horizontal guidelines" (2011) 32 (7) European Competition Law Review 343-349.

[132] See for example Marcus Glader (n 35) 611; Swann (n 35); Mark Lemley (n 13).

[133] Guidelines on the applicability of Article 101 of the TFEU to Horizontal Co-operation Agreements OJ [2011] C 11/1 ("The Guidelines").

[134] Ibid.

[135] Sven Sattler (n 131) 344; Anna Emanulson, "Standardisation agreements in the context of the new Horizontal Guidelines" (2012) 33 (2) European Competition Law Review. 69-76, 70.

[136] COMP/C-3/38.636 – Commitment Decision by Rambus in response to the Commission's claim that Rambus had breached Art102 TFEU by not disclosing an essential patent before leaving the SSO and trying to charge above FRAND prices. Rambus committed to put a cap on its royalty rates for

concerns about collusion between participants, where the aim is to exclude competitors, to focus on preventing "hold up" problems. This change of emphasis is a result of the increase in the incidence of patents in standards.[137]

The Guidelines acknowledge that standardisation agreements may encourage new and improved products, increase competition, reduce costs and ensure interoperability.[138] In specific circumstances however standard setting can potentially reduce competition by restricting price competition, foreclosing technologies and discrimination by preventing access to the standard for example by using IPRs to "hold-up" users after the standard has been adopted.[139] The Guidelines recognise that SSOs have different rules and procedures, but also provide a limited "safe harbour" for SSOs meeting certain criteria based on unrestricted but non compulsory participation, a transparent procedure and access on FRAND terms.[140] FRAND can also cover RF licensing.[141] It is thought that SSOs with an RF standards policy would meet the safe harbour requirements without having to disclose IPRs.[142] Variation from these terms does not necessarily invalidate the standard but the rules and procedures must satisfy an effects-based assessment, contain only essential restrictions, and display efficiency gains which are passed on to customers. Efficiency gains include technical interoperability and compatibility as they often encourage competition and prevent lock-in.[143]

When implementing open standards a government will normally be interested in the Guidelines as a public procurer and user of standards rather than as a participant. This report considers the role of government from that perspective, as a third party or consumer,[144] not as a participant in the standard setting process. If there is any

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products compliant with the standards for five years. Rambus also agreed to charge zero royalties for certain chip standards in combination with a maximum royalty rate of 1.5% for the later generations of standards.
http://europa.eu/rapid/pressReleasesAction.do?reference=IP/09/1897&format=HTML&aged=0&language=EN&guiLanguage=en

[137] Anna Emanulson (n 135) 70.

[138] Guidelines para. 263 – the Guidelines say these benefits should increase value for consumers.

[139] Guidelines para. 264-269 – Standardisation agreement that have the object of restricting competition are unlawful para. 273.

[140] The safe harbour is only limited: the Guidelines say such agreements will *normally* not restrict competition – Guidelines para. 280.

[141] Guidelines para. 285 (n 3).

[142] Anna Emanulson (n 135) 75.

[143] Guidelines para. 308.

[144] The entity "consumer" is not defined in EC competition legislation but in guidance on competition law "consumer" has included those who purchase goods in the course of their trade including those

collaboration with a participant in the standard-setting procedure then the position needs to be reassessed as a government could then be subject to the rules as a participant.

The main concern for a government adopting open standards is that the standard will be available in the future to maintain existing IT services and for future procurement. The government does not want to be locked-in to a standard which then becomes unavailable because the rules and procedures on which it was adopted were unlawful or unenforceable.

The aim of competition law and the Guidelines is to avoid competition being distorted by the setting of standards. To avoid collusion a transparent process must give unrestricted rights for all competitors to be involved, non-discriminatory allocation of voting rights and objective criteria for selecting the technology.[145] Of more direct interest to a government adopting open standards is the requirement that participants are required to make good faith disclosure of any IPRs so that an informed decision can be made on whether to include the technology in the standard. Perhaps of most importance though is the requirement in the Guidelines that once a standard is adopted there is an irrevocable written commitment to make essential IPR available on FRAND terms.

FRAND can range from RF to a price that is reasonable *ex ante,* before the industry has been locked-in to the market. The participants, not the SSO, must assess whether licence terms are FRAND.[146] This may well result in each firm wishing to use a standard negotiated separately with the patent holder. The Guidelines say the fees should bear a reasonable relationship with the economic value of the IPR rather than a cost-based method as it would be difficult to attribute development costs to particular patents. Comparisons with *ex ante* pricing by the company for relevant patents is one possibility. Another is an independent expert assessment of the "objective centrality and essentiality to the standard at issue of the relevant IPR portfolio."[147] Again comparisons can be drawn with other relevant *ex ante* prices. The Guidelines are not exhaustive and no mechanism is provided to resolve disputes. It is recognised that the courts are still the only final arbiters if a reasonable royalty cannot be agreed.[148]

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who are the customers of the parties to the agreement and subsequent purchasers – see for example Philip Marsden and Peter Whelan, "Consumer detriment" and its application in EC and UK competition law" ECLR 27(10 (2006) 569-585.

[145] Guidelines para. 281.

[146] Guidelines para. 288.

[147] Guidelines para. 290.

[148] The Commission has taken proceedings against Qualcomm for failure to licence on FRAND terms but there Qualcomm was allegedly dominant and proceedings were under Art 102 TFEU see press

The Guidelines try to block a loophole by which the FRAND obligation could be sidestepped. Not only must participants give irrevocable commitments in writing to licence any essential IPRs that are adopted by the standard on FRAND terms, but also, in order to ensure the effectiveness of the commitment, ensure that when they transfer the IPR any transferee is also bound by that commitment, for example by a contractual clause.[149] This is aimed at preventing a recurrence of the problems that arose when IPCom acquired standard-essential patents from Bosch and the FRAND commitment did not automatically follow suit.[150] The Commission stepped in again, and IPCom relented before the opening of formal proceedings. By doing so the Commission recognised that the unrestricted access to essential patents on FRAND terms for all third parties safeguards the pro-competitive economic effects of standard setting.

The main aim of the Guidelines is to shape the standardisation process in accordance with competition law. By doing so they fortunately also come to the assistance of governments aspiring to reduce costs and lock-in by introducing open standards. The common aim of safeguarding proprietary technology on FRAND terms for all third parties is of mutual benefit. The Commission's principle of "prevention is better than cure" of identifying IPRs before the industry is locked-in is another benefit.[151]

Remaining perils include: The Guidelines allow participants to disclose *ex ante* their most restrictive licensing terms.[152] The Guidelines do not allow participants to negotiate an aggregate royalty rate for a standard,[153] so although the individual royalty may seem reasonable, the aggregate cost for all the essential patents in a standard could be undesirably high, and potentially amount to royalty stacking. Without the ability to discuss, in theory each licence has to be negotiated separately

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release - Antitrust: Commission initiates formal proceedings against Qualcomm. http://europa.eu/rapid/pressReleasesAction.do?reference=MEMO/07/389&format=HTML&aged=1&language=EN&guiLanguage=en

[149] Guidelines para. 285. This was highlighted as a potential problem in Knut Blind and others (n 57).

[150] Commission, Press release 'Antitrust: Commission welcomes IPCom's public FRAND declaration' (December 10, 2009) MEMO/09/549. http://europa.eu/rapid/pressReleasesAction.do?reference=MEMO/09/549&format=HTML&aged=0&language=EN

[151] Sven Sattler (n 131) 349.

[152] Guidelines para. 299 – the Commission may have hoped that reasonable ex ante rates would be disclosed but parties are more likely to disclose a high maximum which could raise aggregate royalties rather than lower them - John Temple Lang, "Patent pools and agreements on standards" (2011) 36 (6) European Law Review 887-895, at 891.

[153] This can give rise to an abuse of monopsony power by the oligopsonists in the SSO, see Knut Blind and others (n 37).

which slows and complicates the process and can lead to secret informal discussions. These arrangements are inefficient and inconsistent with the system of patent pooling[154] where the parties can discuss and agree an affordable aggregate royalty rate. In practice royalty terms are often set between the patent owner and the supplier of technology using the standard. The end user is not involved although the cost will normally be passed on to them. The Guidelines only apply to standards that have market power.[155] It could therefore be possible to adopt a standard which is not subject to the Guidelines. Before adopting a standard the terms of the SSO must be checked rather than assuming FRAND applies.

3.2 Public Procurement

Calls for tenders for IT systems with open standards that come within the threshold of public procurement legislation must comply with the Public Procurement Directive 2004/18/EC[156] and Article 23 in particular. This requires technical specifications to afford equal access and not create unjustified obstacles to competition. The Directive specifies in an annex which technical standards can be used, and in which order of preference, but any reference to a standard must be accompanied by the words "or equivalent".[157] It is said a standard cannot be rejected if it meets the performance requirements, regardless of whether it contains IPRs on FRAND terms.[158] Standards should not be used in a discriminatory fashion that is unjustified by the subject matter of the contract.[159] Also, unless justified by the subject matter of

[154] See John Temple Lang (n 152) and see Guidelines on the Application of Article 81 of the EC Treaty to Technology Transfer Agreements [2004] OJ C-101/2; The practice of setting royalty terms with the supplier was set out in email correspondence between Jacques Crémer and Mark Schankerman and the authors (29 August 2012). Carl Mair in correspondence with the authors (1 October 2012) points out that once a standard has been adopted a patent pool can be established. The Horizontal Guidelines will no longer apply and the terms of the Technology Transfer Guidelines will be controlling.

[155] Guidelines para. 277 – market power is not defined.

[156] Directive 2004/18/EC1 on the co-ordination of procedures for the award of public works contracts and public supply contracts and public service contracts [2004] OJ L 134/114. Council Decision 87/95/EEC on standardisation in the field of IT predates the Directive and provides guidance for public procurement of IT systems.

[157] The obligation to consider equivalent standards or solutions which conform to the standard in practice shifts the burden of proof from the supplier to the contracting authority which would need to justify why it rejected the alternative solution. In practice authorities are not well equipped to make this evaluation and a common practice is to accept a proof of declaration from the supplier. Ramona Apostol, "Formal European standards in public procurement: a strategic tool to support innovation" (2010) 2 Public Procurement Law Review 57-72, 63.

[158] Susannah Sheppard (n 7) 54- 56.

[159] Case 45/87, Commission v Ireland, [1988] ECR 4929 the Irish *Dundalk* pipeline case where the standard favoured national contractors.

the contract, calls should not specify products or services by proprietary make or IPRs such as trademarks or patents and should not discriminate in favour of particular suppliers. There is evidence that despite this, the use of trademarks is widespread.[160] The desire for compatibility may lead the procurer to explicitly prefer proprietary technology, particularly when it is locked-in.[161]

Legal challenges have occurred when public authorities have adopted a policy of preferring open source software on the grounds the policy does not meet principles of equal treatment and non-discrimination.[162] Several attempts to adopt open source and/or open standards policies have been moderated so that rather than preferring open source, procurement is based on careful consideration of all possible alternatives.[163]

The Dutch Government's action plan "*Netherlands in Open Connection",* adopted in 2007, expresses an explicit "preference for open-source software in the case of equal suitability".[164] This public procurement policy is said to recognise that it should not discriminate between individual vendors but rather adopts a specific business model to meet procurement requirements. The preference for open source is not implemented by acquiring specific software applications or by favouring particular vendors, but through the functional requirements and award criteria specified in calls for tenders.[165]

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[160] Of 171 contact notices for computer software scanned for trademarks in the period from February 1 to April 30, 2009, 37 (21.6 percent, against 25 percent on 2008 exercise), mentioned trademarks in procurement documents. In 22 cases (12.8 percent), tender notices mentioned Microsoft or one of Microsoft's products. Open Forum Europe Procurement Monitoring Report: "Discrimination in Public Procurement Procedures for Computer Software in the EU Member States" (December 2009).

[161] For an account of this and similar procurement practices see Rishab Ghosh, "An Economic Basis for Open Standards" (2005) University of Maastricht.
http://www.intgovforum.org/Substantive_1st_IGF/openstandards-IGF.pdf

[162] McLean Sieverding, "Choice in Government Software Procurement: a Winning Strategy" (2008) 8 (1) Journal of Public Procurement 70-97, discussing the decision of the Belgian Supreme Administrative Court in 2003 and the Brazilian Supreme Court in 2004 which rules against legislation that preferred the use of open source software.

[163] Ibid, 80-81, citing the case of Massachusetts and other states including California which in the period 2004 to 2005 considered preferring open sources but then adopted a policy of software neutrality and best value based on total cost of ownership.

[164] http://www.noiv.nl/files/Actionplan%20The%20Netherlands%20in%20Open%20Connection.pdf

[165] Rishab Ghosh and others "Guideline on Public Procurement of Open Source Software" 2010 (June 2010 revision) IDABC Programme.
http://www.epractice.eu/files/Guideline%20on%20public%20procurement%20of%20Open%20Source%20Software.pdf

IT solutions must be designed to fit into the organisation's IT architecture. The IT architecture needs of public sector organisations are strongly linked to interoperability and open standards. “Public authorities need to be able to define their ICT strategies and architectures, including interoperability between organisations, and will procure ICT systems/services and products or components thereof, that meet their requirements.”[166]

Open standards may be essential to interoperability between systems for an effective IT architecture. This is the reason for the emphasis on open standards, and at a higher level, interoperability agreements in the European Interoperability Framework.[167] Open standards requirements can be defined in tenders in terms of these functional, technical or business needs, or by referring to standards. Likewise, a requirement to be able to modify and distribute the software and have access to the source code would justify specifying open source software on the basis of functional, technical and business model requirements.[168]

When technical criteria are met, selection is on the basis either of ″the lowest price″ or, where quality and not price alone is the deciding factor, ″the most economically advantageous from the point of view of the contracting authority″.[169] It is often said that the Total Costs of Ownership (TCO) of software purchases should be considered.[170] While there may be no licence fee for open source software, other costs will apply. TCO should include all the long-term costs involved in software purchases, such as the costs of required regular upgrades, or the exit cost of migrating to other software. These costs can be greater without open standards and forward compatibility due to restriction in choice of future suppliers and lock-in. TCOs that are narrowly defined can still omit other non-quantifiable costs such as the benefits of flexibility, independence and transparency which are essential to a

[166] European Commission, “White Paper on Modernising ICT Standardisation in the EU –The Way Forward” (COM(2009) 324) 7.

[167] COM (2010) 744 final Communication – Towards interoperability for European public services – European Interoperability Framework for European Public Services v.2 (“EIF2”).

[168] Rishab Ghosh and others (n 165) 25 and also Annex B which gives a legal guide behind the practical guidelines. http://www.epractice.eu/files/Guideline%20on%20public%20procurement%20of%20Open%20Source%20Software.pdf

[169] Public Procurement Directive 2004/18/EC, Article 53.

[170] Maha Shaikh and Tony Cornford, Total cost of ownership of open source software: a report for the UK Cabinet Office supported by Open Forum Europe http://eprints.lse.ac.uk; discussed in email correspondence with Jacques Crémer of University of Toulouse and Mark Schankerman of London School of Economics (29 August 2012); see also Josh Lerner and Mark Schankerman (n 23) 107-155.

public organisation. Costs and benefits should be analysed over the long term, rather than relying on TCO studies that are too narrowly defined.[171]

Research to assess the effect of standards in public procurement failed to prove a positive correlation between standards and innovation, but the use of functional or performance-based standards can aid innovative bidders. Development of an open standard early in the development of new technology can give the first mover a competitive advantage and in the long run increase competition and reduce the cost of the innovative technology. Interoperability standards were also found to have a positive influence on innovation. The reasons that the use of standards in public procurement gives these benefits includes opening public markets to innovate products by giving the public procurer confidence in the product which disseminates the product among public procurers and stimulates further R&D investment.[172]

It is recognised that standards must keep pace with rapid technological development and that in the IT sector most standards ensuring interoperability are not developed by the formal SSOs. A draft regulation proposes to permit the use of standards set by other organisations, commonly referred to as global fora and consortia, to be specified in public procurement. Before adoption the standards will have to comply with a set of criteria based on WTO principles. SMEs and other stakeholders will be better represented in European standardisation with financial support available for their representation.[173]

A policy that precludes FRAND licensing is said to be an obstacle to tenderers reliant on royalty-based licensing and may prevent the use of some formal European standards which incorporate IPRs. Such a policy has been seen as an attempt to extract essential IPR from market participants at no cost, which is not a legitimate policy objective. Also, because of the size of the market for IT in the public sector, affirmative action for RF and open source turns public procurement into a form of market intervention.[174] An RF open standard policy would however only extend to the IPR in the standard itself and standards with RF or FRAND terms both allow competition from proprietary suppliers, although the GPL attempts to restrict the extent of integration of open source and proprietary software. The RF terms are

[171] Rishab Ghosh and others (n 165) 31; Bjorn Lundell, 'e-Governance in public sector ICT procurement: what is shaping practice in Sweden?', 12 European Journal of ePractice March/April 2011 - ISSN: 1988-625X – total cost of ownership on procurement should include exit costs.

[172] Ramona Apostol (n 157) commenting on the Steppin project (Standards in European Public Procurement Lead to Innovation), part of the Commission's Europe Innova initiative.

[173] Proposal for a Regulation of the European Parliament and of the Council on European Standardisation Brussels, 1.6.2011 SEC(2011) 315 final.

[174] Susannah Sheppard (n 7).

limited to the standard and as discussed above the rationale for IPR in software standards remains uncertain.

Interim Conclusion

The legal framework is complicated but can support a policy of open standards. The Guidelines have helped when adopting standards but the SSOs are not responsible for agreeing FRAND terms and this remains an area of uncertainty. Despite a FRAND commitment the rise in the incidence of patents in interface standards has increased the commercial significance of the standard setting procedure so that the standards themselves are a source of income in addition to the market they serve. The Commission will only become involved in exceptional cases, for example when the patent holder is dominant. There is no substitute for careful due diligence of the SSO and of each standard before adoption. There is evidence that the Procurement Directive encourages the use of standards to specify the subject matter of contracts and there is evidence that the Directive will accommodate an open standards policy based on the functional non-discriminatory requirements of a specific business model.

4 A Review of the Literature on Certain Options for the Implementation of an Open Standards Policy

There are several practical limiting factors that should be recognised, as these will reduce the potential benefits of an open standards policy or influence how it should be implemented. These factors are illustrated here but this does not form an exhaustive account. Standards do not guarantee interoperability, indeed many standards provide only limited interoperability. The study by Shah and Kesan on compatibility between ODF, OOXML and DOC revealed examples of poor compatibility varying from formatting problems to loss of information in pictures, footnotes, comments, tracking changes and tables. Less than 100% interoperability may significantly reduce the value of these document formats for some government applications such as the archiving of information.[175]

Another consideration is whether a single standard should be adopted, and if so which one. Not all standards are successful and it appears that only a few generate most of the impact in a "winner takes all" scenario. Standards that are likely to have a high impact can be recognised at the development stage: they are more likely to have more participants and more divisive debates. This can result in longer standards, so more complexity and more words can indicate a standard with more impact.[176] It is said that little research has been done on the impact of competing (functionally equivalent) open standards on such matters as interoperability, innovation, and the environment and this is not directly addressed in guidance such as the Dutch selection procedure and the CAMSS project.[177] Egyedi considers that selecting two or more functionally equivalent standards is inadvisable as this may reduce market transparency, decrease overall interoperability, decrease network externalities, decrease ease of use, fragment the market and possibly lead to forms of lock-in and increase transaction costs, for example the costs of converters.[178] To

[175] Rajiv Shah and Jay Kesan, "Lost in Translation: Interoperability Issues for Open Standards" (September 2008) Illinois Law and Economics Research Paper series No. LE08-026. http://papers.ssrn.com/abstract=1201708

[176] Rajiv Shah and Jay Kesan, "An Empirical Study of Open Standards" TPRC Conference Proceedings 23 Research Conference on Communications, Information and Internet Policy, Sept. 28-30, 2007.

[177] Tineke Egyedi, "To select or not? Dealing with Competing Standards in Public IT Procurement" (2012) Delft University final version.

[178] Ibid.

benefit from network effects it is best to adopt a successful standard. Early adoption of a standard can reduce conversion costs, but ensuring adoption of the right standard at the right time is undoubtedly easier said than done.

Kesan and Shah, analysing Massachusetts' adoption of ODF when it was an immature standard, promote a policy of "multiple independent interoperable implementations" or "running code" to avoid users being locked-in to an open standard.[179] Sieverding warns against mandating a particular path to interoperability which would include adopting a specific standard, open or otherwise, particularly if the open standard is immature and unproven. Doing so may reduce flexibility and foreclose other opportunities of benefiting from advances in interoperability and so be ineffective and costly.[180] Swann also warns against standardisation taking place too early in the development cycle which can then exclude alternative and possibly superior technology. Conversely, standardising too late can involve high transition costs. There appears to be a proportional relationship between the number of standards and their positive effect on the process of innovation, which is reversed when the number of standards rises above a certain number.[181]

4.1 Should the Policy Favour RF or Include both RF & FRAND?

RAND and RF terms for standards were evaluated by the US Department of Justice and the Federal Trade Commission in 2007. Opinions varied from those who considered RAND to be effective and had no complaints with RAND terms,[182] to those who considered RAND was not a sufficient safeguard against the abuse of a patent that is essential to a standard.[183] One of the reasons RAND may be inadequate is because terms such as 'reasonable' and 'non-discriminatory' are not well defined. Commentators considered 'reasonable' to be so vague that it did not amount to anything,[184] and RAND to be an empty term[185]. SSOs give little

[179] Jay Kesan and Rajiv Shah, "Running Code as Part of an Open Standards Policy" (2009) 6 (14) University of Illinois Research Paper 08-38 http://ssrn.com/abstract=1416115.

[180] McLean Sieverding (n 162) 86.

[181] Ramona Apostol (n 157) commenting on Peter Swann, "Do Standards Enable or Constrain" DTI Economics Paper No.3, 2005 published as part of the "The Empirical Economics of Standards" (June 2005) DTI Economics Paper 12, Department of Trade and Industry www.bis.gov.uk/files/file9655.pdf

[182] US Dep't of Justice & Fed. Trade Comm'n , Antitrust Enforcement and Intellectual Property Rights: Promoting Innovation and Competition (2007) 46, see Paul Vishny, referring to the experiences of the Telecommunications Industry Association of which he is the General Counsel and of other standard development organisations such as IEEE and ANSI. (Nov. 6 Tr. At 22-23).

[183] For example the Federal Trade Commission ibid with Scott Peterson, Corporate Counsel for IP, Hewlett-Packard Company and Chair American National Standards Institute, Patent Committee, 46.

[184] Ibid, Carl Shapiro (Nov. 6 Tr. at 63), 47.

explanation or guidance on what RAND means and there has not been much judicial guidance.[186]

Additionally, SSOs do not want to become involved in complaints about RAND licensing terms. The absence of a good forum for resolving disputes about RAND licensing terms has contributed to problems including patent hold ups.[187]

There is doubt as to whether the requirement to licence on FRAND terms is even legally enforceable, and this may vary from one jurisdiction to another. There is no agreement as to the terms or mechanism to objectively determine the terms, which amount to a "recipe for litigation".[188] It may not be possible to compel the granting of FRAND licences in private law and any remedy that may exist under competition law is cumbersome and ex post. This does of course look at the worst case scenario and the industry appears to operate and muddle through although it is questionable whether this is adequate when so much depends on reliable standards.

The Horizontal Guidelines give little further guidance on how FRAND should be assessed although it is said that the fees should not be excessive or prevent or make it difficult to implement the standard. It is for the participant not the SSO to assess whether the fee fulfils the FRAND commitment. The Guidelines permit *ex ante* disclosure of the most restrictive licensing terms which may provide a model for license fees to be capped in advance.[189]

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[185] Ibid, Earle Thompson, Senior Counsel Texas Instrument; Vishny "'The people who are negotiating for the establishment...of a standard don't know what [RAND] mean(s)." (Nov. 6 Tr. at 64) 47.

[186] Ibid, Daniel G Swanson, Gibson, Dunn and Crutcher LLP (Apr. 18 Tr. At 286-87), 47; Mark Lemley (n 13) 1906; see also at 1954 n.272. The case of *Georgia-Pacific v United States Plywood*, 318 F. Supp. 1116 (S.D.N.Y., 1970) set out a "15 factors test" but uncertainty remains. In Case n° 39247 *Texas Instruments v Qualcomm* [2009] the complainants argued that licensing terms are FRAND when royalties are proportional to the number of essential patents included in the standard (so-called "numeric proportionality test").

[187] Ibid, Farrell (Nov. 6 Tr. At 27-28), 47.

[188] Iain Mitchell QC and Stephen Mason "Compatibility of the Licensing of Embedded Patents with Open Source Licensing Terms" (2010) International Free and Open Source Software Law Review 3(1) 25-58. An example of litigation involving FRAND can be seen in the patent dispute between Apple and Samsung where Samsung claims a 2.4% royalty on the entire selling price of Apple's technology employing an ETSI standard which based on the average selling price of the iPhone would equal $14.40 per unit, or more than 100% of the price of a baseband chipset which was the only component of Apple's products that employed the patented technology. http://docs.justia.com/cases/federal/district-courts/california/candce/5:2011cv01846/239768/1323/0.pdf?ts=1343373719

[189] As discussed in email correspondence between Valerio Torti and authors (24 August 2012), also Valerio Torti, "IPRs, Competition and Standard Setting: in Search of a Model to Address Hold-Up", (2012) 33(9) *European Competition Law Review* 387-397.

The most recognised and certain interpretation of RF is of a standard that *requires* all participants to make essential patent claims available on a RF basis. There are however said to be other interpretations which are more difficult to monitor.[190]

Only a small minority (4 out of 43) of SSOs that were the subject of a study required RF licensing of patents incorporated in standards.[191]

RF could be the best means to limit licensing hold up, but it does not obviously benefit the patent owner. Arguably there could be a first mover advantage which could favour the IPR holder's complementary technologies.[192]

There is concern that RF does not provide an efficient incentive to innovate. Intellectual property protection is the means by which those who invest in R&D have an expectation of achieving a return that is greater than zero.[193] The alleged connection between software patents and innovation has been discussed above.

As well as removing the incentive to invest there is concern that mandating RF licences, by removing the licensor's ability to earn a return from its investment in R&D through its intellectual property, is a disincentive to joining the standard. RF raises the technology monopsony concern much more sharply than *ex ante* negotiation of RAND.[194] It may be possible to resolve the problem if members are not committed to licensing their technology at the outset, but are only obliged to do so if they want to take advantage of getting a RF license from the other members by agreeing to a reciprocal RF license.[195] This gives choice rather than a monopsony, but with some organisations there is a commitment on entering to licence all patents, and there can be asymmetry where some patents are more valuable than others.[196] RF is implemented in many different ways.[197] RF may be appropriate in certain technologies, particularly ones less populated by patents or at least few essential patents, where there might be unpatented alternatives, and in which case the

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[190] Steve Mutkoski, "Defining Open Standards: A Comparison of Policy and Practice" (October 17, 2011). http://ssrn.com/abstract=1945252

[191] Lemley (n 13).

[192] David Teece and Edward Sherry, "Standards Setting and Antitrust", (2003) 87 Minnesota Law Review 1913, 1954 proposes that licensing patents royalty free is most likely to occur where the patent holder has complementary capabilities that allows them to profit from its innovation other than from royalties.

[193] Federal Trade Commission (n 182) Swanson (Apr. 18 Tr. 289).

[194] Ibid, Joseph Farrell (Nov. 6Tr. At 66-67) 48.

[195] Ibid, Joseph Kattan (Nov. 6 Tr. At 67-68) 48.

[196] Ibid, Joseph Farrell (Nov. 6 Tr. At 66-67) 48 and Carl Shapiro (6Tr. At 66-67).

[197] Ibid, Galbreath and Peterson (Nov 6 Tr. At 70).

licensor may be willing to accept RF.[198] Reciprocal or cross-licensing is of less value in standards than in some patent pools as patents in standards may not be useful in the licensee's income generating technology. While there is evidence that RF licensing can be preferred even by IPR holders, there is little incentive for pure IPR companies, such as NPEs, to participate in RF licensing. The grant of an RF licence, even with a non-assertion clause, does not prevent claims by patent holders outside the SSO. The remedies of defensive patenting, competition law and challenging the validity of the patent are expensive and not a complete solution. This should not justify abandoning the policy of RF but it does mean that an open standard policy that adopts RF does not immediately lose the problems of claims by patent holders that are normally associated with FRAND.[199]

The European Interoperability Framework v.2.0 opted for a principle of openness that requires IPRs to be licensed on FRAND terms or on an RF basis in a way that allows implementation in both proprietary and open source software.[200] This is intended to foster competition between the business models. While EIF2 includes RF within FRAND, it has been said that a policy that prefers RF does not align with the first recommendation of EIF2 to align interoperability frameworks to take into account the European dimension of public service delivery and contravenes the duty of sincere cooperation contrary to the TFEU. The EU does not have treaty competence in the area of organisation and delivery of public services, outside the remit of procurement, and cannot legislate in the area of interoperability systems for provision of public services. For this reason a Commission Communication was used which is said to have intellectual and moral authority, but is not directly legally enforceable.[201]

The consultation on Modernising Standards in the EU revealed that IPRs are perceived as one of the most critical issues in IT standardisation. Most of the respondents to the consultation supported FRAND policies although several felt more clarity, transparency and predictability was required. Of those supporting

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[198] Ibid, Peterson (Nov 6 Tr. At 71).

[199] Carl Mair (n 119) makes the case that there is a risk that RF standards could be less open than FRAND based standards in the long run due to less participation by pure upstream companies and NPEs which stay outside the SSOs.

[200] COM (2010) 744 final Communication – Towards interoperability for European public services – European Interoperability Framework for European Public Services v.2, para. 5.2.1.

[201] The point that a policy preferring RF may not align with EIF2 and contravene the duty of sincere co-operation was made in email discussion between Elisabetta Rotondo of Kemp Little LLP and the authors (30 August 2012), also Kemp Little LLP "UK government's Open Standards Consultation – a step in the wrong direction?" (2012).
http://www.kemplittle.com/publications/item.aspx?ListName=KL%20Bytes&ID=76
On legal standing see Iain Mitchell QC and Stephen Mason (n 188) 27 & 28.

FRAND, the majority also supported the inclusion of RF approaches as well. They recognised that business models, other than charging royalties on standards, could support further R&D.[202] Disadvantages to the FRAND model included the time spent negotiating licensing arrangements. This was seen as out of step with the speed of innovation and evolution in the IT domain where the increase in the number of patents had dramatically increased the complexity of monitoring the implementation of IPR policies.[203]

The "Roadmap for Open ICT Ecosystems" considered that provided there was interoperability, open systems should not rely on one software model and the ensuing competition between open source and proprietary software could result in lower licensing costs and increased innovation. There was a desire to retain the innovative capacity of proprietary suppliers. Software selection should be based on function and scalability as well as the least costly, fastest solution. However active management is needed to realise the benefits of open source software and to ensure that enough open source software exists to provide competition. This should include a better understanding and evaluation of open source software, supporting collaborative R&D programs based on the open source model, and using open source when the business case supports it to achieve a critical user base.[204]

There are issues however with the inclusion of a FRAND option. In markets where competing software is implemented by small firms or individuals without significant funds, the economic effect of open standards may only be achieved on RF terms. If several standards exist in one product the amount of royalties that have to be paid, even under FRAND terms, could harm some competitors.[205] Basing standards on RF terms, rather than FRAND or other commercial terms, is said to reduce the risk that data will become unavailable over time.[206]

Some open source licences, such as GNU v.2 and v.3 are considered incompatible with FRAND and royalty payments on patents.[207] Arguably this is a choice taken by

[202] Modernising ICT Standardisation in the EU – The Way Forward – overview of the results of the public consultation on the White Paper (December 2009) DG Enterprise and Industry D/4 (2009) DB/AL/pm D (2009) 40002, section 8.

[203] Ibid.

[204] Roadmap for Open ICT Ecosystems, Berkman Centre for Internet and Society, 29.

[205] Rishab Ghosh (n 161) 8 which draws comparison to the GSM standards where compared to the capital requirements for manufacturing telecommunications hardware the licensing and royalty rates are relatively undemanding.

[206] Björn Lundell et al "Exploring Tool Support for Long-term Maintenance of Digital Assets: a Case Study, in Fomin, V & Jakobs, K (Eds) Proceedings: 16th EURAS Annual Standardization Conference 2011, European Academy of Standardisation, The EURAS Board p 207-217.

[207] Even RF may not be compatible with GPL 2 and GPL 3 terms as restrictions may still exist preventing the automatic downstream cascade of patent rights. Iain Mitchell QC and Stephen Mason

the open source software developer[208] and should not of itself prohibit a policy of using both FRAND and RF software or even preferring RF. Nevertheless, the existence of this legal incompatibility may be relevant where the main existing or potential competitor to proprietary software is open source software. It can be argued that the open standard should be compatible with the development and distribution of the open source software's licence terms.[209]

The incompatibility of FRAND licencing and open source software arose when Microsoft was ordered by the Commission to licence interoperability information in the form of protocol specifications on RAND terms including remuneration charged. When setting the charge Microsoft had to disregard its market power and not impose any restriction that could create disincentives to compete or unnecessarily restrain innovation.[210]

Microsoft ended up with at least two forms of licence. A 'No-Patent Agreement' at a flat rate royalty fee of €10,000 that was compatible with open source models[211] and a 'Patent Agreement' at 0.4 per cent of licensee's product revenues.[212] One version of the 'No-Patent Agreement', negotiated by SAMBA, amounted to a non-disclosure agreement between Microsoft and the Protocol Freedom Information Foundation (PFIF) on behalf of open source developers. In return for a one off fixed fee of €10,000 the agreement enabled the PFIF to licence the protocol information for free to 'subcontracting' open source developers.[213] The agreement does not include a licence of any patents. Instead it contains a list of patents to inform the PFIF and the wider open source community of Microsoft's patents related to WSPP.[214] The subcontractors then know what is patented and hence what to avoid. In return Microsoft agrees not to assert any patents that are not notified in the agreement and, crucially for the open source ethos, this non assertion undertaking covers all open

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(n 188) 54. 'Restriction Free' may give better solutions than royalty free. But not all FOSS licences are incompatible with FRAND, see eg Stephen Mutkoski, "Government Procurement Policy, Patent Royalties and the Myth of "Discrimination" against Free and Open Source Software Developers". http://ssrn.com/abstract=1949832.

[208] For a discussion on this see Jay Kesan (n 22).

[209] Rishab Ghosh (n 161).

[210] *Microsoft* (Case COMP/C-3/37.792) Commission Decision of 24 March 2004 relating to proceedings under Art. 82 EC.

[211] Nicholas Economides and Ioannis Lianos "The quest for appropriate remedies in the EC Microsoft cases: a comparative appraisal." in Luca Rubini (ed) *Microsoft on Trial,* Edward Elgar, 2010.

[212] Ibid, 423 – Microsoft initially tried to charge a royalty between 7 and 5.95 percent.

[213] http://www.samba.org/samba/PFIF/PFIF_history.html {accessed 16/3/2012}.

[214] Workgroup Server Protocol Program.

source developers involved in WSPP protocols. This form of agreement was compatible with the GPL licence.[215]

Adopting a policy which mandates RF standards could reduce choice as the vast majority of SSOs have at least one option that allows patent holders to charge on a RAND basis. Governments should appreciate that this could limit the pool of standards available to them. While the intended aims may be laudable, governments should be careful that the objectives they have as purchasers of IT are not intertwined with objectives the government might have as a market regulator.[216]

However, examples of public administrations claiming cost savings and other benefits from adopting open source abound.[217] It makes good sense to ensure that any policy of open standards allows the government to take advantage of the benefits it may gain from using open source solutions.

If FRAND and RF terms, in line with the EIF2 are adopted to help achieve a level playing field, a policy should be adopted which promotes the wide dissemination of information on open source software and the adoption of pilot projects. It is argued that further government subsidies are not appropriate as open source software is under-priced as the contributions to its design and maintenance are voluntary and not reflected in the price.[218] It should however be borne in mind that, as discussed above, problems exist with IPRs in software including granting patents when there

[215] http://www.samba.org/samba/PFIF/PFIF_agreement.html {accessed 16/3/2012} . In email correspondence with the authors (27 September 2012) Björn Lundell claims the SAMBA case should not be presented as an argument for the compatibility of GPL and FRAND licensed standards. The case concerns a Microsoft proprietary specification rather than a standard controlled by an SSO. Björn Lundell asserts that over time the integrity of the specifications cannot be assured and the arrangement for patents may be challenged.

[216] Josh Lerner and Mark Schankerman (n 23).

[217] All public administrations showcased on the OSOR website indicate that they have saved money with free and open source software. A thesis on IT use at the Finnish judicial system concluded that the move to OpenOffice in 2007 has so far resulted in considerable savings, even when including the costs for licensing, maintenance and training, over a period of six years (Martti Karjalainen, 2010). The migration ultimately cost 1.9 million Euro, less than one-third of the switch to the most often used proprietary solution (6.8 million). “The ‘economic efficiency’ of OpenOffice is impressive”. The thesis compares in great detail the costs of two proprietary office solutions and the open source alternative, including a breakdown of the kind of problems users reported at the IT help desk. Jacques Crémer and Mark Schankerman say in correspondence with the authors (29 August 2012) that governments may not be objective when supporting the solution they have adopted (cf. Josh Lerner and Mark Schankerman, n 23).

[218] Jacques Crémer and Mark Schankerman “Economic Principles for Efficient Public Procurement in Information Technology” (May 2012) A submission to the Cabinet Office in connection with the Open Standards Consultation.

has been no innovation. These problems could be addressed by a number of means including improving the patent examination process or some form of exception to patent protection for interfaces, but that will require regional and international cooperation. Until that occurs government policy on open standards must be designed to make the best of the present arrangements.

5 Costs and Benefits of Aspects of the Proposed Policy

5.1 Overview

Several countries, including The Netherlands, Chile, Japan and Denmark have attempted to increase the efficiency of government IT delivery by adopting an open standards approach. This has generally been regarded as a positive development, but there is a paucity of hard economic or financial data on the benefits achieved, and the adoption of an open standards approach incurs costs as well as benefits. The Netherlands incurred a total cost of €8,450,000 in implementing an open standards action plan, but expected the total cost for IT migration to be lower in due course.

The cost of adopting open standards is said to be justified by the benefits realised as a result although benefits are not always shared equally between departments, or always expressed in monetary terms, but can nevertheless be substantial (for both individual departments and the public sector as a whole) and include:

- Savings by making use of generic solutions and avoiding duplicating existing work;
- Improved quality, for instance by making use of unambiguous, reliable information;
- Standardisation, which improves flexibility, as the organisation is better able to cooperate with other bodies, citizens and businesses. [219]

An audit of the potential savings to be achieved through the use of open standards and open source software in the Netherland's central government concluded that approaching ICT from a purely cost angle is too limited. Expectations for potential savings to be achieved from open technology should be tempered by an approach based on clearly defined and unambiguous strategic goals, for example by distinguishing between policy goals to improve operational management and policy goals to organise the software market.

Opportunities for migrating to open standards and open source are not universal. Advantages and disadvantages, opportunities and risks in each case should be

[219] Dutch National Interoperability Framework (*Nederlandse Overheid Referentie Architectuur* – Dutch Government Reference Architecture) – NORA Strategy Supplement which not only adopted open standards but also an architecture based on common basic principles used in designing systems with particular relevance to interoperability. http://www.e-overheid.nl/images/stories/architectuur/nora_maart%202010-eng.pdf

determined after careful study of the circumstances and products available, particularly as products change rapidly.

A cost/benefit analysis took account of implementation, management and other operational costs, maintenance costs and procurement costs. Licence fees amounted to only 4% of total ICT costs. It was unclear whether the analyses considered potential costs and benefits associated with lock-in and compatibility.[220]

Experience of adopting open standards in higher education found that the intended effect of interoperability and reduced lock-in were not always achieved although this may have been due to non technical factors such as the specification process being driven by the vendors. Other issues were patent claims and adopting standards too early in the development of a technology which can impact innovation and the development of the standard. As a result of these experiences a pragmatic, contextualised approach is recommended where the policy of open standards is designed to fit the context and is combined with the dissemination of user experience and a support and quality assurance framework.[221]

Although the public sector is by far the largest procurer of ICT services in Europe, the standards set by the fora and consortia, with a few exceptions, are not formally approved and cannot yet be specified in public procurement.

Each standard created by the European SSOs (CEN, CENELEC and ETSI) costs about €1million, and can take 24 to 36 months or longer to finalise.[222] This sum includes the cost of experts, organisation of meetings, travel etc which is financed primarily by industry (93-95%) with the remainder paid by national governments and the European Commission. An estimated 80% of the ICT standardisation work since

[220] Netherlands Court of Audit Report, "Open standards and open source software in central government" 15 March 2011; email correspondence between Jacques Crémer and Mark Schankerman and the authors (29 August 2012). http://www.courtofaudit.nl/english/Publications/Audits/Introductions/2011/03/Open_standards_and_open_source_software_in_central_government

In email correspondence with the authors (27 September 2012) Björn Lundell comments on shortcomings in the Netherlands Court of Audit Report including the failure to consider exit costs. He draws attention to costs resulting from not using open standards such as the lack of access to public information and the cost to democracy. He also considers open standards can aid longevity of data reducing the risk of loss of archive data. Björn Lundell (n 171). In email correspondence with the authors (2 Oct 2012) Tineke Egyedi supports the reservation that the report did not adequately consider compatibility and lock-in.

[221] Brian Kelly and others, "Openness in Higher Education: Open Source, Open Standards, Open Access" (June 2009) Proceedings ELPUB 2007 Conference on Electronic Publishing, Vienna.

[222] The ETSI typical time frame for ETSI is 24 to 36 months, Impact Assessment on Proposal for a Regulation on European Standardisation, Commission Staff Working Paper, (final SEC(2011) 671) 9.

the 1980s has been done by informal fora and consortia worldwide[223] as they have the required specialised expertise.[224] Between the 1980s and 2004 about 70,000 standards were developed in the ICT Industry. Growth is expected to continue.[225]

5.2 Open Standards Reduce the Size and Duration of ICT Projects

Modularity – managing complexity by breaking complex systems into discrete components which can then communicate with one another only through standardized interfaces[226] – is made possible in systems using open standards. Components based on open standards help implementers and end users integrate new components with existing systems.[227] When combined with a "service orientated" approach this can give a low risk way of retaining useful legacy systems that work with new components.[228]

Increasing the modularity of systems brings important benefits. The possibility of smaller companies becoming involved in modular IT projects increases the choice of contractor available to the customer. Errors are said to reduce with decreasing program size so smaller programs are less likely to have errors than larger ones – not only per program but also per line of code.[229] Reusing smaller software modules is therefore a valid method of reducing programming errors.[230]

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[223] CEN currently counts some 238 fora and consortia, but does not include the most patently commercially-motivated ones. Other private sources that do not do any such screening list a total of 534. www.consortiuminfo.org/links

[224] For Fora and consortia such as OASIS, OMG, W3C, ETSI, and ISO/IEC/JTC1, the time is normally 12 -24 months from new to completion if they are seeking consensus but in extreme cases can be 6 months. They prefer solutions from concrete industry practice which give a high level of interoperability. Unlike the SSOs they do not require formal national ratification and draft specifications or standards are normally available for comment over the internet at an early draft stage although formal voting remains restricted to members. Timothy Simcoe "Delay and *de jure* standardization: exploring the slowdown in Internet standards development" in Shane Greenstein and Victor Stango (eds) *Standards and Public Policy* (Cambridge, 2007).

[225] Impact Assessment on Proposal for a Regulation on European Standardisation, Commission Staff Working Paper, (final SEC(2011) 671).

[226] Richard Langlois (n 31) 19.

[227] Roadmap for Open ICT Ecosystems, Berkman Centre for Internet and Society 27.

[228] Ibid, 27.

[229] Mark Lemley and David O'Brien, "Encouraging Software Reuse" (1997) 49 Stanford Law Review" 255 from Kevin Kelly, "Out of Control: The new Biology of Machines, Social Systems and the Economic World" 194-95 (1994).

[230] Ibid, 265.

Modularity may reduce the tendency for companies or consortia to bid excessively low in order to ensure that they are not on the wrong side of an "all or nothing" contract decision, relying on modifications during the course of the contract to make a reasonable return.

5.3 Open Standards Avoid or Reduce Switching Costs Associated with Lock-in

Open standards can contribute to the avoidance of lock-in to a single supplier. An illustration is the electronic information exchange platform developed by the Chilean government, based on XML, SOAP and Web Services, to integrate the platforms of various public agencies, to ensure the information is available to its citizens.[231]

Lock-in and switching costs, described earlier, are reduced or eliminated if open standards are adopted. The total costs associated with installing new software (such as an ERP system) are normally eleven times greater than the software itself. The additional costs include infrastructure upgrades, consultants, and retraining programs etc.[232] In 2006, the Danish Government decided that the balance of risk associated with having all software solutions in the hands of a few suppliers had tipped and outweighed the perceived risks associated with the move to open standards.[233]

However, even with open standards there can still be switching costs if multiple standards are used. The costs can vary from the normal switching costs to the costs for converters.[234]

The "bargain then rip-off" model associated with vendor lock-in is avoided as open standards avoid lock-in to a particular supplier. This could result in a decrease in the discount offered on the initial contact as the supplier would not be able to charge a premium when supplying further software or services. This would increase the initial cost of switching to new software but, as future procurement will remain competitive, there should not be an increase in the total cost of ownership.

[231] Roadmap for Open ICT Ecosystems, Berkman Centre for Internet and Society at 12.

[232] Changing software environments at the organizational level is also very costly. One study found that the total cost of installing an Enterprise Resource Planning (ERP) system such as SAP was eleven times greater than the purchase price of the software due to the cost of infrastructure upgrades, consultants, retraining programs, and the like. See Ian Larkin (n 45).

[233] Sofie Blinkenberg Federspiel and Benedikte Brincker, "Software as Risk: Introduction of Open Standards in the Danish Public Sector" (2010) 26 The Information Society 38-47.

[234] Tineke Egyedi (n 177).

5.4 Open Standards Increase Competition and Opportunities for Smaller Companies and Increase Innovation

Combining open standards with appropriate procurement practices can improve opportunities for smaller companies. Specifying a set of services based around an open standard means that fewer individual companies can meet all the requirements of the proposal. This encourages consortia which can include SMEs.

Open standards encourage growth by allowing resources to focus on innovation, building on existing protocols. Publishing open standards, as part of a framework for government interoperability policy and procedures, is considered to improve awareness and enable suppliers to build applications to meet those requirements. However it is recommended that the open standards rule is pragmatic, as restricting procurement to only officially approved standards can inhibit the adoption of new technologies.

Those already using open standards consider there is greater competition among suppliers for products and services thus helping government to improve performance and financial efficiency. Open standards strengthen the bargaining position of buyers and give end users more choice when setting requirements and performance criteria.[235]

The introduction of more informal fora and consortia, using the open standard model, to the public procurement process is expected to benefit the public procurer. It will lead to greater competition among suppliers, products and services, and this should translate into lower costs. It is also expected to create business opportunities for SMEs as they could build on existing protocols and procedures and innovate with lower costs and diminished technological and market assessment risks. In standardised and modular markets, SMEs would have greater opportunities to provide add-ons and applications. It is expected to have a marginal impact on innovation.[236]

Various studies showed that although SMEs need to use standards, they encounter a series of problems when doing so due to their size and limited resources. SMEs have difficulties in choosing the right standard, in understanding it and in implementing it. Furthermore the cost is relatively high for SMEs and is increasingly cited as a problem by SMEs and other stakeholders.[237]

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[235] Roadmap for Open ICT Ecosystems, Berkman Centre for Internet and Society at 10.

[236] Studies referred to in Impact Assessment on Proposal for a Regulation on European Standardisation, Commission Staff Working Paper, (final SEC(2011) 671) 181 including 'Towards an increased contribution from standardisation to innovation in Europe" – discussion paper' (2007, DG Enterprise and Industry, Unit I.3).

[237] Ibid.

According to the regional government of Andalusia the use of open source software over six years has saved millions of Euros and has brought other benefits. These benefits include providing local companies with an opportunity to become more competitive and offering better support through their detailed knowledge of open source software and development processes which has nurtured the local IT software sector.

5.5 Reuse of and Sharing ICT Solutions Across Departments Reduces Costs and Inefficiencies

Software has a reinvention culture – it tends to be rewritten for new tasks rather than built on existing components and methods.[238] Software reuse has been defined as the process of creating software systems from predefined software components.[239] In order to reuse software, "artefacts" in the form of code, system architecture, documentation, and user interfaces must be created from existing software systems.[240]

The culture of avoiding reuse leads to increased costs and inefficiency. Hewlett-Packard (HP) found that a project to reuse code gave productivity improvements of up to 57%.[241] Indirect costs are also reduced, as newly created software modules exhibit much higher error rates than software that has been used many times and debugged.[242] Reuse can also help bring products to market more quickly or reduce the completion time of projects.[243]

While reuse projects may occur within software companies, external reuse in any systematic way by other organisations, even large corporations, is uncommon.[244] There appears to be a good case for software reuse for the user as well as for the producer, provided there is an internal or external market to justify the additional cost associated with creating reusable software. One problem is that a user can easily copy and distribute components without payment, albeit unlawfully. The incentive for producers of component software will diminish if there is inadequate protection and

[238] Mark Lemley and David O'Brien (n 229) 257.

[239] M. Rokunuzzaman and Kiriti Prasad Choudhary, "Economics of Software Reuse and Market Positioning for Customized Software Solutions" (2011) 6 (1) Journal of Software, 31.

[240] Mark Lemley and David O'Brien (n 229) 264.

[241] Wayne Lim "Effects of Reuse on Quality, Productivity and Economics" (Sept 1994) IEEE Software, at 23.

[242] Ibid (analyzing software quality improvements associated with reuse).

[243] Rokunuzzaman (n239) 32.

[244] Mark Lemley and David O'Brien (n 229) 264.

enforcement of their IPRs. The challenge for encouraging reuse by users is a possible lack of interoperability and a lack of standards.[245]

Sharing software may allow for more centralised systems, thus avoiding the duplication of overhead costs. Cost savings of sharing "back office" functions in the private sector has typically exceeded 20 per cent, with a less than five year payback. However, a project to implement shared services following the Gershon Review 2004 failed to achieve cost savings. Planned benefits of £159 million cost savings by 2010/2011 were not achieved. Causes included the excessive complexity of services overly tailored to customer needs. Limited standardisation led to inefficiencies such as overheads for running multiple systems and processes. Costs to establish, maintain and upgrade were high. The need to simplify and standardise systems and reduce customisation was recognised.[246] In contrast, the Danish Government's initiative to centralise government ordering and invoicing using open standards is expected to lead to annual savings of 160 million Euros.[247]

The European Interoperability Framework recommends that public administrations should reuse and share solutions to benefit from the work of others and use solutions that have proven their value elsewhere. Reuse and sharing should lead to cooperation and collaborative platforms and more efficient development of public services.[248] Initiatives to promote reuse and sharing include Joinup, which is a platform to support and encourage the collaborative development and re-use of publicly-financed, free, libre and Open-Source Software (F/OSS) applications for use in European public administrations.[249]

Open standards can also extend the life of hardware when, as in the following examples they are combined with open source software.

The City of Munich is said to have achieved cost savings of over €4m in one year by switching from a proprietary supplier to open source Linux. A third of the IT department's budget was saved by switching to Linux and OpenOffice. It is reported that not only was the costs of purchasing new proprietary software and upgrading systems achieved at a saving of €15m but a further cost of €2.8m for licence renewal was also avoided. Support calls to help desks fell from 70 a month to 46. In addition

[245] Billy Lim and Joseph Wen, "Web Services: an analysis of the technology, its benefits, and implementation difficulties" (Spring 2003) 20 (2) Information Systems Management.

[246] National Audit Office "Efficiency and reform in government corporate functions through shared service centres" (7 March 2012) HC 1790.

[247] Ibid, 10.

[248] COM (2010) 744 final Communication – Towards interoperability for European public services – European Interoperability Framework for European Public Services v.2, 12.

[249] Joinup: http://joinup.ec.europa.eu/software/page/oss_on_joinup

the City continued to use its existing hardware as Linux did not "stress" the system. Extending the life of hardware not only avoids cost, but can also have environmental benefits by avoiding waste.[250] The reported cost savings are said to take account of retraining and porting costs. It is reported that other European governments are examining such schemes.[251]

The French Gendarmerie calculates that its plan to move some 85,000 PCs across 4,500 police stations from proprietary software to open source software saves €2 million per year in licence fees as well as saving money on hardware, as they no longer need 4,500 dedicated servers and can simplify maintenance.[252]

5.6 Business and Consumer Interfaces with the Government

It is considered that open standards encourage collaborative partnerships as they can access standard specifications, supporting material and code. This will encourage communities that work together to share knowledge, develop competencies and innovate. The Internet is a good example of an open public-private collaboration.[253] It is said that governments could use open standards to generate clusters of collaboration by improving communication and collaboration between the research community, business and investors. The improved open infrastructure can also attract new research and business.[254]

Business, consumers and other end users of government services as well as developers and suppliers can contribute to the design, implementation and maintenance of open systems. Their voices will provide essential input and feedback and they may contribute skills and services.[255]

The adoption of open standards should avoid the practice of requiring citizens who access public services to purchase systems from specific suppliers. This practice disadvantages citizens and harms competition and amounts to granting certain suppliers a state-sanctioned monopoly,[256] and could also harm the democratic

[250] See also Gerry Gavigan, "Public Sector ICT Royalty Free Open Standards" (April 2012) Open Source Consortium, on environmental and other benefits from open standards.

[251] http://www.theregister.co.uk/2012/03/29/munich_linux_savings/

[252] http://www.canonical.com/sites/default/files/active/Casestudy-GendarmerieNationale.pdf

[253] Roadmap for Open ICT Ecosystems, Berkman Centre for Internet and Society.

[254] Ibid, 30.

[255] Ibid, 32.

[256] Rishab Ghosh (n 161).

process by influencing the functioning and transparency of the process and how citizens engage with it.[257]

Other social benefits arising from open standards include greater access and digital inclusion as the challenge presented by the cost of providing software to citizens can be controlled.[258] Better access to information for citizens improves transparency and the efficient use of data.[259] Improved technical interoperability is important for government roles in disaster response and the archiving of public documents.[260]

[257] Laura DeNardis and Eric Tam, "Open Documents and Democracy, A Political Basis for Open Document Standards", Yale Information Society Project. http://papers.ssrn.com/sol3/papers.cfm?abstract_id=1028073

[258] For example the Acessa Livre program in Sao Paulo State where open technologies enabled the state government to overcome the challenge of the cost of acquiring, localizing, reconfiguring, upgrading and maintaining software for thousands of computers. Roadmap for Open ICT Ecosystems, Berkman Centre for Internet and Society.

[259] For example the Denmark CareMobil project used open specifications to improve access to information for care workers. Roadmap for Open ICT Ecosystems, Berkman Centre for Internet and Society.

[260] Laura DeNardis, "E-Governance Policies for Interoperability and Open Standards", (2010) Yale Information Society Project. http://ssrn.com/abstract=1629833

6 Conclusion

Although there is a lack of quantitative evidence on expected cost savings from adopting open standards, abundant examples exist where an open standards policy has been adopted with various consequent benefits, and the literature identifies few downside risks. The challenges appear to lie in the manner of implementation so that potential pitfalls, such as adopting the wrong standard, are avoided while potential gains from increased interoperability, including more competitive procurement and benefits to SMEs and citizens are maximised. Conventionally, adopting the “right” single standard has been seen as the best approach but it is less certain whether this remains the case. Open standards should give more interoperability both within and possibly with other standards, and mandating one standard may merely replace supplier lock-in with standard lock-in while missing the benefits to users of optimising their choice of software. It is recommended that there should be further research in this area of implementation. Another area for consideration is what RF and FRAND policy should be adopted. Adopting FRAND can be justified in certain applications on the ground that while it may not be compatible with some OSS, it leaves the widest range of options available, but there are considerable risks as the owners of the IPR will have rights (magnified by being part of a standard) which could conflict with users’ interests. The use of RF standards where available and commercially viable has advantages and should be encouraged. Policies that might be adopted include preferring RF standards or a more general policy of encouraging open standards (coupled with a policy of encouraging open source software to increase competition) in public procurement through dissemination of information and pilot projects.

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