Literature review

Patent Landscaping in the Indian Marketplace

January 2016

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I. Research questions

1. Are there indications of increasing patent filing over time by the mobile device industry in India?
2. What patents pertain to capabilities commonly found in networked mobile devices sold in India for USD 100 or less?
3. What are the existing patent pools for each of the capabilities identified in question 2? What do we know about these patent pools?
4. Would the existing patent pools be sufficient to ensure that:
    1. consumers continue to have access to inexpensive devices?
    2. manufacturers operating in the budget segment are not snuffed out by patent litigation or do not pass on losses caused by patent litigation to their consumers?
    3. the rights of patent holders are not infringed upon? If not, why?
5. Which of these patent pools could go into an India-based mobile device patent "pool of pools" formed possibly through government intervention and having a royalty level supportable by the domestic Indian consumer market for mobile devices?
6. What is the design and manufacturing flow of a finished Internet-enabled low-cost mobile phone sold in India?

Literature review

II. Patenting activity in India

1. Are there indications of increasing patent filing over time by the mobile device industry in India?

There has been a steady increase in the number of patent filings in India. 14.3% of all patent applications filed in India between 1999 and 2013 were for computer technology and 3.34% were for digital communication (WIPO, 2014)[1]. With the increasing number of mobile subscribers, the rate of filing of patent applications by telecommunication companies in India has increased[2]. 250,000 patents were estimated to be relevant and active to smartphones by RPX Corporation, a patent agency in the US as of 2011[3]. The Center on Law and Information Policy has identified 37 companies as key market players in the global smartphone industry[4].

III. Definitions

Patent Landscape Analysis

2. What patents pertain to capabilities commonly found in networked mobile devices sold in India for USD 100 or less?

The World Intellectual Property Organisation (WIPO) defines patent landscaping as:
Patent landscape reports provide a snap-shot of the patent situation of a specific technology, either within a given country or region, or globally.

Patent databases of the relevant jurisdictions are searched for the relevant technology with the aim of extracting data that would answer specific questions related to the technology. For example, the questions could be: what are the patterns or trends in patenting activity in a certain jurisdiction(s) for a given time period?; who are are major assignees?; and what types and sub-types of the technology under study have received the most patent applications. The search results are visualised as graphs, tables, charts and so on. Patent landscapes are generally accompanied by an analysis or a conclusion based on the empirical data found.

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1 WIPO, "Statistical Country Profile – India", 2014, www.wipo.int/ipstats/en/statistics/country_profile/profile.jsp?code=IN, Last accessed December 31, 2014.

2 Clairvolex, "Patenting in Telecom in India", 2010, http://patent-landscape-analysis-report.com/en/files/Indian-patent-landscape-in-telecommunication-technology.pdf, Last accessed December 31, 2014, p. 22, "…*"our analysis shows there is a direct correlation between patent filing and teledensity"*.

3 RPX, http://www.sec.gov/Archives/edgar/data/1509432/000119312511240287/ds1.htm#toc, p. 59, Last accessed December 31, 2014.

4 The Impact of the Acquisition and Use of Patents in the Smartphone Industry, Centre for Law and Information Policy, December 13, 2012, http://www.wipo.int/ip-competition/en/studies/clip_study.pdf, Table 3, p. 9, Last accessed December 31, 2014.

A study of various patent landscaping analyses conducted by patent agencies, law firms and industry associations for different mobile technologies in India and other countries reveals that there is no single commonly accepted methodology for analysing patents. Every patent landscaping exercise developed its methodology from contexts and conditions that depended on the region, the research objective, the technology under study, et cetera.

Standard

The National Institute of Standards and Technology (NIST) defines the term "standard," or "technical standard" in the National Technology Transfer and Advancement Act (NTTAA)[5] as including:

- Common and repeated use of rules, conditions, guidelines or characteristics for products or related processes and production methods, and related management systems practices.
- The definition of terms; classification of components; delineation of procedures; specification of dimensions, materials, performance, designs, or operations; measurement of quality and quantity in describing materials, processes, products, systems, services, or practices; test methods and sampling procedures; or descriptions of fit and measurements of size or strength.

The International Organisation for Standardisation (ISO) defines a "standard" as "a document that provides requirements, specifications, guidelines or characteristics that can be used consistently to ensure that materials, products, processes and services are fit for their purpose"[6].

Standard Essential Patents (SEP)

European Telecommunications Standards Institute (ETSI) defines standard essential patents as: *When it is not possible on technical grounds to make or operate equipment or methods which comply with a standard without infringing an IPR, i.e. without using technologies that are covered by one or more IPR, we describe that IPR as 'essential'.*[7]

Standards bodies require that if their members believe they hold patents that may be SEPs, then they disclose them to the body before or during the standards setting process and as

5 http://www.nist.gov/standardsgov/definestandards.cfm/

6 International Organisation for Standardisation, http://www.iso.org/iso/home/standards.htm, Last accessed April 27, 2015.

7 ETSI.org, Intellectual Property Rights (IPRs), http://www.etsi.org/about/how-we-work/intellectual-property-rights-iprs, Last accessed April 27, 2015.

soon as possible. SEPs are thus always self-declared.

Patent pool

Aoki and Schiff (2007)[8] define a patent pool as "an arrangement between two or more patent holders in which the relevant patents are licensed jointly as a package. The licensees may be the patent holders themselves, other users of the technology, or both." In economies of scale, patent pools can significantly lower transaction costs. Patent pools can be more efficient if their patents are complementary. Royalties accrued from licensing the patents in the pool are distributed with the members of the pool after deducting administrative costs.

Patent pools managed in India or by Indian entities

No India-specific patent pools were found in the course of this literature survey.

IV. SEPs and smartphone litigation

4. Would the existing patent pools be sufficient to ensure that:

1. *manufacturers operating in the budget segment are not snuffed out by patent litigation or do not pass on losses caused by patent litigation to their consumers?*
2. *the rights of patent holders are not infringed upon?*

All the patent infringement litigation that has occurred in India as of 2015 pertains to SEPs. Ericsson, which partnered with Sony to manufacture smartphones until 2011, has sued homegrown Indian manufacturers Micromax, iBall, Gionee, Kingtech, Intex, and Xiomi over the alleged infringement of 8 of its SEPs related to the AMR, 3G, and EDGE standards. (Lakshané, 2015). Vringo, another company that operates on the model of monetising its intellectual property, has sued ZTE in India over the alleged infringement of one of its CDMA2000-EV-DO Rev. A SEPs. Vringo has also sued Asus in India over a non-SEP, which is a text prediction software patent. (Lakshané, 2015).

In a 2012 paper, Bekkers et al studied 5,004 declarations from the disclosure records of thirteen major SSOS. The declarations pertained to 9,635 unique US and European patents, primarily covering digital information and communication technologies. They found that their sample was four times more likely to be asserted in litigation than a matched "control" sample belonging to the same time period. The data also empirically

8 Promoting Access to Intellectual Property: Patent Pools, Copyright Collectives and Clearinghouses, Aaron Schiff and Reiko Aoki, September 2007, http://papers.ssrn.com/sol3/papers.cfm?abstract_id=976852, Last accessed May 24, 2015.

indicates that SSO patents with FRAND, RAND and other licensing commitments are more likely to be litigated over than SSO patents for royalty-free technologies. (http://home.ieis.tue.nl/rbekkers/bekkers_et_al_%282012%29_nber_conf.pdf)

Blind and Pohlmann (2013) attribute increasing litigation to the increase in the number of SEPs, in the number of rights holders, in the number of standards that are subject to SEPs, an increasing demand for leading edge technologies in the market, and grey zones in the sale and transfer of licensed patent portfolios. (Trends In The Interplay Of IPR And Standards, FRAND Commitments And SEP Litigation, Knut Blind and Tim Pohlmann, September 2013, Les Nouvelles, http://www.iplytics.com/download/docs/articles/Blind_Pohlmann_2013_Trends%20In%20The%20Interplay%20Of%20IPR%20And%20Standards.pdf)

Gupta and Snyder, authors affiliated with Qualcomm, (2014) offer a counterview. They have argued that:
a. litigation in the recent years over SEPs is sensationalised
b. litigation in the smartphone industry is primarily driven by non-SEPs
c. litigation is related to the quality of the patent rather than its type (SEP or otherwise)
d. the trend of litigation may be on the decline.

They have suggested that concerns about SEPs and smartphone litigation need to be examined before proposing policy measures. By examining, *inter alia,* a statistical record of all patent litigation involving SEPs from 2001 to 2013 against a record of all smartphone litigation that happened in the same period, the authors note that the latter outnumbers the former. They also statistically study the number of uniquely asserted patents in the same period by twelve large firms in the smartphone domain and observe that nine of them litigated more over non-SEPs than over SEPs.

The study disclaims that these views are of the authors' and do not reflect those of others, including Qualcomm. (*Smart Phone Litigation and Standard Essential Patents, Gupta and Synder, Hoover Institution Working Group on Intellectual Property, Innovation, and Prosperity, Stanford University, Working Paper Series No. 14006, May 2014.)*

Suggested measures to avoid litigation over SEPs and FRAND
Matheson J.E, of Intel suggests adopting five principles in India policy:

1. An FRAND commitment by the SEP-holder applies to every willing licensee.
2. An SEP owner with a FRAND commitment must not allowed to obtain injunctions against alleged infringers except under three defined and limited conditions.
3. No deadline should be imposed on FRAND negotiations. It puts the patent holder at an unfair advantage. Instead, the courts should determine if a potential licensee is unwilling.
4. A reasonable royalty can be calculated on the basis of the smallest practicing component of the patented technology, by factoring the value of the SEP with respect to alternative technologies available, and keeping the amount proportionate to the the contribution of the SEP in comparison with other patent licenses required to implement the standard.
5. Holders of SEPs should not 'bundle' non-SEPs licenses as a condition for licensing SEPs.
(Patents and Standards: FRAND Challenges in India's ICT Sector, John E. Matheson, September 2014, SpicyIP.com/?p=13039)

The European Commission has in the context of standardisation clarified that where SEP holders have committed to license their SEPs on FRAND terms, it is anti-competitive to seek to exclude competitors from the market by seeking injunctions on the basis of SEPs, if the licensee is willing to take a license on FRAND terms.

Lemley and Shapiro (2013) have suggested that “reasonable” royalties for SEPs should be set at the time the standard is set (by an SSO) based on a hypothetical arms-length negotiation. The SEP-holder would not be allowed to change the royalty rates later or charge different rates from different licensees. *(A Simple Approach to Setting Reasonable Royalties for Standard-Essential Patents, Lemley and Shapiro, Berkeley Technology Law Journal, Vol. 28:1135, 2013)*

V. SEPs and patent ownership

What are the existing patent pools for each of the capabilities identified in question 2? What do we know about these patent pools?
Would the existing patent pools be sufficient to ensure that:
consumers continue to have access to inexpensive devices?
the rights of patent holders are not infringed upon? If not, why?

Numerous studies have found that strategic planning is more likely to get a patent included into a standard and declared essential than the technological indispensability of the patent.

A study by Bekkers and Martinelli (2004) builds upon the concepts of technological

regimes and trajectories to empirically investigate the interplay between standardisation and technological change. By comparing the set of patents in most of the important technological trajectories with the set of SEPs declared to standards bodies, Bekkers and Martinelli conclude that there is no significant relationship between the two sets[9][10].

Goodman and Myers (2005) inferred from a study of 3G standards, "Even with the narrow definition of essential and the low ratio of essential patents to declared patents it may be necessary to acquire rights to several dozens of patents, depending on the equipment or service to be produced. In addition to the patents that are technically essential, there are probably other patents that are commercially essential because they contain the best (albeit not the only) possible implementation of the standard."

Several studies have found evidence that SSO patents are cited far more frequently than non-SSO ones (which form a control set pertaining to the same vintage), and receive citations for a much longer time. (Rysman and Simcoe, 2005, http://www.netinst.org/Rysman2005.pdf; Bekkers et al, 2012, http://home.ieis.tue.nl/rbekkers/bekkers_et_al_%282012%29_nber_conf.pdf)

VI. Standards found in Internet-enabled mobile phones

What patents pertain to capabilities commonly found in networked mobile devices sold in India for USD 100 or less?

2G

The second generation (2G) of mobile telecommunication standards was defined in 1989. **GSM (Global System for Mobile Communications)** has become the dominant standard in 2G cellular networks worldwide. Despite the existence of higher standards, 58% of the global market share was covered by GSM as of December 2014. The Ericsson Mobility Report pegged the number of GSM/ EDGE-only mobile subscriptions to 4 billion globally as of Q3 2014[11]. Over 90% of India's population is covered by GSM/ EDGE networks.[12]

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9 The interplay between standardization and technological change: A study on wireless technologies, technological trajectories, and essential patent claims, Bekkers, Martinelli, June 2014, http://ecis.ieis.tue.nl/node/142, Last accessed May 24, 2015.

10 Strategic behaviour in Standard-Setting Organisations, DeLacey et al, Harvard University, September 2006, http://papers.ssrn.com/sol3/papers.cfm?abstract_id=903214, Last accessed May 24, 2015.

11 Ericsson Mobility Report, p. 2, http://www.ericsson.com/res/docs/2014/ericsson-mobility-report-november-2014.pdf, Last accessed April 27, 2015.

12 Ericsson Mobility Report, p. 16, http://www.ericsson.com/res/docs/2014/ericsson-mobility-report-november-2014.pdf, Last accessed April 27, 2015.

ETSI developed GSM in 1991. GSM specifications were transferred to the 3rd Generation Partnership Project (3GPP) in 1999[13]. GSM EDGE Radio Access Networks (GERAN) is one of 3GPP's four Technical Specification Groups (TSG)[14].

The GERAN TSG has three working groups (WGs)[15]:

TSG GERAN WG1	Radio Aspects
TSG GERAN WG1	Protocol Aspects
TSG GERAN WG3new	Terminal Testing

Other 2G standards are:

- Interim Standard-95 (IS-95; commercial name CDMAOne)[16]
- Personal Digital Communication System (PDC), used exclusively in Japan[17]
- Integrated Digital Enhanced Network (iDEN)
- Digital Advanced Mobile Phone System/ D-AMPS/ Interim Standard-136 and Interim Standard 54/ IS-136 and IS-54

While CDMAOne has been evolved to higher versions, the rest have become obsolete in the commercial mobile telephony domain.

GSM and its higher versions employ the time-division multiple-access (TDMA) method, CDMAOne and its future generations the code-division multiple-access (CDMA) method.

Two signalling methods are used in the core cellular networks: GSM TDMA and TIA IS-41 (Telecommunications Industry Association Interim Standard-41).

With the release of the General Packet Radio Services (GPRS) standard and later Enhanced Data rates for GSM Evolution (EDGE), 2G networks evolved from circuit-switching ones to

13 3GPP, GSM Spec History, http://www.3gpp.org/specifications/gsm-history, *"Initially, change requests were approved twice: by 3GPP and by TC SMG, but gradually, the non-radio GSM specs were transferred to 3GPP ownership and this dual approval vanished.", Last accessed April 27, 2015.*

14 3GPP, About 3GPP, http://www.3gpp.org/about-3gpp/about-3gpp, Last accessed April 27, 2015.

15 3GPP, GERAN plenary, http://www.3gpp.org/specifications-groups/26-geran, Last accessed April 27, 2015.

16 IS-95 CDMA and cdma2000: Cellular/PCS Systems Implementation, Vijay K. Garg, 1999, http://books.google.co.in/books?id=VMe87kOKW3wC&lpg=PT3&ots=dovcovPY5-&dq=is-95%202g&lr&pg=PT27#v=onepage&q=is-95%202g&f=false/

17 Innovations in Organizational IT Specification and Standards Development, Edited by Kai Jacobsi, p. 186, 188 http://books.google.co.in/books?id=TbeeBQAAQBAJ&lpg=PA183&ots=rTDk9anvEv&dq=2G%20PDC%20japan&lr&pg=PA183#v=onepage&q=pdc&f=false/

data packet switched ones. GPRS is informally known as the 2.5G standard and EDGE as 2.75G, as a reference to their intermediateness between 2G and 3G. EDGE is also known as Enhanced GPRS, EGPRS, IMT Single Carrier (IMT-SC), and Enhanced Data rates for Global Evolution. GPRS has been integrated in GSM from 3GPP Release 97[18], EDGE from Release 98[19]. Thus, 2G evolved from GSM to GPRS to EDGE to EDGE-Advanced.

3G

The third generation (3G) of mobile telecommunication technology is based on the International Telecommunication Union's (ITU) International Mobile Telecommunications-2000 (IMT-2000) family of standards.

Universal Mobile Telecommunication System (UMTS), released in 1999 (3GPP Release 99) in Europe was the first to meet the ITU's requirements for the third-generation standard.[20] It was developed and is maintained by 3GPP. The next stage in the evolution of 3G standards was High speed packet access (HSPA) rolled out in 2005[21] and informally known as 3.5G. The next upgrade, HSPA+, also known as HSPA advanced, was rolled out in 2008. Wideband Code Division Multiple Access (W-CDMA) (ITU name: IMT2000 direct spread) is another name for the 3G GSM standard UMTS. Thus, 3G evolved from UMTS to HSPA to HSPA+.

The other dominant 3G standard, offered by 3GPP2, is CDMA2000 in its various versions: 1X Advanced, 1xEV-DO (Evolution-Data Optimised), Release 0, Release A, and Release B. CDMA2000 1X Advanced supported voice, while the rest support data as well. CDMA2000 1X has been repealed. The family of standards is also known as International Mobile Telecommunications Multi-Carrier (IMT-MC).

4G

The dominant standard in the fourth generation (4G) of mobile telecommunication standards is Long Term Evolution (LTE), rolled out in 2010. The latest 4G standard is LTE advanced. A competing 4G standard is WiMAX, and its latest version is WiMax2.

Indian patent firm iRunway, in a patent landscaping analysis of 4G LTE patents, breaks

18 3GPP.org, http://www.3gpp.org/specifications/releases/78-functionality-in-early-gsm/ See Release 97, Last accessed April 27, 2015.
19 3GPP.org, http://www.3gpp.org/specifications/releases/78-functionality-in-early-gsm/ See Release 98, Last accessed April 27, 2015.
20 Architectures for Baseband Signal Processing, Frank Kienle, p. 6, 2013 edition, ISBN 978-1-4614-8030-3
21 See footnote #20.

down the technology into 7 top-level categories, which are further drilled down into sub-categories:

– Data transfer rate
  – Directional signal transmission, Hybrid automatic repeat request (HARQ), Multiple input and Multiple Output (MIMO)
– Spectral efficiency
  -- Orthogonal Frequency Division Multiple Access (OFDMA), Carrier aggregation
– Power management
  – Coordinated Multi-point Transmission (CoMP)
– Communication reliability
  – Relay
– Network coverage
  – HetNet
– Network deployment
  – Self organising network (SON)
– Network security

5G

The fifth generation (5G) is currently under development and is expected to be rolled out by 2020[22], the year in which 50 billion Internet-connected devices are projected.[23]

Key Technologies for 5G Wireless Communication Networks
– Massive MIMO (multiple-input multiple-output)
– Cloud Technologies for Flexible Radio Access Networks
– Advanced Interference Management
– Network Densification
– Millimeter-Wave Beam forming for 5G Cellular Communications

Each of these technologies come with a set of merits and challenges. While 5G is deemed to be an enabler and a requirement for the the “Internet of Things”, some alternative technological solutions that could be considered are:

– Co-operative green Heterogeneous Network (HetNet) framework
– Content Caching and Delivery Techniques

22 ITU-R M.[IMT.VISION], “IMT Vision-Framework and overall objectives of the future development of IMT for 2020 and beyond", ITU working document 5D/TEMP/224-E, July 2013.
23 More than 50 billion connected devices, Ericsson, February 2011, White paper, http://www.ericsson.com/res/docs/whitepapers/wp-50-billions.pdf, Last accessed May 24, 2015.

– Cognitive Radio (CR)
– Mobile Femtocell
– Visible Light Communication (VLC)

WiFi/ IEEE 802.11

The IEEE 802.11 family of standards (first released in 1997) for wireless local area network (WLAN) products[24] are marketed with the WiFi brand. Depending on the data rate and frequency in GHz, the generations are termed: 802.11a, 802.11b, 802.11g, 802.11n, 802.11ac, and 802.11ad.[25] The the time of writing, the most commonly used standards in mobile phones are 802.11b/g/n.[26] Upcoming propocols are 802.11ah, 802.11ai, 802.11aj, 802.11ak, 802.11aq, 802.11ax, and 802.11ay.[27]

Bluetooth

Created by Ericsson in 1994, Bluetooth is a global wireless standard for data exchange among mobile and non-mobile devices. It uses the ISM (industrial, scientific and medical) band from 2.4 GHz to 2.485 GHz for short-distance communication and for building personal area networks (PANs). http://www.bluetooth.com/Pages/Fast-Facts.aspx

Bluetooth is defined in the IEEE 802.15.1 specification but IEEE does not maintain it anymore. The Bluetooth Special Interest Group (SIG) develops and manages the standard. It's operational versions are 2.1+EDR, 3.0+HS, 4.0, 4.1, and 4.2, the latest being released in 2014.

Near Field Communication (NFC)

NFC is a global, standardised wireless technology for exchanging data over distances of 10 cm or less by using contactless integrated circuit cards and proximity cards. NFC functions over an unlicensed radio frequency ISM band at 13.56 MHz. *http://nfc-forum.org/what-is-nfc/*

The ISO/IEC, ETSI and ECMA, and the NFC Forum have devised standards for NFC. The NFC Forum specifications are based on the NFC standards created and maintained by the ISO/IEC, EMCA and ETSI.
http://www.nearfieldcommunication.org

24 IEEE 802.11 Handbook: A Designer's Companion, O'Hara et al, p.5, Second edition, ISBN-13: 978-0738144498
25 See footnote #24
26 http://www.brighthand.com/news/wi-fi-802-11ac-to-be-the-new-norm-in-smartphones-by-2015/
27 IEEE, http://grouper.ieee.org/groups/802/11/Reports/802.11_Timelines.htm, Last accessed May 24, 2015.

http://members.nfc-forum.org/aboutnfc/interop/

Sony and NXP Semiconductors developed NFC technology in 2002 (ttp://cistems.com/about-nfc). The NFC Forum, a non-profit industry body, was formed in 2004 in order to further the use of NFC. As of February 2014, the NFC Forum has around 170 members, which include manufacturers, application developers, and financial services institutions.

GPS

The Global Positioning System (GPS) service is provided by the U.S. government, as per a federal statute, on a "continuous, worldwide basis, free of direct user fees" for civilian use. In mobile phones, GPS modules determine a geographical location by finding, receiving, and triangulating signals from the GPS satellite navigation system. The United States has entered into several agreements with countries and organisations worldwide for the cooperative development of GPS and sharing of systems. Apart from GPS, several smartphones support Assisted Global Positioning System (AGPS), which provides more accurate positioning in comparatively less time. AGPS makes use of the satellite data available with cellphone towers to improve the quality of GPS signals. 3GPP and 3GPP2 standards include "specifications of the minimum required performance for A-GPS in a mobile phone." (*Ericsson, Positioning with LTE 7 (White Paper No. 284-23-3155, Sept. 2011)* *http://www.sharetechnote.com/Docs/WP-LTE-positioning.pdf;* Jonas Willaredt, WiFi and Cell-ID Based Positioning – Protocols, Standards and Solutions, (http://www.snet.tu-berlin.de/fileadmin/fg220/courses/WS1011/snet-project/wifi-cellid-positioning_willaredt.pdf)

The satellite navigation system developed by Russia is GLONASS (Globalnaya navigatsionnaya sputnikovaya sistema), or "GLObal NAvigation Satellite System". Several smartphone manufacturers such as Asus, Acer, Apple, Xiaomi, ZTE, and Huawei make GLONASS-compatible phones. (https://en.wikipedia.org/wiki/List_of_smartphones_supporting_GLONASS_navigation) These phones also support GPS.

MP3

MPEG-1/ MPEG-2 Layer 3, also known as MP3, is a lossy audio compression format[28]

28 http://www.jiscdigitalmedia.ac.uk/glossary/#m.jpeg, Last accessed May 24, 2015.

standardised by the ISO in 1993.[29]

AAC

Advanced Audio Coding (AAC) is a lossy audio compression format[30] and an advancement on the MP3 standard[31]. It was first defined in the MPEG 4 Part 7 specification. Later, an update to AAC was defined in MPEG 4 Part 3. (ISO/IEC 14496-3).

FLAC and Apple Lossless

Free Loss Audio Codec (FLAC) and Apple Lossless are the most used lossless audio compression formats.

VII. Standard setting organisations (SSO), standards development organisations (SDO), consortia, and their IPR policies

Corresponding questions: What are the existing patent pools for each of the capabilities identified in question 2? What do we know about these patent pools? Would the existing patent pools be sufficient to ensure that:

consumers continue to have access to inexpensive devices?

manufacturers operating in the budget segment are not snuffed out by patent litigation or do not pass on losses caused by patent litigation to their consumers?

3GPP (3rd Generation Partnership Project)

As of April 2015, 3GPP is a consortium of seven telecom standard development organisations (SDOs), which it terms as "Organisations Partners". 3GPP started in 1998 as a consortium of five SDOs.

ARIB (Association of Radio Industries and Businesses)	Japan
ATIS (Alliance for Telecommunications Industry Solutions)	US
CCSA (China Communications Standards Association)	China
ETSI (European Telecommunications Standards Institute)	Europe
TSDSI (Telecommunications Standards Development Society of India)	India
TTA (Telecommunications Technology Association)	Korea

29 http://mp3licensing.com/mp3, Last accessed May 24, 2015.
30 http://www.jiscdigitalmedia.ac.uk/glossary, Last accessed May 24, 2015.
31 http://www.jiscdigitalmedia.ac.uk/blog/entry/aac-explained, Last accessed May 24, 2015.

TTC (Telecommunications Technology Committee)	Japan

IPR policy

According to 3GPP's licensing policy, all Intellectual Property Rights (IPR) holders, irrespective of whether or not they're Individual Members of 3GPP, are supposed to license their patents to all third parties under fair, reasonable and non-discriminatory (FRAND) terms[32]. 3GPP's IPR policy[33] as defined in its working procedures states, *inter-alia*: *Individual Members should declare at the earliest opportunity, any IPRs which they believe to be essential, or potentially essential, to any work ongoing within 3GPP. Declarations should be made by Individual Members to their respective Organizational Partners.*

3GPP2 (3rd Generation Partnership Project 2)

3GPP2 is a consortium of five SDOs, also known as 3GPP2's "Organisational Partners", and was formed in 1998 as a partnership parallel to 3GPP. 3GPP2 standardised the CDMA2000 family of standards.[34]

Members:

ARIB (Japan), TTC (Japan), TTA (Korea), CCSA (China), Telecommunications Industry Association (TIA) (North America).[35]

All SDOs but TIA are members of 3GPP as well.

IPR Policy:

3GPP2's IPR policy mandates that members declare standards essential patents pertaining to 3GPP2's work at the earliest and that Organisational Partners encourage their members to license them on FRAND terms.[36]

TSDSI (Telecommunications Standards Development Society, India)

The Telecommunications Standards Development Society, India is a telecommunications standards development organization whose mandate includes the development and promotion of India-specific requirements in technology, and "standardising solutions for

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32 3GPP.org, FAQs, http://www.3gpp.org/contact/3gpp-faqs#L5/, Last accessed April 27, 2015.

33 3GPP.org, 3GPP Working Procedures, http://www.3gpp.org/ftp/Information/Working_Procedures/3GPP_WP.htm#Article_55/ Last accessed April 27, 2015.

34 IP for 4G, David Wisely, 2009 edition, p. 16, ISBN 978-0-470-51016-2

35 3GPP2, About 3GPP2, http://www.3gpp2.org/Public_html/Misc/AboutHome.cfm#who, Last accessed April 27, 2015.

36 3GPP2, Legal Issues, http://www.3gpp2.org/public_html/misc/legal.cfm, Last accessed April 27, 2015, *"In accordance with Article 55 of the 3GPP2 Working Procedures Document..."*

meeting these requirements and contributing them to international standards".[37] It was established in November 2013. The TSDSI became an Organisational Partner of the 3GPP in January 2015 and a member of ETSI in November 2013.

As of October 2015, the TSDSI had 44 members. Its member organisations include telecom service providers such as Vodafone India and Bharti Airtel; telecom equipment manufacturers such as Apple India and Nokia Solutions and Networks India; academic institutions such as IIT Kanpur; and research and development organisations such as Broadcomm Semiconductor India and the Centre for Development of Telematics.

Dr. Kumar N. Sivarajan, Chief Technology Officer at Tejas Networks, outlines the importance of India having its own telecom SDO[38]: He contrasts the low affordability, poor broadband penetration, low spectrum availability and high spectrum cost in India with the situation in Europe. He highlights that there has been limited 4G rollout in India despite the spectrum being auctioned years ago as an indicator that the deployment of 4G did not factor in Indian demographics and could not reach less-privileged, non-urban consumers.

In the context of 5G deployment, Dr. Kumar N. Sivarajan suggests that India needs to "avoid new BTS [base transceiver station] roll-outs, [and] avoid the need for new/ more spectrum", unlike in Europe where these are less significant criteria. India does not need connectivity for multiple devices or high-speed mobility, as traffic snarls in cities eliminate the need for them. These differences between India and Europe illustrate the need to standardise and utilise technology to cater to the Indian market.

VIII. Standards and ownership of related patents

Corresponding question: What patents pertain to capabilities commonly found in networked mobile devices sold in India for USD 100 or less?

3G standards and patent ownership

Goodman and Myers (2005)[39] studied 7,796 patents and patent applications declared essential to the two erstwhile dominant 3G standards – W-CDMA (3G GSM) and CDMA2000 (3G CDMA). A preliminary evaluation of these patents across 887 "families"

37 About Us, Telecommunications Standards Development Society, India, Last accessed on October 27, 2015. http://tsdsi.org/main/about-us/

38 What India wants from 5G, Kumar N Sivarajan, Last accessed November 2, 2015, http://www.tsdsi.org/media/attachment/Dr._Kumar_Sivarajan_Tejas_Networks_Ltd..pdf

39 3G cellular standards and patents, Goodman and Myers, IEEE Wireless 2005, http://eeweb.poly.edu/dgoodman/wirelesscom2005.pdf/, Last accessed April 27, 2015.

indicated that only 21% of the declared SEPs were actually essential. These included 732 W-CDMA SEPs and 537 CDMA2000 SEPs.

Forty one different companies held rights to the patents in the study, but four companies -- Qualcomm, Nokia, Ericsson, and Motorola -- together owned the rights to 75% of the patents. 90% of 3GPP patents belonged to 12 companies.[40] 8 companies owned most of the 3GPP2 declared SEPs.[41]

A panel of technical experts asked to evaluate the patents in the study to determine if an SEP claim was actually essential. At the end of the evaluation, the panel found that 79% of the patents declared essentials probably weren't.[42] Further, of the 13 companies with patents judged essential to 3GPP2, 12 companies have patents judged essential to 3GPP.

In another review of 477 W-CDMA patents declared essential to 3GPP and 97 additional "family members", done by Goodman and Myers (2009), 39% patents were judged essential or probably essential. Together with the results from three previously published reviews, out of 1889 declared W-CDMA SEPs, 28% were judged essential.[43],[44] The study discloses that it was conducted independently by the authors and that Nokia, the funding body was contractually bound to not exert influence on them. (Since the study was done, Telecommunications Industry Association (TIA) in North America has ceased to be a member of 3GPP, while a new member, TSDSI (India) has joined the partnership.)

Several open-source software projects, such as the OpenBTS Base transceiver station, implement the GSM standard but their patent implications remain hazy.

4G Standards and Patent Ownership

A patent landscape analysis published by an India-based patent agency, iRunway for patents filed in the USPTO database from 1990 to 2011, identifies eight companies as key patent holders in the 4G gdomain for the span 1993-2011: Samsung. Ericsson, Qualcomm, Motorola Mobility, Interdigital, Nokia, Nortel Networks, and Motorola Solutions[45]. Around

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40 Qualcomm, Ericsson, Nokia, Motorola, Philips, NTT DoCoMo, Siemens, Mitsubishi, Fujitsu, Hitachi, Interdigital, and Matsushita.

41 Qualcomm, Nokia, Motorola, NTT DoCoMo, Ericsson, Matsushita, Hitachi, and NTT, in decreasing order of the number of patents.

42 The owners of 3GPP patents judged by the panel as essential were: Nokia, Ericsson, Qualcomm, Motorola, Siemens, Alcatel, in decreasing order of the number of patents held, followed by Philips, NTT DoCoMo, Mitsubishi, Hitachi, Interdigital, and Matsushita. For 3GPP2, the rightholders were: Qualcomm, Nokia, Motorola, NTT DoCoMo, Hitachi, Sherbrooke, and Ericsson.

43 Review of Patents Declared as Essential to WCDMA Through December 2008, Goodman, Fairfield Resources International, p.1, January 2009, http://www.frlicense.com/wcdma1.pdf, Last accessed May 24, 2015.

44 Analysis of patents declared essential to GSM as of June 6, 2007, Goodman, Fairfield Resources International, December 2007, http://frlicense.com/GSM_FINAL.pdf, Last accessed May 24, 2015.

45 "Patent Landscape and Analysis of 4G-LTE Technology", iRunway, 2012, p. 11, http://www.i-runway.com/images/pdf/iRunway%20-%20Patent%20&%20Landscape%20Analysis%20of%204G-

20% of the seminal LTE patents were found to be held by small and medium enterprises (SMEs) and non-practising entities (NPEs)[46].

Another patent landscaping exercise done by Japan-based consulting and research firm Cyber Creative Institute (June 2013) analysed 5,919 families of 4G (LTE) patents uploaded by ETSI in November 2012. It found that the largest percentage of declared SEPs belonged to Qualcomm (11.1%), Samsung (11%), Huawei (10.2%), Nokia (8.5%) and InterDigital (7.1%). In order to determine if the patents from ETSI's list were SEPs or not, Cyber Creative Institute selected a representative patent from the family. In the order of preference, the jurisdictions were Japan, US, EU, and WO. Essentiality was determined by classifying a patent into one of three categories, according to its relevance to standards:
A: The invention contained in the patent matches the standards (this category corresponds to essential patent).
B: The invention partially matches the standards.
C: The invention does not match the standards.
http://www.cybersoken.com/research/pdf/lte03EN.pdf

Two patent pools, Sisvel and Via Licensing, have publicly disclosed royalty rates of their LTE portfolios:

Sisvel

Licensors:[47]

- Airbus DS SAS
- Bräu Verwaltungsgeselschaft mbH
- China Academy of Telecommunication Technology (CATT)
- Electronics and Telecommunications Research Institute (ETRI)
- Koninklijke KPN N. V.
- Orange SAS
- TDF SAS

LTE SEPs acquired by Sisvel from Nokia Corp. in 2011 are also included in the pool[48].

LTE.pdf, Last accessed December 31, 2014

46 "Patent Landscape and Analysis of 4G-LTE Technology", iRunway, 2012, p. 20, http://www.i-runway.com/images/pdf/iRunway%20-%20Patent%20&%20Landscape%20Analysis%20of%204G-LTE.pdf, Last accessed December 31, 2014.

47 Sisvel, LTE/ LTE-A Patent Owners, http://www.sisvel.com/index.php/lte-ltea/patent-owners, Last accessed May 24, 2015

48Sisvel, LTE/ LTE-A, http://www.sisvel.com/index.php/lte-ltea, Last accessed May 24, 2015

Sisvel Patent Pool charges 0.99 Euros per device sold.[49]

Via Licensing

Licensors:[50]

- AT&T Intellectual Property II, L.P.
- China Mobile Communications Corporation
- Clear Wireless LLC
- Deutsche Telekom AG
- DTVG Licensing, Inc.
- Hewlett-Packard Company
- KDDI Corporation
- NTT DOCOMO
- SK Telecom Co., Ltd
- Telecom Italia S.p.A.
- Telefonica, S.A.
- ZTE Corporation

Via Licensing has announced a royalty rate based on the volume of sales for every unit sold.[51]

Erik Stasik of Swedish firm Avvika AB in 2010 provided a breakdown of the number of 4G LTE patents declared essential to ETSI. Among 1,941 patents beloging to 38 companies, 437 belong to Interdigital and one of its subsidiaries, 350 belong to Qualcomm (published handset royalty rate 3.5%), 182 to Huawei (1.5%), 170 to Samsung (handset royalty rate not published), 150 to LG (handset royalty rate not published), 146 to Ericsson (1.5%), and 142 to Nokia (1.5%). The average royalty rate came to approximately 2.1%.

Armstrong et al have compiled publicly announced LTE royalty rates of nine companies. The royalty rate declared by Qualcomm in its LTE/ WiMax Patent Licensing Agreement (2008) is the highest of all, at 3.25% of the cost of the device.[52] Via and Sisvel LTE pools

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49 Introduction and Royalty Rate, Sisvel, http://www.sisvel.com/index.php/lte, Last accessed February 11, 2015.

50 Via Licensing, LTE Licensors, http://www.vialicensing.com/licensecontent.aspx?id=1514, Last accessed April 27, 2015.

51LTE License Fees, Via Licensing, http://www.vialicensing.com/licensecontent.aspx?id=1516, Last accessed February 11, 2015 (...for the first 500,000 units, licensees pay $3 per unit, for units 500,001 to 2,500,000, licensees pay $2.55, and the per-unit fee continues to decrease to $2.10 per unit for units 10,000,001 or more).

52The Smartphone Royalty Stack: Surveying Royalty Demands for the Components Within Smartphones, [Working Paper], Ann Armstrong et al, p.13,

and the nine companies together account for 50% to 60% of the LTE patents declared essential to ETSI.[53] As of 2014, among the top ten LTE SEP owners, Samsung, Interdigital and LG had still not declared their royalty rates.[54]

Goodman and Myers (2010) reviewed patents declared essential to LTE and SAE. A panel of experts reviewed 375 patents categorised into 210 "families" and found that 50% of the families had at least one patent judged essential or probably essential.[55] The study discloses that it was conducted independently by the authors and that Nokia, the funding body was contractually bound to not exert influence on them.

WiFi/802.11 and patent ownership

WiFi SEPs are subject to RAND terms as per IEEE's IPR policy.[56]

Armstrong et al have compiled royalty rates per unit, collected by 7 SEP holders (5 companies and 2 patent pools) for various generations of the 802.11 standard. These rates were either sought as a part of licensing negotiations or were set by the courts. They arrived at a total royalty rate of approximately USD 50 per unit.[57]

Sisvel Patent Pool:

Licensors:[58]

- Nokia Corporation
- Ericsson
- ETRI
- Sanyo Electric Co. Ltd

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http://www.wilmerhale.com/uploadedFiles/Shared_Content/Editorial/Publications/Documents/The-Smartphone-Royalty-Stack-Armstrong-Mueller-Syrett.pdf, Last accessed February 11, 2015.

53 The Smartphone Royalty Stack: Surveying Royalty Demands for the Components Within Smartphones, [Working Paper], Ann Armstrong et al, p.14, http://www.wilmerhale.com/uploadedFiles/Shared_Content/Editorial/Publications/Documents/The-Smartphone-Royalty-Stack-Armstrong-Mueller-Syrett.pdf, Last accessed February 11, 2015.

54 Royalty Rates and Licensing Strategies for Essential Patent s on LTE (4G) Telecommunications Standards, Erik Stasik, Les Nouvelles, September 2010, p. 116, Table 1, http://beta.investorvillage.com/uploads/82827/files/LESI-Royalty-Rates.pdf, Last accessed May 24, 2015.

55 Review of Patents Declared as Essential to LTE and SAE Through June 30 2009, Fairfield Resources International, p.1-2, January 2010, http://www.frlicense.com/LTE%20Final%20Report.pdf, Last accessed May 24, 2015.

56 IEEE, SA Board Of Governors, SA Standards Board Bylaws, § 6 (Dec. 2013), http://standards.ieee.org/develop/policies/bylaws/sb_bylaws.pdf, Last accessed December 15, 2014.

57 The Smartphone Royalty Stack: Surveying Royalty Demands for the Components Within Smartphones, [Working Paper], Ann Armstrong et al, p.26, http://www.wilmerhale.com/uploadedFiles/Shared_Content/Editorial/Publications/Documents/The-Smartphone-Royalty-Stack-Armstrong-Mueller-Syrett.pdf, Last accessed May 24, 2015.

58 WiFi patent owners, Sisvel, http://www.sisvel.com/index.php/wi-fi/patent-owners, Last accessed February 11, 2015.

- Hera Wireless S.A.

Via Licensing Pool:

The pool covers 802.11(a-j) standards.

Licensors:[59]

- ETRI
- Japan Radio Co., Ltd.
- LG Electronics, Inc.
- Nippon Telegraph and Telephone Corporation

GPS and patent ownership

Armstrong *et al* have found instances of litigation over the use of AGPS in cellular devices. In 2010, ITT Corporation published a news release announcing that it had reached confidential settlements in patent infringement suits against Nokia and Motorola over the use of AGPS in their mobile devices. Armstrong *et al* did not find any publicly available information about royalty rates for AGPS. (*Armstrong et al, The Smartphone Royalty Stack, Page 36)*

MPEG and patent ownership

Sisvel MPEG Audio Patent Pool

Licensors:[60]

- Orange (formerly France Télécom)
- TDF S.A.S.
- U.S. Philips Corporation
- Koninklijke Philips Electronics N.V.
- Institut für Rundfunktechnik GmbH
- Bayerische Rundfunkwerbung GmbH.

MP3 and patent ownership

Armstrong et al have compiled the royalty rates for the two dominant MP3 patent pools – Technicolor (Thomsom Multimedia and Fraunhofer IIS) and Sisvel. Additionally, they have identified Alcatel Lucent, Texas MP3 Technologies, and Hybrid audio as holding SEPs for MP3.[61]

59ViaLicensing, 802.11(a-j) Licensors, http://www.vialicensing.com/licensing/ieee-80211-licensors.aspx, Last accessed February 11, 2015.

60 Sisvel, MPEG Audio Patent Owners, http://www.sisvel.com/index.php/wi-fi/patent-owners, Last accessed February 11, 2015.

61 The Smartphone Royalty Stack: Surveying Royalty Demands for the Components Within Smartphones, [Working

They have also identified royalty rates for the two pools.[62]

AAC and patent ownership

Armstrong et al have identified a patent pool managed by Via Licensing as the only body licensing AAC patents. The pool has 10 licensors[63] and more than 750 licensees.[64]

Via Licensing charges a sliding royalty rate from licensees depending on the volume of units sold, apart from a one-time license fee of USD 15,000.[65]

FLAC, Apple Lossless, and patent ownership

Free Loss Audio Codec (FLAC) and Apple Lossless are royalty free.

http://news.cnet.com/8301-27076_3-20127129-248/apples-lossless-audio-format-goes-open-source/, License, FLAC, https://xiph.org/flac/license.html

Digital imaging and patent ownership

Patent firm iRunway conducted a landscaping in 2013 of patents granted by the USPTO from 1985 to 2011. It found nearly 32,000 patents, which it put into six categories, *viz.*, image acquisition, image storage, image manipulation, image display, image networking, and image recognition. The landscape includes traditional two-dimensional display technologies such as AMOLED (active-matrix organic light-emitting diode), Super-AMOLED, TFT-LCD (thin-film-transistor liquid-crystal display), and Retina; touchscreen technologies such as haptic touchscreen and tactile touchscreen; and display protection technologies such as Gorilla glass. The patent landscape also covers three-dimensional display technologies such as autostereoscopy and parallax-barrier techniques for Glass-less 3D.

50 companies were profiled. The top 10 companies were Canon, Microsoft, Sony, Samsung,

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Paper], Ann Armstrong et al, p.43, http://www.wilmerhale.com/uploadedFiles/Shared_Content/Editorial/Publications/Documents/The-Smartphone-Royalty-Stack-Armstrong-Mueller-Syrett.pdf, Last accessed February 11, 2015.

62 The Smartphone Royalty Stack: Surveying Royalty Demands for the Components Within Smartphones, [Working Paper], Ann Armstrong et al, p.43, Table http://www.wilmerhale.com/uploadedFiles/Shared_Content/Editorial/Publications/Documents/The-Smartphone-Royalty-Stack-Armstrong-Mueller-Syrett.pdf, Last accessed February 11, 2015.

63 ViaLicensing, Advanced Audio Coding (AAC), http://www.vialicensing.com/licensing/aac – overview.aspx, Last accessed February 11, 2015.

64The Smartphone Royalty Stack: Surveying Royalty Demands for the Components Within Smartphones, [Working Paper], Ann Armstrong et al, p.41, http://www.wilmerhale.com/uploadedFiles/Shared_Content/Editorial/Publications/Documents/The-Smartphone-Royalty-Stack-Armstrong-Mueller-Syrett.pdf, Last accessed February 11, 2015.

65The Smartphone Royalty Stack: Surveying Royalty Demands for the Components Within Smartphones, [Working Paper], Ann Armstrong et al, p.42, http://www.wilmerhale.com/uploadedFiles/Shared_Content/Editorial/Publications/Documents/The-Smartphone-Royalty-Stack-Armstrong-Mueller-Syrett.pdf, Last accessed February 11, 2015.

Kodak, Panasonic, IBM, Ricoh (Asahi), Fujifilm, and Mitsubishi (Nikon) in decreasing order of the number of patents held. Together they held 11,926 patents, that is, 32% of the total number of patents found. The next 40 companies owned 9,037 (24%) patents.

Sony was found to own the most number of seminal patents (6.6%), about twice as many as those of Microsoft. Canon owned the second largest share (4.4%).

The number of patents in the "image networking" category grew enormously from the year 2000 to 2011. The growth was attributed to online image searches and the sharing and tagging of images on social networking websites. iRunway also found that 38% of the patents in the "image networking" category were asserted through litigation. One of the reasons cited for this was that the infringement of these patents is relatively more discoverable, and therefore, these patents are considered more valuable. Around 347 digital imaging patents were involved in lawsuits between 1990 and 2012. Patents in the "image sharing", "image compression", "image sensors" and "content rework" sub-domains were litigated over the most. (*Digital Imaging in Mobile Devices, iRunway.com, 2013)*

NFC and patent ownership

Members of the NFC Forum must follow the IPR policy, which mandates that they license their patents that are declared essential to NFC on RAND terms.
Intellectual Property Rights Policy, NFC Forum, (Nov. 9, 2004), http://nfc-forum.org/wp-content/uploads/2013/11/NFC-Forum-IPR-Policy.pdf (last visited Feb. 23, 2014); see Why Does the NFC Forum Have an IPR policy at All?, NFC F ORUM , http://nfc-forum.org/resources/why-does-the-nfc-forum-have-an-ipr- policy-at-all/

Amrstrong *et al* identified one NFC patent pool operated by Via Licensing from June 2007 to June 2012. Over five years, France Telecom, NXP, Inside Secure (formerly known as Inside Contactless), and Motorola listed their NFC patents in the pool. Via determined the royalty rate for the pool on the basis of the patents that it considered were actually essential. The pool was discontinued because NXP and Inside Secure reportedly withdrew their patents owing to discontent with Via's licensing efforts. (*Armstrong et al, Page 37)*

A landscape of NFC patents worldwide was published in 2012 by PatSeer. Depending on the context, some of the patent analyses were done on "unique publications" (after deduplicating patents and applications from the result set) and others were run on "unique

families" (after collapsing the number of patents to one member per patent family).

The number of NFC-related patents published annually increased steadily from around 100 in the year 2006 to approximately 850 in 2011, and 800 in 2012.

The top 15 companies by decreasing number of unique publications were Sony, NXP BV, Research in Motion, Nokia Corp, Sony Ericsson Mobile, Samsung, Philips, ZTE, Qualcomm, Inside Contactless (now Inside Secure), Gemalto NV, Innovision Res and Tech, Oberthur Technologies, Microsoft, and LG Electronics. The companies for which the top inventors worked for were, in ascending order: Vivotech, NXP BV, Logomotion SRO, Inside Contactless, Sony, and Research in Motion (now Blackberry).

The number of filings by country in descending order were: US, China, Korea, France and Japan. In the US, NFC applications such as payments and ticketing showed the fastest growth from 2003 to 2012. (*NFC Patent Report using PatSeer – Part 1, patseer.com)*

Software patents and patent ownership

Software refers to computer instructions and data that can be stored electronically.
Cass, R.A. (2015) observes that protection granted to software under other IP protection mechanisms other than patents aggravates legal issues, especially in the context of mobile devices.[66] He opines that solutions implemented in response to smartphone patent litigation are overarching and that they do away with good patent claims along with bad ones and introduce questionable remedies along with much-needed ones. He recommends a refining of the process of determining remedies based on the identity of the entity asserting its patent rights through litigation. He makes several recommendations to address software patent quality in order to thwart litigation and the high costs associated with it.

On the other hand, Graham and Vishnubhakat (2013) who examined US patents involved in prolific smartphone litigation among four major companies in the US found that 17 out of 21 software patents were judged valid or likely valid by the courts.[67] They argue that the system of examining and issuing software patents in the US isn't broken, contrary to

66 Patent Litigants, Patent Quality, And Software: Lessons From The Smartphone Wars, Ronald A. Cass, Minnesota Journal of Law, Science & Technology (vol. 16, no. 1, 2015), http://ssrn.com/abstract=2459390, Last accessed May 24, 2015.
67 Of Smartphone Wars and Software Patents, Stuart Graham and Saurabh Vishnubhakat, Journal of Economic Perspectives, Vol. 27, Number 1, Winter 2013, p.73, http://www.jstor.org/stable/41825462, Last accessed February 24, 2015.

popular perception, and with the advent of policy changes such as the America Invents Act (2011) the system has got better. They conclude that the smartphone wars are an indicator of a system that spurs rapid innovation and not of a dysfunctional software patent regime.

IX. Patent Commons

R.K. Bera notes that funding research institutions and universities with the precise objective of putting the results in a patent commons or a "patent-information commons" was one of the measures adopted by the pharmaceutical and biotechnology industries to establish a trade-off between the interests of society and their own profits, as well as to lower competition among themselves. Some other measures used were adopting open standards, cross-licensing, patent pooling, patent exchanges, and forming a "pre-competitive information commons".[68] He suggests the formation of an *SEP commons* for FRAND-encumbered SEPs.

In the paper he suggests that in law and in policy-making, SEPs be given special treatment as "patents of national importance" and separate rules for dealing with injunctions be framed. He also suggests that an SEP Tribunal be set up to minimise FRAND commitments (as holders of important and valuable SEPs are averse to FRAND commitments) and that the government should have the right to intervene in the event anti-competitive activities occur.

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68Standard essential patents (SEPs) and 'fair, reasonable and non-discriminatory' (FRAND) Licensing, Rajendra K. Bera, 2015, p.12-13, http://papers.ssrn.com/sol3/papers.cfm?abstract_id=2557390, Last accessed May 24, 2015.

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