***Huawei v. ZTE* in Context – EU Competition Policy and Collaborative Standardization in Wireless Telecommunications**

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Abstract Collaborative standardization, an efficient and inclusive form of organized innovation under the auspices of standard-setting organisations (SSOs), has demonstrated significant technological achievements in the field of wireless telecommunications. At the core of collaborative standardization is a working balance of interests and incentives of all stakeholders involved, i.e. contributors of technology and users of standards, epitomized by licensing on FRAND terms. Standardization contributes to significant gains in consumer welfare, in the form of lower prices, more innovation and more consumer choice and convenience. At the same time, standardization fosters competitive markets, upstream and downstream. Public policy has not always been successful in accommodating collaborative standardization. The enforcement of Art. 102 TFEU by the EU Commission, for instance, reveals an underlying mistrust of the operation of markets in the context of collaborative standardization and a strong preference for court-determined FRAND terms. However, the recent CJEU ruling in *Huawei v. ZTE* provides strong incentives for private stakeholders to determine FRAND through bilateral commercial negotiations and as such it is a welcome shift in EU competition policy in collaborative standardization.

Keywords FRAND · SSOs · SEPs · Wireless standards · Standardization · *Huawei v. ZTE*

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1 Introduction

In the past few decades information and communication technologies have transformed every aspect of human endeavour; mobile technologies, being the most rapidly adopted technologies in human history, have fundamentally changed the way we work, learn, travel, consume and communicate with each other.¹ Connected devices bundle multiple functionalities, which were hitherto performed by various independent gadgets, in integrated, multi-component devices. However, for such devices to operate and communicate seamlessly with each other, common interfaces and technical specifications are required. These common interfaces and specifications, allowing interoperability between individual components, devices and networks, are known as industry standards.²

There are, in general, three paths to standardization: the first one is the emergence, through fierce competition “for the market”, of a technical solution as dominant in the market, that is as a *de facto* standard³; the second one is standardization by government intervention and the regulation of technical aspects of products, also known as legal standards⁴; the third one, which is the subject of the present paper, is standardization through industry collaboration under the aegis of standard-setting organizations (SSOs).⁵ SSOs engaged in the standardization of wireless communications have produced some of the most innovative and commercially successful standards, adopted by millions of consumer electronic devices around the world.⁶ Such standards provide long- and short-range connectivity (cellular standards, Wi-Fi, Bluetooth and USB), and audio, picture and video functionalities (MP3, ACC, GSM voice codecs, JPEG, PNG and MPEG).⁷

Collaborative standardization under the auspices of SSOs has, thus far, a remarkable record of breakthrough technological achievements, high-quality, cutting-edge standards, vibrant follow-on innovation in the implementation of standards and open, competitive upstream and downstream markets. Interoperability standards produce massive efficiency gains and result in tangible benefits for consumer welfare. Interoperability implies economies of scale, cost savings, and gains in productivity and efficiency. However, standardization efforts in recent years aim not only at seamless interoperability, but also at the highest possible level

¹ The Boston Consulting Group (2015), pp. 3 and 7.

² Geradin and Rato (2007), pp. 103, 104.

³ A typical example of a *de facto* standard would be the QWERTY typewriting layout which emerged at the end of the 19th century. See Cabral (2000), pp. 316–318.

⁴ Legal standards are mandatory for all parties engaged in the relevant commercial activity, such as, for instance, fuel emission standards. See Gilbert (2012), pp. 2–3.

⁵ See Geradin and Rato, *supra* note 2, at p. 104; see also Rysman and Simcoe (2008), p. 1920.

⁶ The most relevant SSOs in the field of wireless communications standards are the European Telecommunication Standards Institute (ETSI), the Institute of Electrical and Electronics Engineers (IEEE), the 3G Partnership Project (3GPP), the International Telecommunications Union (ITU) and the Internet Engineering Task Force (IETF). See ECORYS and Eindhoven University of Technology (2014), pp. 31–33.

⁷ *Ibid.*, at p. 64.

of performance, i.e. in capacity, data rates, latency, reliability and security.⁸ Providing for high performance, cutting-edge standards form the infrastructure upon which a whole ecosystem of innovating products and services has flourished.

Navigating through the complexities of collaborative standard-setting has proved a challenge for EU competition policy. The European Commission, in particular, has demonstrated an ambivalent stance towards collaborative standardization, recognizing its pro-competitive potential in theory, but revealing mistrust on the efficient performance of standard-setting in its actual enforcement of EU competition law. The Court of Justice of the EU in its recent landmark *Huawei* ruling marked a shift of EU competition policy towards a more balanced and market-oriented approach.⁹

The structure of the present article is the following: in Sect. 2, the historical course of standardization in wireless telecommunications will be briefly outlined; in Sect. 3, the efficient and inclusive nature of the standard-setting process and its tangible benefits to consumer welfare will be discussed; in Sect. 4, the standard-setting process will be analyzed as a fundamentally disruptive process; Sect. 5 discusses EU competition policy on collaborative standardization; and finally Sect. 6 presents the conclusions of this paper.

2 Standardization in the Mobile Telecommunications Sector: From Analogue to the Internet of Things

Collaborative standardization takes place under the auspices of SSOs, industry bodies governed by rules and regulations agreed upon by their members, which include technology contributors and implementers of standards.¹⁰ SSOs are of varying size, membership and formal recognition: some SSOs are formally recognized standardization bodies by governments and international organizations (ITU, ETSI, ISO, IEC)¹¹; others are semi-formal institutions, not officially recognized but enjoying a status similar to formal SSOs (IEEE, IETF); many SSOs are informal industry consortia, established for specific purposes, which provide for flexibility in standardization efforts but are not bound by principles such as transparency, consensus and openness.¹²

Collaborative standardization is a long-term, resource-draining and intensive endeavour; even after a standard is formally adopted by an SSO it takes several years before it is finally commercialized on the market.¹³ For instance, the 2G-GSM standard took 15 years to develop and the development of the 4G-LTE standard

⁸ Net!Works (2012), p. 3.

⁹ Case C-170/13, *Huawei v. ZTE* (2015) (not yet published).

¹⁰ Epstein et al. (2012), p. 10.

¹¹ In the EU, three SSOs are recognized by the EU Commission as official European standardization bodies: CEN, CENELEC and ETSI.

¹² Gilbert, *supra* note 4, at p. 4; ECORYS and Eindhoven University of Technology, *supra* note 6, at p. 33; *see also* Bekkers and Updegrove (2012), p. 5.

¹³ Teece et al. (2014), p. 87.

consumed no less than one million working hours by engineers employed in 43 companies worldwide.¹⁴ The standard-setting process normally begins with setting out a clear and bold goal for a future level of desired technological performance.¹⁵ Once such a goal is set, working groups of technical experts, representing all interested stakeholders, decide upon submitted proposals and choose the most meritorious technical solutions to be included in the specifications of the standard.¹⁶

The first wireless cellular telecommunication networks were commercially rolled out in the early 1980s. The first generation of mobile telecommunication networks (1G) was built on analogue frequency modulations to transmit voice signals.¹⁷ In its very early days, the development of wireless telecommunication standards was a predominantly national process characterized by a strong national focus; telecommunication markets at the time were highly concentrated, on the basis of a rigid, thoroughly regulated structure of one country, one network operator and one service vendor.¹⁸

Moreover, the narrow national orientation of 1G precluded interoperability among the various national telecommunication networks. Limited interoperability, in turn, curbed the massive uptake of mobile telecommunications by impeding economies of scale and keeping prices for network equipment and handsets very high.¹⁹ As a response, in the mid-1980s, in several major markets, including the U.S. and the EU, a far-reaching process of liberalization of the telecommunications sector began to unfold.²⁰

In the early 1990s, standardization for the second generation of wireless telecommunications departed radically from 1G in two crucial respects: firstly, the narrow national focus was replaced by a more international approach, especially in Europe with the emergence of ETSI and the GSM Working Party. Secondly, 2G involved a drastic leap forward in technology, with the development of standards based on the digital transmission of voice and SMS messages.²¹ With 2G, mobile telecommunications for the first time reached a massive consumer market, benefiting from better and cheaper networks, services and handsets. That said, competing 2G standards precluded the emergence of global interoperability and slow mobile internet connectivity (download speed of less than 128 kbits/s) allowed the performance of only rudimentary online tasks, such as e-mail and limited web-surfing.²²

¹⁴ The Boston Consulting Group, *supra* note 1, at p. 30.

¹⁵ For instance, the goal of the development of 3G cellular standards was to increase network capacity ten-fold. *See ibid.*

¹⁶ ECORYS and Eindhoven University of Technology, *supra* note 6, at pp. 29–30; The Boston Consulting Group, *supra* note 1, at pp. 29–30.

¹⁷ Goodman and Myers (2005), p. 1.

¹⁸ ECORYS and Eindhoven University of Technology, *supra* note 6, at p. 59.

¹⁹ ECORYS and Eindhoven University of Technology, *supra* note 6, at p. 59.

²⁰ *Ibid.*

²¹ Goodman and Myers, *supra* note 17, at p. 1.

²² The Boston Consulting Group, *supra* note 1, at p. 9.

The third generation of mobile telecommunications (3G), in the early 2000s, represented a radical leap forward, introducing the era of high-speed, ubiquitous mobile internet and the emergence of vibrant mobile applications (“apps”) ecosystems.²³ 3G dramatically improved mobile data speeds (download speed up to 63 Mbps/s) and enabled connectivity through Wi-Fi and Bluetooth.²⁴ In drastically improving interoperability, 3G generated massive economies of scale in the manufacturing of network equipment and smartphone devices, robust follow-on innovation and product differentiation, lower prices and more intense competition in the downstream markets for standard-compliant products. However, ever-increasing consumer demand for online services at the same time created the need for faster, more efficient and innovative networks, leading to the development of the fourth generation of mobile telecommunications and the emergence of the first, truly global wireless standard, with high throughput and low latency characteristics, the LTE.

Spurred by steep growth in demand for mobile data, the fourth generation of wireless standards initially evolved around two competing technologies, LTE and WiMax; however, after a decade of commercial deployment, LTE has gained a decisively higher adoption rate, being essentially the first global wireless standard.²⁵ The fourth generation of wireless standards delivered impressive gains in cost-efficiency, spectral efficiency, capacity, data rates and quality of service. More importantly, though, for the first time LTE enabled the widespread use of sensors and the ubiquitous connectivity of all kinds of everyday consumer devices, laying the ground for the Internet of Things (IoT).

The IoT could be defined as a system of “sensors and actuators, connected by networks to a computing system”.²⁶ Other important technological developments notwithstanding,²⁷ standardization and the new mobile telecommunication networks are the key enablers behind the emergence of the IoT.²⁸ Cutting-edge wireless standards, and in particular 4G-LTE, provided not only interoperability between myriad devices and sensors on the basis of long-range wireless networks, but also dramatic improvements in performance, reliability and in energy and cost efficiency.

Conclusively, once the process of open, collaborative standardization was set in motion in the early 1990s, the following pattern could be discerned: investment and innovation in telecommunication standards grow markets and consumer demand, which in turn increases demand for investment in innovation and standardization. At the end of every major standardization effort, better-performing standards also bring

²³ 3G was developed around two interoperable core network technologies, with the decisive involvement of informal standardization consortia, the W-CDMA-UMTS (3GPP), later evolving into HSPA and HSPA+, and CDMA-2000 (3GPP2), which in turn evolved into EV-DO. See Qualcomm (2014), p. 19.

²⁴ The Boston Consulting Group, *supra* note 1, at p. 9.

²⁵ ECORYS and Eindhoven University of Technology, *supra* note 6, at p. 60; The Boston Consulting Group, *supra* note 1, at p. 27.

²⁶ McKinsey Global Institute (2015), p. 17.

²⁷ In particular, improvements in cost-efficiency and the battery life of sensors, and advances in big data and cloud storage. See The Economist Intelligence Unit (2013), p. 10.

²⁸ *Ibid.*, at p. 18 (“IoT will not fly if we do not have standards”).

about larger, integrated markets and more consumer demand for innovative services and better performing standards.²⁹

3 The Standard-Setting Process and Its Impact on Competition and Consumer Welfare

3.1 Collaborative Standardization as an Efficient, Open and Inclusive Process

Collaborative standardization in wireless telecommunications has a remarkable record of technological achievement and innovation. However, this in itself does not automatically imply that collaborative standardization is the only path to standardization or that it brings welfare gains such that they outweigh the negative implications of collaboration between competitors. After all, interoperability is also plausible through the emergence of an independently developed *de facto* standard. That said, there are good reasons to believe that collaborative standardization is indeed the most efficient path to standardization and that its overall impact is strongly pro-competitive.

Collaborative standardization owes its success to its character as an *efficient, open and inclusive* process of organized innovation. Standard-setting organizations have an active interest, as well as regulations and policies in place, to promote open and unrestricted membership of all interested parties and to foster consensus-based decision-making processes.³⁰ SSOs compete with each other in the development of the most innovative and commercially successful standards.³¹ Thus, SSOs have powerful incentives to attract, on the one hand, contributors of the best technologies, and, on the other hand, numerous implementers that will successfully commercialize developed standards.

Of course, diverse membership necessarily implies that participants have diverging and often conflicting interests and business models.³² In general, vertically integrated firms adopt a more balanced attitude with regard to licensing of standard-essential patents (SEPs), having important stakes in both the upstream and the downstream markets and an interest in broad cross-licensing agreements with other SEP-holders which provide valuable “freedom to operate”.³³ Pure upstream firms depend on royalty revenue to make a profit, lacking any downstream business and interest in

²⁹ This self-reinforcing dynamic is noted by several industry experts. See The Boston Consulting Group, *supra* note 1, at p. 34 (“The digital services ecosystem is thriving, which drives stronger investment in core technologies and infrastructure. This in turn, drives additional investment in digital services.”); see also McKinsey Global Institute (2013), p. 32 (“As consumers spend more time online, the number and quality of Internet-based services are increasing, further driving demand.”).

³⁰ Geradin and Rato, *supra* note 2, at p. 104; Gilbert, *supra* note 4, at p. 3.

³¹ Harkrider (2013), p. 23.

³² Layne-Farrar (2010), p. 1; see also European Commission, “Guidelines on the applicability of Article 101 TFEU to Horizontal Cooperation Agreements”, [2001] OJ C3/2.

³³ Layne-Farrar, *supra* note 32, at p. 6.

cross-licensing. Conversely, pure downstream implementers, having no patents to offer for cross-licensing and viewing royalties as an additional input cost, have an interest in keeping the royalty rates low.³⁴

SSOs face the difficult task of accommodating such conflicting interests: they need to attract cutting-edge technology and enable efficient and rapid commercialization of standards.³⁵ The meeting point of the interests of contributors and users of the standard is FRAND licensing, based on a commitment to make a standardized technology available on fair, reasonable and non-discriminatory terms.³⁶ FRAND is an apparently abstract and ambiguous term. However, the purpose of the FRAND commitment is to ensure that access to the standard will remain unrestricted, the precise terms of the licence being left to the parties to agree upon in good faith and in the context of commercial negotiations.³⁷

Unrestricted access and licensing on FRAND terms are at the core of the success of collaborative standardization. FRAND licensing is vital for maintaining a predictable and rewarding structure of returns that provides incentives for contribution of cutting-edge technology and implementation of standards. On the one hand, licensing revenue from FRAND royalties, by ensuring that patent holders reap a fair reward for their contributions, provides strong incentives for leading innovators to contribute the best available technologies to the standard-setting process.³⁸ Over-restrictive IPR policies might provide strong disincentives to participation.³⁹ On the other hand, the FRAND commitment ensures that standards will remain accessible and implementation unrestricted. The FRAND commitment ensures implementers that they will not fall victim to opportunistic conduct by SEP-holders; that they will have access to third-party technologies on reasonable terms that allow profitable implementation of the standard; and that they will not be discriminated against vis-à-vis their downstream competitors.

This working balance of interests and incentives distinguishes collaborative standardization as a process of superior efficiency, in particular compared to de facto standardization. De facto standards that emerge as the outcome of fierce standardization races between competitors competing “for the market” are associated with serious inefficiencies in investment in innovation; the reward, complete dominance over an entire market, would induce over-investment and wasteful duplication of R&D efforts, raising the cost of implementation and putting a brake on adoption.⁴⁰ Even such over-investment offers little assurance that the market will eventually pick the most meritorious technical solution. Of course, this balance of interests and incentives is an uneasy one, and commercial disputes on the

³⁴ *Ibid.*

³⁵ Harkrider, *supra* note 31, at p. 23.

³⁶ Geradin and Rato, *supra* note 2, at p. 110.

³⁷ *Ibid.*, at p. 113; *see also* Geradin (2010), p. 4; Epstein, Kieff and Spulber, *supra* note 9, at p. 14.

³⁸ Bekkers and Updegrove, *supra* note 12, at p. 9.

³⁹ In particular, a royalty-free licensing commitment might be perceived as a “contamination” threat to a valuable patent portfolio. *See* DeVellis (2003), p. 343.

⁴⁰ Drex1 (2015), p. 31, para. 13; *see also* The Boston Consulting Group, *supra* note 1, at p. 32.

appropriate level of royalties have become more frequent.⁴¹ However, the overall success of collaborative standard-setting in spurring innovation and competition is hard to deny.

3.2 Interoperability, Economies of Scale and Efficiencies

Successful collaborative standardization brings significant benefits to consumer welfare. Interoperability allows companies to benefit from network externalities,⁴² economies of scale, specialization and integration of international markets. Consumers, in turn, reap significant gains in prices, product choice and innovation. Interoperability is vital to wireless telecommunications in that it allows networks, network equipment (such as base stations), devices and components within devices (such as antennas and baseband chips) to work seamlessly with each other.⁴³ Network equipment, devices and components are typically manufactured by a wide range of firms worldwide and for this vast number of individual devices to work together, common interfaces and product specifications are vital.⁴⁴ Compatibility between individual components within a network allows firms to specialize in what they do best.⁴⁵ Moreover, interoperability between networks and devices results in significant economies of scale, since equipment and device manufacturers serve an integrated, international market.⁴⁶ Successful international standards also boost consumer confidence that components will work well together, they increase consumer adoption and allow positive network externalities to materialize faster.

Interoperability further enhances efficiency by bringing down technical, non-tariff barriers to international trade, integrating international markets and enabling competition between firms worldwide.⁴⁷ Consumers have access to a wider range of standard-compliant products at competitive prices. This aspect of market integration is particularly relevant in the context of the EU and EU competition law with its strong focus on the integration of the internal market and in particular on the emergence of an internal digital market: common, European wireless standards bring down barriers to cross-border trade⁴⁸ and allow the interpenetration of national markets by telecom service providers.

⁴¹ See, among others, *IPCom v. Nokia*, [2012] EWHC 1446 (Ch) (UK); *IPCom v. Deutsche Telekom & Vodafone*, Dusseldorf District Court (*Landgericht*), 24 April 2012, Case 4b O 274/10 (Germany); *Apple Inc. v. Motorola, Inc.*, 757 F.3d pp. 1286, 1331 (Fed. Cir. 2014); *Microsoft Corp. v. Motorola, Inc.*, 696 F.3d pp. 872, 878 (9th Cir. 2012); *Microsoft Corp. v. Motorola Inc.*, 864 F. Supp.2d pp. 1023, 1038 (W.D. Wash. 2012); *Realtek Semiconductor Corp. v. LSI Corp.*, 946 F. Supp.2d pp. 998, 1005 (N.D. Cal. 2013).

⁴² On network externalities, see Economides (2000); Economides (2006), p. 78; Economides (1996), p. 673; Katz and Shapiro (1985), p. 424.

⁴³ Layne-Farrar et al. (2011), p. 2.

⁴⁴ Layne-Farrar, *supra* note 32, at p. 1; Geradin and Rato, *supra* note 2, at p. 103.

⁴⁵ Layne-Farrar, *supra* note 32, at p. 2.

⁴⁶ DeLacey et al. (2006), p. 2.

⁴⁷ The Boston Consulting Group, *supra* note 1, at pp. 32–33.

⁴⁸ ECORYS and Eindhoven University of Technology, *supra* note 6, at p. 34.

3.3 Performance-Driven Standardization and Innovation

Although interoperability is a key driver of collaborative standardization, recent standardization efforts have moved beyond this point. Standardization in wireless telecommunications is performance-driven, aiming not merely to integrate networks and devices, but also to achieve the highest possible level of performance and capabilities.⁴⁹ This high level of performance owes much to the meritocratic nature of collaborative standardization: SSOs have strong incentives to guarantee that the best available technologies are included in standards. Performance-driven standards also reduce technological risks for implementers, thus facilitating the rapid and smooth industrial transition from inferior to superior technologies.

The evolution of collaborative standardization, from interoperability to performance-driven, results from the internal dynamic of the process and from strong competitive pressures that SSOs find hard to resist. The development of standards takes place within working groups of technical experts presented with various alternatives as solutions to specific technical problems. Although non-technical matters, such as the accessibility of a particular technology and licensing terms, might occasionally be taken into account, engineers at working groups decide on inclusion primarily on the basis of technical merit. SSOs in their regulations make efforts to ensure that the development of standards is open, transparent and consensus-based at all stages of the process.⁵⁰

Strong competitive pressure also comes into play. SSOs that fail to include the best technologies presented to them might find out that someone else – be it another SSO or a new standardization consortium, or even a firm unilaterally – did. Failure to include the best available technologies might have important implications for an SSO and its standardization efforts. A second-best technology might not gain acceptance by industry and consumers.⁵¹ Moreover, the superior technology might be independently commercialized and compete head-on with the chosen inferior solution.⁵² The market would be divided between competing standards negating the very purpose of standardization itself.

There is substantial evidence that SSOs in wireless telecommunications have performed well. The performance of telecommunication networks has increased dramatically in all important respects: in capacity, data rates, reliability, latency and security. Added to that, empirical evidence suggests that patents declared as standard-essential at SSOs are of higher quality and receive roughly three times

⁴⁹ *Ibid.*, at p. 25 (“Standard setting has evolved from the definition of interface specifications enabling interoperability to joint development of large technology platforms including critical technologies.”).

⁵⁰ Geradin and Rato, *supra* note 2, at p. 104.

⁵¹ DeVellis, *supra* note 39, at p. 343.

⁵² *Ibid.*

more citations than their non-SEP counterparts.⁵³ Transfers of SEP portfolios also indicate that SEPs are highly valued by the market.⁵⁴

Collaborative standardization is successful not only at handpicking the best technologies, but also at organizing transition from inferior to superior technologies in a smooth and rapid manner. In general, markets with strong network effects exhibit excess inertia in moving to new technologies, due to imperfect information; without complete and reliable information on the real value of a technology, market actors fail to coordinate their transition to a superior technology.⁵⁵ SSOs, by including a technology into a standard, send a strong signal to the market that the particular technology is valuable and that their hefty investments in capital expenditure will not go to waste. Thus, SSOs reduce the risks of implementation of standards, encouraging rapid and widespread adoption of cutting-edge technologies.⁵⁶

3.4 Robust Competition in All Relevant Markets

Collaborative standardization, at first sight, represents a paradox: although it provides a forum where competitors coordinate the technical specifications of their products, at the same time it spurs competition in all relevant upstream and downstream markets. In the upstream market for technologies, standardization creates fierce rivalry for inclusion in a standard, pressing firms to invest more, to innovate and become more efficient. In the downstream markets for standard-compliant products, standardization brings about integrated, open markets and access to cutting-edge technologies at reasonable rates, providing strong incentives for firms to outperform their rivals in prices, follow-on innovation and product differentiation.

Innovators have strong incentives to invest, participate and contribute to the process. Barriers to entry are low: SSOs develop standards on the basis of merit and participation is open. Although firms with no previous engagement in the standard-setting process might need to invest more than others in developing strong R&D capabilities, entry is frequent and meaningful. Entry is also reasonable and attractive from a business perspective; companies that are successful in their contributions can expect a licensing revenue stream for many years.⁵⁷ Low barriers to entry and the expectation of licensing revenue result in vibrant competition for inclusion and more investment in innovation. The rapid increase in patented inventions in the field of wireless telecommunications indicates that standardization has had a profound impact on innovation: according to WIPO, wireless telecommunication patents have

⁵³ Rysman and Simcoe, *supra* note 5, at p. 1932.

⁵⁴ For instance, in 2011, Apple, RIM, Ericsson, Sony and Microsoft, all members of the Rockstar consortium, spent \$4.5 billion in an auction to acquire Nortel's thousands of SEPs in wireless telecommunication standards. See Teece, Sherry and Grindley, *supra* note 13, at p. 89. However, it is not yet quite clear whether the high market valuation of a portfolio of SEPs stems solely from technological merit, or could rather be associated with the strong bargaining position of a SEP-holder.

⁵⁵ Simcoe et al. (2007), p. 4; Layne-Farrar, Llobet and Padilla, *supra* note 43, at p. 2.

⁵⁶ The Boston Consulting Group, *supra* note 1, at pp. 9 and 30.

⁵⁷ DeLacey et al., *supra* note 46, at p. 2.

increased in the past 30 years from virtually non-existing to 400,000 today, representing 6% of all patent activity.⁵⁸

Competition is also fierce in downstream markets for network equipment, components, devices and services. Implementation is open and downstream firms can expect access to some of the best technologies available on reasonable terms that allow for profitable implementation. Moreover, non-discriminatory licensing terms ensure a level playing field for all downstream competitors. Investment in follow-on innovation and product differentiation is strong; dramatic improvements have been achieved in smartphone battery life, processing power, cameras and design. Every year consumers enjoy a vast array of compliant devices to choose from, assured that interoperability and high performance are guaranteed.

Strong – actual and potential – competition and economies of scale bring prices down. Holding performance constant, real prices have fallen dramatically⁵⁹: a fully functional smartphone with LTE connectivity might cost less than \$100. Prices for networks and network equipment have also fallen drastically: the deployment of 3G networks brought the cost of network equipment down by 95% and the deployment of 4G-LTE networks brought this cost down even further by 67%.⁶⁰

4 The Standard-Setting Process and Disruptive Innovation

Collaborative standardization has contributed decisively to massive gains for consumer welfare, productivity and innovation. However, standardization is also a profoundly disruptive process. It involves radical leaps in technology, in business and in everyday life. It is an important accelerator of the Schumpeterian process of creative destruction.⁶¹ Yet the representation and structure of the process might conceal the magnitude of technological leaps.

Standardization efforts in wireless telecommunications are expressed in consecutive generations of standards (2G–3G–4G). Such representation tends to create a misleading impression of continuity and incrementalism. It understates the drastic technological advances between each consecutive standard. The structure of the process contributes to this misrepresentation. Standards are developed over many years, in thousands of meetings of technical experts, resulting in several consecutive “releases”. This incremental process with its apparently gradual improvements conceals the drastic character of the core technologies included in a standard.⁶²

More importantly, though, collaborative standardization, in providing telecommunication networks with ever more capabilities at lower costs, accelerates the process of creative destruction in such remote sectors as manufacturing, banking and entertainment. In particular, high-speed mobile broadband has been the basis

⁵⁸ The Boston Consulting Group, *supra* note 1, at p. 29.

⁵⁹ Teece, Sherry and Grindley, *supra* note 13, at p. 96.

⁶⁰ The Boston Consulting Group, *supra* note 1, at p. 9.

⁶¹ Joseph Schumpeter, “Capitalism, socialism and democracy” (first published 1942; Routledge, 2013).

⁶² Of course, even a particular release of a standard can represent a drastic innovation. Yet the structure of the process leaves a different impression.

upon which a vibrant ecosystem of software apps has emerged⁶³; with each step forward in standardization, new digital services come online and transform fields with massive impact, such as healthcare, finance and education.⁶⁴

High-performance standards have also lowered the cost of follow-on innovation and thus barriers to entry for disruptive new firms and entrepreneurs that challenge incumbents.⁶⁵ The low cost of access to high-speed broadband, as well as the emergence of global markets of billions of consumers, allows start-ups with even a modest initial investment to offer new, groundbreaking services and introduce new and disruptive business models.⁶⁶ This disruptive effect spills over into a vast range of markets and sectors.⁶⁷ Evidence of disruptive innovation abounds. Online mobile banking, for instance, has effectively challenged the centuries-old basis of banking, the bricks-and-mortar retail banking, providing consumers online access to a full range of banking services. Billions of previously disenfranchised citizens in the developing world, for the first time, have access to banking services, integrating millions of people in financial markets.

Entertainment and content are also under drastic transformation. On demand, HD video streaming capabilities have resulted in an explosion in the amount of online content consumed by users. At the same time, it has a profoundly disrupting effect on the business models in entertainment. Much of the consumed content is generated by users on social media platforms, outside the formal entertainment sector. Moreover, content is increasingly consumed through mobile devices, shifting viewers from cable and broadcast channels.⁶⁸ Disruption of established business and consumption patterns will reach new levels with 5G and, in particular, with the IoT.

5 Implications for EU Competition Policy

5.1 Anticompetitive Risks and Private Ordering in Collaborative Standardization

Although collaborative standardization has demonstrated strong pro-competitive potential, the process is not without risks, for it is, after all, a form of coordination involving discussions among competitors. Formal standardization could, under certain circumstances, raise barriers to entry and enable stakeholders to exercise control over the standard, thereby excluding actual or potential competitors.⁶⁹ The European

⁶³ The Boston Consulting Group, *supra* note 1, at p. 28 (“The core technologies are the oxygen within the mobile ecosystem: fundamental to life, invisible to the user and necessary for all other functions to continue.”).

⁶⁴ *Ibid.*, at p. 7.

⁶⁵ McKinsey, *supra* note 29, at p. 38.

⁶⁶ In 2013, 100 billion mobile apps were downloaded by consumers. This number is forecast to grow in 2017 to reach an astounding 270 billion. See Qualcomm, *supra* note 23, at p. 2.

⁶⁷ McKinsey, *supra* note 29, at p. 38.

⁶⁸ *Ibid.*, at p. 32.

⁶⁹ Horizontal Guidelines, *supra* note 32, at para. 262.

Commission in its “Horizontal Guidelines” identified collusion between competitors to raise prices, reduce output and restrict the inclusion of innovative technologies as a particular concern when assessing standardization agreements under Art. 101 TFEU.⁷⁰ It further stressed the exclusionary effects of standardization for technologies that fail to be included in a standard and which subsequently face insurmountable barriers to entry.⁷¹

However, the most serious frictions in the context of collaborative standardization concern the licensing and enforcement of standard-essential patents and the allocation of rents along the standardization value chain. Opportunism in the standard-setting context arises, as much as in every other context, from asset-specific investments and incomplete contracting.⁷²

Indeed, in collaborative standardization, stakeholders normally undertake asset-specific investments well before the negotiations for licensing of SEPs. On the one hand, technology contributors commit resources to research and development years before a standard is adopted. Such investments in contribution to the standard-setting process are not recoverable since, once a standard is adopted, patent holders cannot switch and offer their patented technologies independently on the market for there would be no market demand. Technology contributors are thus locked into their relationship with SSOs and standard users.⁷³

On the other hand, standard implementers also sink investments in building their manufacturing capabilities to produce standard-compliant products. Such investment is typically undertaken once a release of a standard is published and before any licences of essential IPRs are negotiated. Switching to competing technologies at a later point is costly and market demand for non-standard-compliant products might be extremely weak. This lock-in of technology contributors and standard users fundamentally transforms their relations with each other and creates the ground for opportunism with a view to extracting hold-up value.

Added to that, under certain circumstances, hold-up might seem an attractive strategy from a business perspective. Collaborative standardization, in fostering open markets, has exposed all participants to fierce competitive pressures. On the one hand, vertically integrated firms facing strong pressures in downstream markets might be tempted to enforce their essential IP aggressively with a view to obtaining supra-FRAND royalties (patent hold-up) and thus to restrict accessibility to a standard.⁷⁴ Pure upstream stakeholders, in need of cash to fund costly R&D endeavours, might also be tempted to extract hold-up value. On the other hand, downstream firms with no contributions – and SEPs – upstream might be tempted to gain a competitive advantage vis-à-vis their downstream competitors by lowering SEP licensing fees or free-riding on others’ IP and innovations (reverse hold-up and hold-out).⁷⁵

⁷⁰ *Ibid.*, at para. 266.

⁷¹ *Ibid.*, at para. 275.

⁷² Ginsburg et al. (2015), pp. 2, 6; Kobayashi and Wright (2010), p. 7; Mair (2016), pp. 59, 67.

⁷³ Ginsburg, Wong-Ervin and Wright, *supra* note 72, at p. 4.

⁷⁴ This type of strategic behaviour is known in the relevant literature as patent hold-up. See Lemley and Shapiro (1991), p. 1991.

⁷⁵ This second type of strategic behaviour is known as hold-out or reverse hold-up. See Epstein, Kieff and Spulber, *supra* note 10, at p. 22.

However, the economics of contractual opportunism and hold-up have long established that market participants routinely overcome hold-up situations by means of private ordering, including reputation and credible commitments; standardization is a repeat game and opportunistic stakeholders suffer harm to their reputations that decisively impacts their future dealings.⁷⁶ Moreover, technology contributors commit to SSOs to offer access to their standard-essential IP on FRAND terms.

From a contractual point of view, the FRAND commitment is incomplete.⁷⁷ SSOs rarely define what FRAND terms might actually mean or provide any guidance on issues of royalty determination.⁷⁸ Instead, the FRAND commitment is meant as a general assurance to standard users that the price they will be called upon to pay for using the technologies incorporated in a standard will not be prohibitive, that they will not be discriminated against vis-à-vis their downstream rivals and, more importantly, that licences will not be altogether withheld.⁷⁹

This contractual incompleteness, though a source of dispute on several occasions, represents a sensible choice given the significant costs of a more precise definition of FRAND. To begin with, a more precise definition of FRAND by SSOs would deprive the commitment of much-needed flexibility to accommodate the various complexities of commercial bargaining.⁸⁰ Additionally, a more precise definition of FRAND would significantly raise transaction costs for all participants in collaborative standardization. Businesses have widely diverging views on which contractual terms qualify as FRAND, and negotiations within SSOs to establish a common ground would be costly, protracted and would also distract SSOs and their membership from their main duty, i.e. to decide on the technical specifications of standards. Moreover, discussions on issues such as royalty calculation would expose SSOs and their members to considerable risks of antitrust liability. It is not yet clear where the boundary actually lies between a “more precise definition of FRAND” and anticompetitive collusion to fix prices.⁸¹

Contractual incompleteness and opportunism are not normally issues of concern from a competition law perspective. Indeed, in jurisdictions where contract law remedies are readily available, competition law is confined to a minor role in the standard-setting context. In the U.S., for instance, courts have repeatedly recognized the contractual nature of FRAND commitments, and claims for breach of contract are routinely put forward by standard users faced with demands they view as non-FRAND.⁸² Moreover, requests for injunctive relief are subject to close scrutiny

⁷⁶ Ginsburg, Wong-Ervin and Wright, *supra* note 72, at p. 5; Williamson (1975), pp. 26–30; Epstein, Kieff and Spulber, *supra* note 10, at p. 10; Brooks (2011), p. 435; Chien (2013), p. 22.

⁷⁷ Wright (2013), p. 791.

⁷⁸ Mair, *supra* note 72, at p. 73.

⁷⁹ Contreras (2015), pp. 39, 42.

⁸⁰ Wright, *supra* note 77, at pp. 2, 3.

⁸¹ Petit (2016); Sidak (2009), p. 123; Sidak (2015a), p. 48.

⁸² *Realtek Semiconductor Corp. v. LSI Corp.*, 946 F. Supp.2d pp. 998, 1005 (N.D. Cal. 2013); *see also* *Microsoft Corp. v. Motorola, Inc.*, 696 F.3d pp. 872, 878 (9th Cir. 2012).

under the U.S. Supreme Court's four-factor *eBay* test.⁸³ Claims for antitrust remedies are rarely raised in SEP-related litigation and no U.S. court has ever found that a request for injunctive relief violates antitrust law.⁸⁴

However, in contradistinction to the U.S., competition law has figured prominently in SEP-related disputes in Europe, particularly in Germany. Germany is the biggest market for mobile telecommunication devices in the EU and at the same time an especially attractive forum for patent owners in view of its strong pro-patentee legal tradition and its civil procedure for patent infringement cases.⁸⁵

Crucially, German patent infringement courts have interpreted FRAND commitments as mere declarations of an obligation to conclude a contract that already exists under German competition law.⁸⁶ Denying the contractual enforceability of the FRAND commitment has the important implication that defendants in SEP infringement disputes cannot rely on contractual remedies when faced with unreasonable licensing demands. Moreover, German patent law and civil procedure rules are considerably less flexible when it comes to injunctive relief for patent infringement compared to their equivalent in the U.S. Consequently, competition law is practically the *only* legal framework in Germany that can be relied upon in cases of SEP-related disputes to rein in opportunistic patent assertions.

Moreover, in adjudicating SEP disputes, German courts relied on the "FRAND defence" introduced by the German Federal Supreme Court (*Bundesgerichtshof*) in its *Orange Book Standard* ruling.⁸⁷ It is important to note that *Orange Book* concerned a de facto standard on DVDs. The standard was not developed through the familiar cooperative process under an SSO, and the SEPs reading on the standard were not FRAND-committed. German lower courts, however, controversially extended the application of the Supreme Court ruling to the different factual

⁸³ Under Sec. 283 of the U.S. Patent Act, courts adjudicating on patent infringement cases *may* issue injunctions prohibiting infringers from making, selling or offering for sale infringing products "in accordance with the principles of equity". The U.S. Supreme Court ruled in *eBay* that the traditional four-factor test for awarding injunctive relief in equity should equally be applied to patent infringement cases. According to the Supreme Court, for an injunction to be granted, the patentee must establish: "(1) that it has suffered an irreparable injury; (2) that remedies available at law, such as monetary damages, are inadequate to compensate for that injury; (3) that, considering the balance of hardships between the plaintiff and defendant, a remedy in equity is warranted; and (4) that the public interest would not be disserved by a permanent injunction."; see *eBay Inc. v. MercExchange, L.L.C.*, 126 S.Ct. p. 1837 (2006).

⁸⁴ Ginsburg, Wong-Ervin and Wright, *supra* note 72, at p. 6; however, the FTC has enforced antitrust rules in merger control cases involving acquisition of SEPs. See FTC Consent Order, *In the Matter of Robert Bosch GmbH* (23 April 2013), <https://www.ftc.gov/sites/default/files/documents/cases/2013/04/130424robertboschdo.pdf> (accessed 30 September 2016); FTC Consent Decree, *In the Matter of Motorola Mobility and Google* (23 July 2013), <https://www.ftc.gov/sites/default/files/documents/cases/2013/07/130724googlemotorolado.pdf> (accessed 30 September).

⁸⁵ Jones (2014), pp. 1, 10.

⁸⁶ *IPCom v. Deutsche Telekom & Vodafone*, *supra* note 41.

⁸⁷ According to the *Orange Book Standard* decision, the defendant in a patent infringement action involving a de facto SEP must meet two conditions to escape an injunction. The first condition is that the defendant must make an unconditional offer to conclude a licence agreement that the patent owner cannot refuse without breaching competition law. The second requirement is that the defendant must have behaved like a licensee, that is, paid a "reasonable" licence fee to the SEP-holder or otherwise put a sufficient amount in escrow. See *Orange Book Standard* (2009), p. 694. See also *Orange Book Standard* (2010), 41 IIC p. 369 (English translation).

setting of collaborative standardization. Expectedly, defendants in SEP-related disputes have so far universally failed to fulfil the stringent conditions of *Orange Book* and injunctions have been granted on several occasions.⁸⁸

5.2 EU Competition Policy and the European Commission's Enforcement of Art. 102 TFEU

The European Commission has twice enforced EU competition law, specifically Art. 102 TFEU, against SEP-holders requesting injunctive relief in several EU Member States, issuing an infringement decision in *Motorola*⁸⁹ and an Art. 9 Regulation 1/2003 commitments decision in *Samsung*.⁹⁰ Both actions intervened in the so-called smartphone wars⁹¹ between major handset device manufacturers.

In its *Motorola* ruling, the Commission found a breach of Art. 102 TFEU at Motorola's request and enforcement of injunctive relief against Apple before the District Court of Mannheim on the basis of some of its SEPs reading on the ETSI 3G wireless standard. The Commission established Motorola's dominance, within the meaning of Art. 102 TFEU, in the upstream market for technologies contributed to the ETSI 3G standard.⁹² In the Commission's view, the fact that there were no substitutes for Motorola's contributed technologies in dispute, as well as no viable substitute to the ETSI 3G standard, gave rise to industry lock-in and placed Motorola in a position of market dominance vis-à-vis downstream manufacturers implementing the standard.⁹³

The Commission further formulated its test of abuse of a dominant position in the context of collaborative standardization and enforcement of SEPs. In line with the CJEU case law on refusal to license IPRs,⁹⁴ the Commission identified the "exceptional circumstances" that warranted a competition law interference with the exercise of IPRs: the standard-setting process and the FRAND commitment.⁹⁵ However, the Commission distinguished its decision in *Motorola* from previous CJEU cases on the interface between competition and intellectual property. Although the factual differences between the enforcement of SEPs encumbered with FRAND commitments and contributing to the collaborative standard-setting process and the CJEU line of cases on the refusal to license non-essential IPRs are quite obvious, what mostly motivated the Commission's divergence from previous CJEU

⁸⁸ *IPCom v. Deutsche Telekom & Vodafone*, *supra* note 41; *General Instrument Corp v. Microsoft Deutschland GmbH*, Mannheim District Court (*Landgericht*), 2 May 2012, Case 2 O 240/11; *Motorola Mobility Inc v. Apple Sales International*, Mannheim District Court, 9 December 2011, Case 7 O 122/11 and Karlsruhe Court of Appeals (*Oberlandesgericht*), 30 January 2013, Case 6 U 136/11.

⁸⁹ *Motorola* (Case Number AT.39985), Commission Decision, [2014] OJ C344/6.

⁹⁰ *Samsung* (Case Number AT.39939), Commission Decision, [2014] OJ C350/8.

⁹¹ Jones, *supra* note 85, at p. 9.

⁹² *Motorola*, *supra* note 89, at paras. 190–213.

⁹³ *Ibid.*, at para. 212.

⁹⁴ See Cases C-241-242/91, *RTE and ITP v. Commission*, [1995] ECR I-743; Case C-7/97, *Oscar Bronner GmbH & Co KG v. Mediaprint*, [1998] ECR I-7791; Case C-418/01, *IMS Health GmbH & Co OHG v. NDC Health GmbH & Co KG*, [2004] ECR I-5039.

⁹⁵ *Motorola*, *supra* note 89, at para. 281.

case law on “exceptional circumstances” was the difficulty of fitting Motorola’s behaviour at hand within the CJEU’s stringent three-factor test.

Specifically, the CJEU in its previous IP-related competition rulings, particularly in its latest *IMS Health* ruling, held that refusal to license an IPR might constitute an abuse of a dominant position provided that: (a) the IPR in question is indispensable for the production of a *new* product for which there would be consumer demand, (b) the refusal to license is likely to *eliminate competition in a secondary market*, and (c) there was no objective justification for such a refusal.⁹⁶ Had the Commission applied the *IMS Health* test, it would have faced two important barriers. Firstly, contrary to the behaviour of IPR-holders in previous IP-related cases, who completely denied access to their IPRs, Motorola’s behaviour did not follow the same pattern: its pursuit of injunctive relief aimed at higher royalty rates, rather than actual exclusion of its rival from the market. Enforcement of its SEPs were a means to “discipline” the potential licensee into accepting better licensing terms, a conduct that can questionably be characterized as a refusal to license in the first place. Secondly, Motorola did not seek to prevent the emergence of a new product and eliminate competition in a secondary market. Both Motorola and Apple manufactured smartphones. Thus, Motorola’s injunction would not restrict follow-on innovation and the emergence of a new product in a secondary market, but would rather restrict competition by substitution.

Having identified the aforementioned exceptional circumstances, the Commission developed its theory of harm: threatening to seek, seeking and enforcing injunctions against a “willing licensee” might result in exclusion of competitors from the market or in granting access on “disadvantageous terms”.⁹⁷ Moreover, such conduct is, according to the Commission, likely to undermine confidence in the standard-setting process and ultimately to deprive consumers of its benefits.⁹⁸ It appears that the Commission’s theory of harm and legal test of abuse constitutes a new, *sui generis* form of abuse of dominance, a “refusal to license on FRAND terms”. This new form of abuse seems to entail both an exclusionary – the exclusion of competitors from the downstream market – and an exploitative element – imposing disadvantageous licensing terms.⁹⁹

However, the Commission’s notion of “willing licensee” never developed beyond an abstract, vague and open-ended concept. The Commission failed to establish objective criteria and requirements to substantiate “willingness” on the part of a potential licensee, under which seeking and enforcing injunctions would be liable to bring about the above anticompetitive effects.¹⁰⁰ On the contrary, it created an over-broad “safe harbour” for potential licensees who agreed to FRAND royalty determination by an arbitration tribunal or a national court.¹⁰¹ It is hard to conceive of any real circumstances, under the Commission’s test of a “willing licensee”,

⁹⁶ *IMS Health*, *supra* note 94, at para. 28.

⁹⁷ *Motorola*, *supra* note 89, at paras. 322–414.

⁹⁸ *Ibid.*, at paras. 415–420.

⁹⁹ Lundqvist (2016), pp. 367, 378.

¹⁰⁰ Batista and Mazutti (2016), pp. 244, 247.

¹⁰¹ *Motorola*, *supra* note 89, at para. 495.

whereby a standard user would ever actually agree to a licensing offer in the context of bilateral commercial negotiations. Having the option of free and unlicensed use of proprietary technology for an undefined period of time; being free from the threat of IP enforcement and injunctive relief; and being liable to pay a court-determined royalty rate after years of “negotiations” and litigation, it would hardly qualify as sensible for any potential licensee to be actually willing to conclude a licence through good-faith bilateral negotiations.

In diminishing incentives to conclude a licence through commercial bargaining, the Commission based its antitrust analysis on erroneous policy assumptions while revealing a disturbing institutional choice against market-determined prices and in favour of court price-setting. The salient policy concern underpinning the Commission’s enforcement in *Motorola* and *Samsung* is patent hold-up. Judging from the far-reaching protection afforded by the Commission to potential licensees, one might assume that the risk of patent hold-up is exaggerated in the Commission’s understanding of standard-setting. It seems that the Commission tends to disregard the efficient operation of standard-setting, including the licensing of SEPs, in the overwhelming majority of cases. Added to that, standard users can avail themselves of a variety of legal remedies, under contract law, civil law and patent law, in most EU Member States; hence the number of injunctions granted for SEPs in all EU jurisdictions bar Germany is close to zero.¹⁰²

Moreover, the Commission failed to pay appropriate attention to a stream of theoretical contributions pointing out the perils of a heavy-handed antitrust approach to enforcement of SEPs, such as reverse hold-up and hold-out.¹⁰³ Although preventing hold-up in cases where contractual remedies are unavailable, as was the case in *Motorola*, is a legitimate policy aim, competition law enforcement that fails to maintain a fair balance between competing interests might distort the efficient operation of the standard-setting process and skew incentives to innovate and contribute, therefore depriving consumers of significant welfare gains.

Crucially though, the Commission’s preference for price-setting by means of arbitration or litigation instead of good-faith bilateral bargaining is a sign of the Commission’s distrust of the operation of markets in the context of collaborative standardization. Such distrust is unwarranted given the significant achievements of collaborative standardization. Moreover, encouraging litigation or arbitration as the most appropriate means of achieving FRAND outcomes entails significant risks. The Commission’s over-protection of potential licensees would only increase recalcitrance in negotiations, thus resulting in rising litigation costs and uncertainty. Furthermore, it is hard to see why courts, having inferior information on the actual market value of technologies than the private parties involved in negotiations, should be, from a public policy perspective, a preferable forum for determining FRAND compared to private stakeholders doing so themselves. Courts or any other public price regulator for that matter offer only an imperfect simulation of actual market bargaining outcomes. Making court-determined FRAND terms the rule

¹⁰² Rato and English (2016), pp. 103, 105; see also Camesasca et al. (2013), p. 285; Sidak (2015b), p. 1.

¹⁰³ Epstein, Kieff and Spulber, *supra* note 10, at p. 22.; Geradin and Rato, *supra* note 2, at p. 101; Langus et al. (2013), p. 253.

rather than the exception would only interfere with the market price system, distorting the supply and demand of technologies incorporated in standards, and ultimately resulting in various allocative and dynamic inefficiencies to the detriment of consumers.

Had the Commission's approach in *Motorola* been reaffirmed by the CJEU, a negative impact on competitive conditions and licensing negotiations within the framework of collaborative standardization would be the most likely outcome. However, the Commission's analysis, in particular its formulation of the "willing licensee", conflicted with the legal standard applied by German courts, prompting the District Court of Dusseldorf to refer the question of abuse of a dominant position in SEP-related disputes to the CJEU in the *Huawei v. ZTE* case.¹⁰⁴ The Court's ruling represents an important shift in EU competition policy in collaborative standardization.

5.3 *Huawei v. ZTE*: Policy Underpinnings

The case concerns an alleged infringement by ZTE's base stations of Huawei's LTE SEPs. Huawei brought an action for infringement and injunctive relief before the District Court of Dusseldorf. In its request for preliminary reference, the Dusseldorf court essentially asked the CJEU which standard applies for finding a breach of Art. 102 TFEU in cases of requests for injunctive relief on the basis of a SEP subject to a FRAND commitment: the one introduced by the German Federal Supreme Court in *Orange Book* or the one proposed by the Commission in its Statement of Objection to *Samsung*.¹⁰⁵

In its ruling the CJEU, following in large part the approach of Advocate General Wathelet, outlined a framework of bilateral negotiations outside which parties to a SEP-related dispute risk either antitrust liability for breach of Art. 102 TFEU or an injunction on the basis of national patent law. Specifically, according to the CJEU, the SEP-holder must, as a first step, notify in writing the standard user of his alleged infringement and must further identify the specific SEPs that have been infringed and the way they have been infringed.¹⁰⁶ As a second step,

it is for the proprietor of the SEP to present to that alleged infringer a specific, written offer for a licence on FRAND terms, in accordance with the undertaking given to the standardisation body, specifying, in particular, the amount of the royalty and the way in which that royalty is to be calculated.¹⁰⁷

According to the CJEU, it is then for the licensee "diligently to respond to that offer, in accordance with recognised commercial practices in the field and in good faith, a point which must be established on the basis of objective factors and which implies, in particular, that there are no delaying tactics".¹⁰⁸ In the event that the

¹⁰⁴ *Huawei*, *supra* note 9.

¹⁰⁵ *Ibid.*, at para. 39.

¹⁰⁶ *Ibid.*, at para. 61.

¹⁰⁷ *Ibid.*, at para. 63.

¹⁰⁸ *Ibid.*, at para. 65.

licensee finds the terms proposed by the SEP-owner as too onerous, he should submit a formal, written counter-offer on terms he views as FRAND.¹⁰⁹

It is immediately obvious that the CJEU formulates a notion of “willing licensee” that departs drastically from the one developed by the Commission in *Motorola* and *Samsung*.¹¹⁰ Indeed, the negotiation framework envisaged by the CJEU places substantial obligations upon potential licensees in stark contrast with the Commission’s nebulous view on willingness.¹¹¹ This change of course by the EU’s highest court was grounded on two overarching policy goals: the first was the need to strike a fair balance between the interested parties and the second to place licensing negotiations and market determination of FRAND terms back at the epicentre of EU competition policy.

References to the need to strike a fair balance are repeated throughout the Court’s decision, as well as in the Opinion of AG Wathelet.¹¹² Combined with the AG’s particularly interesting remark that the Commission’s approach in *Motorola* resulted in the under-protection of SEP-holders,¹¹³ such emphasis on the need to strike a fair balance might be interpreted as an implication that such a balance was not struck in the past. In particular, the Court emphasized the need to balance, on the one hand, the right to (intellectual) property and effective judicial protection and, on the other hand, the need to maintain undistorted competition.¹¹⁴ Moreover, the AG stressed the fundamental nature of the rights to property and access to courts and that limitations on such rights can be permitted “only in exceptional and clearly defined circumstances”.¹¹⁵

The *Huawei* ruling also reveals a strong preference for FRAND determination in the context of licensing negotiations between patent holders and users. The negotiation pattern outlined by the CJEU provides strong incentives to all stakeholders to come to an agreeable FRAND outcome through serious, good-faith bargaining and to do so as early as possible.¹¹⁶ The Court essentially uses antitrust liability and exposure to IP enforcement as levers to deter opportunism by both patent holders and standard users.¹¹⁷

This strong pro-market orientation of the judgment is best exhibited in its rejection of the Commission’s safe harbour of third-party FRAND determination.¹¹⁸

¹⁰⁹ *Ibid.*, at para. 66.

¹¹⁰ Rato and English, *supra* note 102, at pp. 103, 104.

¹¹¹ *Ibid.*, at p. 111; see also Subiotto et al. (2016), pp. 1, 6; Rato and English, *supra* note 102, at p. 104.

¹¹² Case C-170/13, *Huawei v. ZTE* [2014], Opinion of AG Wathelet, para. 50.

¹¹³ *Ibid.*, at para. 51.

¹¹⁴ *Huawei*, *supra* note 9, at para. 42; Wathelet, *supra* note 112, at paras. 62, 66; Lundqvist, *supra* note 99, at pp. 386–87; Heinemann (2015), pp. 947, 950.

¹¹⁵ Wathelet, *supra* note 112, at para. 62.

¹¹⁶ Lawrance et al. (2016), pp. 227, 228; Lundqvist, *supra* note 99, at p. 391.

¹¹⁷ Petit (2015), p. 6.

¹¹⁸ *Huawei*, *supra* note 9, at para. 68 (“where no agreement is reached on the details of the FRAND terms following the counter-offer by the alleged infringer, the parties may, by common agreement, request that the amount of the royalty be determined by an independent third party, by decision without delay”).

In one of its very few departures from the AG's analysis,¹¹⁹ the CJEU clarified that recourse to third-party determination of FRAND terms is voluntary, subject to agreement of the parties, and on the condition that the standard user provides "appropriate security".¹²⁰ By removing the safe harbour to licensees merely pretending to be willing to conclude a licence agreement following third-party adjudication,¹²¹ the CJEU essentially seeks to actively discourage hold-out practices, tolerated by the Commission's forgiving approach in *Motorola*.

Moreover, the CJEU seeks to strengthen confidence in bilateral licensing negotiations by imposing antitrust liability to some of the worst practices by SEP-holders. In particular, the requirement for SEP-holders to submit a formal written offer, mentioning the IPRs infringed, the proposed royalty rate and the way it was calculated prior to requests for injunctive relief, provides strong incentives to patentees to organize their essential-patent assets, develop licensing programmes on a FRAND basis and refrain from aggressive practices, such as pursuing injunctions following vague and imprecise warning letters, or making exorbitant licensing offers to potential licensees.

5.4 *Huawei v. ZTE*: Antitrust Analysis and Theory of Harm

Although the *Huawei* ruling is firmly based on correct assumptions and makes a prudent policy choice in favour of market bargaining, the Court's legal analysis and its proposed theory of harm create uncertainty and leave ample scope for interpretation by private parties and national courts. The CJEU, following the *IMS* dictum that interference with intellectual property is warranted only in exceptional circumstances, moved on and distinguished the case at issue from previous refusal-to-license cases, and identified the exceptional circumstances of *Huawei*. In the Court's view, a limitation of the patent holder's exercise of its IPRs is justified in view of the fact that the IPRs in question are *indispensable* for the implementation of the standard by downstream manufacturers and that its patent(s) achieved such a status of indispensability and essentiality only in return for an irrevocable commitment to offer access on FRAND terms.¹²² This distinct set of exceptional circumstances is again used to bypass the *IMS* new-product requirement: in *Huawei*, the competition law limitation concerns the very subject matter of the patent, not a new product resulting from follow-on innovation in a secondary market. The Court seems to protect competition between competitors offering more or less the same product.

According to the CJEU, the FRAND commitment on the part of the patent holder creates *legitimate expectations* by third parties and a refusal to license under such circumstances might constitute an abuse of a dominant position.¹²³ The Court, in outlining the negotiation pattern discussed above, essentially drew the boundary

¹¹⁹ Wathelet, *supra* note 112, at para. 93.

¹²⁰ *Huawei*, *supra* note 9, at para. 67.

¹²¹ Heinemann, *supra* note 114, at p. 951.

¹²² *Huawei*, *supra* note 9, at paras. 49–51.

¹²³ *Ibid.*, at para. 53.

between conditions governing normal competition and behaviour that departs from such conditions, which thus cannot be characterized as competition on the merits and as such falls foul of Art. 102 TFEU.¹²⁴

An important question that national courts interpreting *Huawei* will have to deal with is whether compliance with the requirements set out by the CJEU is to be determined on a *step-by-step* basis or whether the Court actually laid out the elements of anticompetitive abuse which have to be established *cumulatively* by the party alleging the abuse. Under a step-by-step approach in case of a patent holder's failure to comply with the *Huawei* requirements, for instance by not submitting a FRAND first offer, injunctive relief should be considered abusive regardless of the potential licensee's behaviour. On the other hand, if a cumulative approach is adopted, even in the case of a patent holder's failure to comply with its own obligations, a potential licensee would still have to meet all the requirements on its part (submit a FRAND counter-offer; no delaying tactics; and appropriate security in case of third party determination of FRAND) in order to establish a breach of Art. 102 TFEU.

Having in mind the Court's focus on the willingness of the potential licensee, a cumulative approach seems more appropriate; a step-by-step approach might extend *Huawei* to cases of actually unwilling licensees. However, it is important that national courts demanding a cumulative application of *Huawei* requirements adopt a flexible approach, focusing more on the good-faith behaviour of the potential licensee which is to be determined on a case-by-case basis and not using the FRAND counter-offer requirement in a way that would render *Huawei* ineffective. In particular, attention should be placed on the fact that FRAND terms refer to a range of outcomes¹²⁵ and that the patent holder, due to information asymmetries, is in principle in a better position to assess compliance with FRAND.¹²⁶

The Court further identified the exclusionary nature of the abuse, without mentioning hold-up as a potential risk,¹²⁷ contrary to the Commission's analysis which alluded to the "disadvantageous licensing terms" as a possible anticompetitive effect. The CJEU essentially based its ruling on a monopoly leverage theory of harm, according to which the enforcement of SEPs might result in the actual exclusion of a *competitor* and the elimination of competition in the downstream market.¹²⁸

The choice of the particular leveraging theory of harm by the CJEU could be interpreted in three ways: the first would be that the Court identified the exclusion of competitors and the elimination of downstream competition as the only practice with antitrust relevance; a second reading would be that the Court gave a case-

¹²⁴ See also Wathelet, *supra* note 112, at para. 74.

¹²⁵ Sidak (2013), p. 931.

¹²⁶ Heinemann, *supra* note 114, at p. 951.

¹²⁷ Rato and English, *supra* note 102, at p. 110.

¹²⁸ *Huawei*, *supra* note 9, at para. 52 ("Although the proprietor of the essential patent at issue has the right to bring an action for a prohibitory injunction or for the recall of products, the fact that that patent has obtained SEP status means that its proprietor can prevent products manufactured by competitors from appearing or remaining on the market and, thereby, reserve to itself the manufacture of the products in question."); see also Petit, *supra* note 117, at p. 3.

specific answer and left open the issue of anticompetitive abuse in other factual settings; and a third approach would be that reference to legitimate expectations might imply that *Huawei* also applies to scenarios other than anticompetitive leveraging.

The first, rather narrow, interpretation of *Huawei* seems plausible given that the Court indeed repeatedly refers to “competitors”, implying a horizontal relationship between the patent holder and the potential licensee in the downstream market, and also refers to the risk that the patentee would “reserve to itself the manufacturing of the products in question”.¹²⁹ In conjunction with the AG’s statement that much of the problem in the licensing of SEPs stems from lack of clarity on FRAND and that SSOs or other *branches of law* could address such issues “adequately – if not better” than competition law,¹³⁰ one might assume that the CJEU identified leveraging as the only scenario meriting an antitrust remedy and that other cases of opportunism could be dealt with by SSOs or under contract and civil law. That said, it should also be taken into account that if such a narrow reading of *Huawei* is accepted, one might doubt the practical relevance of the decision.¹³¹ Many disputes in the standard-setting context concern companies active at different levels of the value chain, such as non-practising entities. Anticompetitive leveraging in such situations seems impossible.

The second interpretation might be more appropriate. The Court was well aware of the factual background of the case – Huawei and ZTE compete on both the market for network equipment and smartphones – and tailored its response to the specific facts of the case, remaining silent on other scenarios. Indeed, the exceptional circumstances identified by CJEU apply to all classes of patent holders, and the legitimate expectations flowing from the FRAND commitment do not depend on the particular business model of the SEP-holder. Moreover, the negotiation pattern envisaged by the Court might well be applicable to other cases as well.

The third interpretation, that *Huawei* as it is applies to all cases of requests for injunctive relief seems the most weak. Reference to exceptional circumstances and legitimate expectations notwithstanding, the Court’s choice of anticompetitive harm is not without consequence. The CJEU had the option of formulating its theory of harm in broader terms, but nonetheless did not. Moreover, the ruling explicitly refers to the fundamental nature of the right to property and effective judicial protection. Limitations on such rights should not be presumed lightheartedly. Extending antitrust liability without a convincing theory of harm would only stretch EU competition law beyond its limits, ultimately deterring pro-competitive behaviour (false positives).

¹²⁹ *Huawei*, *supra* note 9, at para. 52.

¹³⁰ Wathélet, *supra* note 112, at para. 9 (“That does not mean, however, that the matters at issue in the dispute before the referring court, which, in my view, stem largely from a lack of clarity as to what is meant by ‘FRAND terms’ and as to the requisite content of such terms, could not be adequately – if not better – resolved in the context of other branches of law or by mechanisms other than the rules of competition law.”).

¹³¹ Lundqvist, *supra* note 99, at pp. 388–89.

5.5 Implications of *Huawei*

The CJEU's ruling in *Huawei* has important implications for national courts, SSOs and their members, and the European Commission and its policy on injunctions for SEPs. National courts, to begin with, face the difficult task of applying the Court's guidance in practice. German courts, in particular, have to discard a legal standard they have been applying for years in SEP-related cases, and replace it with the test of anticompetitive abuse in *Huawei*. The first few SEP cases in Germany post-*Huawei*¹³² have so far demonstrated the courts' willingness to extend the application of *Huawei* in SEP disputes between NPEs and manufacturers, despite the monopoly leveraging theory of harm expounded by the CJEU and without offering any other alternative theory of harm that would justify a finding of a breach of Art. 102 TFEU. This approach carries the risk of the CJEU rejecting the application of *Huawei* in non-leveraging cases, just as *Huawei* essentially disapproved the application for years of the *Orange Book Standard* in FRAND-encumbered SEPs.¹³³ A more sensible route would be for courts facing licensing disputes between firms that are not competitors to refer back to the CJEU the question of the applicability of *Huawei* in cases where anticompetitive leveraging is impossible.

Moreover, the *Huawei* ruling sends messages to SSOs as well. The AG's remarks that SSOs could contribute to mitigating several problems arising from lack of clarity of FRAND should be taken into account in current policy reform discussions within SSOs. In particular, the establishment of a framework of rules of good conduct proposed by the AG is a reasonable proposal that could contribute to streamlining bilateral negotiations. The *Huawei* negotiation framework could well serve as a starting point in discussions for SSO policy reform. Compared to other – far-reaching – reform proposals, such as disclosure of maximum royalties or joint-licensing negotiations that might distort the market price mechanism,¹³⁴ the introduction of rules of good conduct seems a realistic, pragmatic and market-oriented approach.

Finally, the CJEU's decision in *Huawei* could serve as a good opportunity for the European Commission to rethink its policy in the standard-setting context and critically reflect upon its enforcement of Art. 102 TFEU in SEP-related disputes. The Commission's reaction following the ruling shows otherwise. Competition Commissioner Vestager welcomed the decision as a confirmation of the Commission's approach in *Motorola* and *Samsung*.¹³⁵ However, the Commission should

¹³² *Saint Lawrence Communications GmbH v. Telekom Deutschland GmbH*, Mannheim District Court (*Landgericht*), 10 March 2015, Case 2 O 103/14; *Sisvel v. Haier*, Dusseldorf District Court, 3 November 2015, Cases 4a O 93/14 and 4a O 144/14; *Sisvel v. Haier*, Dusseldorf Court of Appeals (*Oberlandesgericht*), orders of 13 January 2016, Cases I-15 U 65/15 and I-15 U 66/15 (staying the enforcement of an injunction); *Saint Lawrence Communications GmbH v. Vodafone*, Dusseldorf District Court, 31 March 2016, Case 4a O 73/14.

¹³³ Wathélet, *supra* note 112, at para. 49 (“In view of that significant factual difference between that case and the dispute before the referring court, I am of the opinion that *Orange-Book-Standard* cannot be transposed by analogy to the present case.”).

¹³⁴ Hein (2013), pp. 339, 368.

¹³⁵ See speech by Commissioner Vestager, 11 September 2015, 19th IBA Conference, Florence, https://ec.europa.eu/commission/2014-2019/vestager/announcements/intellectual-property-and-competition_en.

take note of the AG's criticism that its decisions resulted in under-protection of IP owners and strike a better balance in the future. Moreover, little – if anything – of the Commission's test of abuse survives in the *Huawei* ruling. The Court followed a different approach that fosters bilateral commercial negotiations, essentially rejecting the Commission's broad safe harbour for potential licensees which would diminish incentives to negotiate in good faith and increase litigation costs and uncertainty.

6 Conclusion

Collaborative standardization in wireless telecommunications has a remarkable record of technological achievement. It has contributed decisively to the development of cutting-edge, high-performance wireless standards. Standardization in wireless telecommunications is driven by a self-reinforcing dynamic: investment and innovation in wireless standards make markets and consumer demand grow; in turn, increasing consumer demand triggers more investment and innovation in wireless standards. This remarkable record of innovation is tangible evidence that markets in collaborative standardization are competitive, open and efficient.

Public policy has not always been successful in accommodating the development of the standard-setting process. European competition policy provides a good case in point. The enforcement of Art. 102 TFEU by the EU Commission reveals an underlying mistrust of the operation of the market in the context of collaborative standardization. The Commission tends to overplay the risks of patent hold-up, ignoring at the same time the risks of reverse hold-up and hold-out. Moreover, its approach in *Motorola* and *Samsung* exhibits a preference for FRAND determination by courts or arbitration, rather than through bilateral negotiations.

The CJEU's ruling in *Huawei* marks a turning point in the application of EU competition law in the standard-setting context. The Court premised its ruling on correct policy assumptions, namely that private parties are in a better position to determine FRAND in the context of licensing negotiations and that court-determined FRAND terms should only be the last resort in case of failure to come to a mutually agreeable outcome. Being a balanced and realistic approach, the negotiation pattern outlined in *Huawei* could also inform the debate on policy reform within SSOs and thus contribute to the better performance of collaborative standardization.

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References

- Batista P, Mazutti G (2016) Comment on ‘Huawei Technologies’: standard essential patents and competition law—how far does the CJEU decision go? IIC 47(244):247
- Bekkers R, Updegrove A (2012) A study of IPR policies and practices of a representative group of standards setting organizations worldwide, p 5. http://papers.ssrn.com/sol3/papers.cfm?abstract_id=2333445. Accessed 17 May 2016
- Brooks RG (2011) Patent ‘hold-up’, standards-setting organizations and the FTC’s campaign against innovators. AIPLA Q J 39:435
- Cabral LMB (2000) Introduction to industrial organization. MIT Press, pp 316–318
- Camesasca P, Langus G, Neven D, Treacy P (2013) Injunctions for standard-essential patents: justice is not blind. J Compet L Econ 9(2):285
- Chien C (2013) Holding up’ and ‘holding out’, Santa Clara University School of Law Legal Studies Research Papers Series, Working Paper No. 19-13, p 22. http://papers.ssrn.com/sol3/papers.cfm?abstract_id=2318648. Accessed 30 Sept 2016
- Contreras J (2015) A brief history of FRAND: analyzing current debates in standard setting and antitrust through a historical lens. Antitrust Law J 80(1):39, 42
- DeLacey B, Herman K, Kiron D, Lerner J (2006) Strategic behavior in standard-setting organizations, Harvard NOM Working Paper 903214, p 2. http://papers.ssrn.com/sol3/Papers.cfm?abstract_id=903214. Accessed 17 May 2016
- DeVellis J (2003) Patenting industry standards: balancing the rights of patent holders with the need for industry-wide standards. AIPLA Q J 31:343
- Drexel J (2015) Standard setting organizations and processes: challenges and opportunities for competition and innovation—introduction (Conference: New Frontiers of Antitrust 2015), No. 3 *Concurrences* p 31, para. 13. <http://www.concurrences.com/Journal/Issues/No-3-2015/Doctrines-1765/Standard-setting-organizations-and?lang=en>. Accessed 17 May 2016
- Economides N (1996) The economics of networks. Int J Ind Organ 14:673
- Economides N (2006) Public policy in network industries. New York University Law and Economics Working Papers, p 78. http://lsr.nellco.org/nyu_lewp/78/. Accessed 30 Sept 2016
- ECORYS and Eindhoven University of Technology (2014) Patents and standards: a modern framework for IPR-based standardization. Study carried out for the European Commission, Ref. Ares (2014)917720–25/03/2014, pp 31–33. <http://ec.europa.eu/DocsRoom/documents/4843/attachments/1/translations/en/renditions/native>. Accessed 17 May 2016
- Economides N (2000) Notes on network economics and the ‘new economy’. <http://down.cenet.org.cn/ufpfile/58/200538104645171.pdf>. Accessed 30 Sept 2016
- Epstein RA, Kieff S, Spulber DF (2012) The FTC, IP, and SSOs: government hold-up replacing private coordination. J Compet Law Econ 8:10
- Geradin D (2010) Reverse hold-ups: the (often ignored) risks faced by innovators in standardized areas, p 4. http://papers.ssrn.com/sol3/papers.cfm?abstract_id=1711744. Accessed 17 May 2016
- Geradin D, Rato M (2007) Can standard-setting lead to exploitative abuse? A dissonant view on patent hold-up, royalty stacking and the meaning of FRAND. Eur Compet J 3(103):104
- Gilbert R (2012) Competition policy for industry standards, pp 2–3. http://papers.ssrn.com/sol3/Papers.cfm?abstract_id=2273333. Accessed 18 May 2016
- Ginsburg D, Wong-Ervin K, Wright J (2015) The troubling use of antitrust to regulate FRAND licensing. CPI Antitrust Chron 10(2):6
- Goodman D, Myers R (2005) 3G cellular standards and patents, IEEE WirelessCom, p 1. <http://patentlyo.com/media/docs/2009/03/wirelesscom2005.pdf>. Accessed 17 May 2016
- Harkrider J (2013) Seeing the Forest through the SEPs. Antitrust 27(3):23
- Hein J (2013) The recent DOJ and FTC policy suggestions for SSOs—the way out of SEP holdup? NYU J Intellect Prop Entertain Law 2:339, 368
- Heinemann A (2015) Standard-essential patents in standard setting organizations: competition law and the realization of licensing commitments. J Intellect Prop Law Pract 10(12):947, 950
- Jones A (2014) Standard-essential patents: FRAND commitments, injunctions and the smartphone wars. Eur Compet J 10(1):1, 10
- Katz ML, Shapiro C (1985) Network externalities, competition, and compatibility. Am Econ Rev 75(3):424

- Kobayashi B, Wright J (2010) Intellectual property and standard setting. George Mason University Law and Economics Research Paper Series 09-40, p 7. http://s3.amazonaws.com/academia.edu.documents/30771994/0940IntellectualPropertyandStandardSetting.pdf?AWSAccessKeyId=AKIAJ56TQJRTWSMTNPEA&Expires=1475319492&Signature=2AUetDh7hxviaUdocmtZgiFxb8%3D&response-content-disposition=inline%3B%20filename%3DIntellectual_Property_and_Standard_Setting.pdf. Accessed 30 Sept 2016
- Langus G, Lipatov V, Neven D (2013) Standard-essential patents: who is really holding-up (and when)? *J Compet L Econ* 9(2):253
- Lawrance S, Rotondo E, Treacy P (2016) IP and competition: a survey of developments. *J Compet Law Pract* 7(3):227, 228
- Layne-Farrar A (2010) Business models and the standard setting process, p 1. http://papers.ssrn.com/sol3/papers.cfm?abstract_id=1718065. Accessed 17 May 2016
- Layne-Farrar A, Llobet G, Padilla J (2011) Payments and participation: the incentives to join cooperative standard setting efforts, p 2. http://papers.ssrn.com/sol3/papers.cfm?abstract_id=1904959. Accessed 17 May 2016
- Lemley M, Shapiro C (1991) Patent holdup and royalty stacking. *Tex Law Rev* 85:1991
- Lundqvist B (2016) The interface between EU competition law and standard-essential patents—from Orange Book Standard to the Huawei case. *Eur Compet J* 11(2–3):367, 378
- Mair C (2016) Taking technological infrastructure seriously: standards, intellectual property and open access. *Utrecht J Int Eur Law* 32(82):59, 67. doi:10.5334/ujiel.266. Accessed 30 Sept 2016
- McKinsey Global Institute (2013) Disruptive technologies—advances that will transform life, business and the global economy, p 32. http://www.mckinsey.com/~media/McKinsey/Business%20Functions/Business%20Technology/Our%20Insights/Disruptive%20technologies/MGI_Disruptive_tech_Mobi.ashx. Accessed 17 May 2016
- McKinsey Global Institute (2015) The internet of things: mapping the value beyond the hype, p 17. http://www.mckinsey.com/~media/McKinsey/Business%20Functions/Business%20Technology/Our%20Insights/The%20Internet%20of%20Things%20The%20value%20of%20digitizing%20the%20physical%20world/Unlocking_the_potential_of_the_Internet_of_Things_Full_report.ashx. Accessed 17 May 2016
- Net!Works (2012) White Paper on Economic Impact of the ICT Sector, p 3. http://www.networks-etp.eu/fileadmin/user_upload/Publications/Position_White_Papers/Net_Works_White_Paper_on_economic_impact_final.pdf. Accessed 17 May 2016
- Orange Book Standard (2009) Federal Supreme Court (Bundesgerichtshof), 6 May 2009, Case KZR 39/06 *Gewerblicher Rechtsschutz und Urheberrecht*, p 694. <http://juris.bundesgerichtshof.de/cgi-bin/rechtsprechung/document.py?Gericht=bgh&Art=en&sid=750afc086c5f5b5b37c137dd78f23d7f&nr=48134&pos=0&anz=1>. Accessed 17 May 2016
- Petit N (2015) Huawei v ZTE: judicial conservatism at the patent-antitrust intersection. *CPI Antitrust Chron* 2:6. http://papers.ssrn.com/sol3/papers.cfm?abstract_id=2681377. Accessed 30 Sept 2016
- Petit N (2016) The IEEE-sa revised patent policy and its definition of ‘reasonable rates’: a transatlantic antitrust divide? http://papers.ssrn.com/sol3/papers.cfm?abstract_id=2742492. Accessed 30 Sept 2016
- Qualcomm (2014) The evolution of mobile technologies, p 19. <https://www.qualcomm.com/wireless-simplified/technology-evolution>. Accessed 17 May 2016
- Rato M, English M (2016) An assessment of injunctions, patents and standards following the Court of Justice’s Huawei/ZTE Ruling. *J Eur Compet Law Pract* 7(2):103, 105
- Rysman M, Simcoe T (2008) Patents and the performance of voluntary standard setting organizations. *Manag Sci* 54:1920
- Sidak G (2009) Patent holdup and oligopolistic collusion in standard-setting organizations. *J Compet L Econ* 5(1):123
- Sidak G (2013) The meaning of FRAND, part I: royalties. *J Compet Law Econ* 9(4):931
- Sidak G (2015a) The antitrust division’s devaluation of standard-essential patents. *Geo Law J Online* 104:48
- Sidak G (2015b) The meaning of FRAND part II: injunctions. *J Compet L Econ* 11(1):1
- Simcoe T, Graham S, Feldman M (2007) Competing on standards? Entrepreneurship, intellectual property and the platform paradox, NBER Working Paper 13632, p 4. <http://www.nber.org/papers/w13632>. Accessed 17 May 2016
- Subiotto R, Little D, Lepetska R (2016) The application of article 102 TFEU by the European Commission and the European Courts. *J Compet Law Pract*, pp 1, 6

- Teece D, Sherry E, Grindley P (2014) Patents and patent wars in wireless communications: an economic assessment. *Digiworld Econ J* 95(3):87
- The Boston Consulting Group (2015) The mobile revolution—how mobile technologies drive a trillion dollar impact, pp 3 and 7. https://www.bcgperspectives.com/content/articles/telecommunications_technology_business_transformation_mobile_revolution/. Accessed 18 May 2016
- The Economist Intelligence Unit (2013) The internet of things business index—a quiet revolution gathers pace, p 10, <http://www.economistinsights.com/sites/default/files/EIU%20Internet%20Business%20Index%20WEB.pdf>. Accessed 17 May 2016
- Williamson O (1975) Market and hierarchies: analysis and antitrust implications. New York Free Press, pp 26–30
- Wright J (2013) SSOs, FRAND, and antitrust: lessons from the economics of incomplete contracts. *Georgetown Law Rev* 21:791. <http://www.georgemasonlawreview.org/wp-content/uploads/2014/06/Wright-Website-Version.pdf>. Accessed 30 Sept 2016