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## **Standard-Essential Patents within Global Networks—An Emerging Economies Perspective**

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An earlier version was presented at the First International Symposium on Standardization and Governance, Hunan University, Changsha, China, November 20, 2016.

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# Standard-Essential Patents within Global Networks - An Emerging Economies Perspective<sup>1</sup>

by

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12/02/16

## Abstract

Efficient licensing of standard-essential patents (SEPs) is crucial for achieving a rapid and broad-based diffusion of innovation. Owners of large SEP portfolios (and their supporters) argue that the governance of SEPs works reasonably well and that patent holdup and other negative effects are “purely theoretical”. In reality however, the governance of SEPs remains highly inefficient.

Nobel prize laureate Jean Tirole as well as Carl Shapiro, Mark Lemley, Josh Lerner and many others have painstakingly documented that the licensing of SEPs is prone to market failures such as externalities (both positive and negative), information problems, market power and free-riding, which might hinder the realization of the economic and societal benefits of the affected standards. There is no doubt that SEP-related market imperfections continue to constrain standard implementers (both large and small) who are increasingly opposed to this form of “technology taxation”.

This paper addresses two unresolved issues. *First*, most of the existing SEP research has focused on advanced countries. It is time to address growing concerns in emerging and developing countries that SEP-related market failures may create added uncertainty for their companies, generating unpredictable and often quite significant costs and delaying market entry of their products. *Second*, such SEP-related market failures are even more important in a world where increasingly complex and diverse global corporate networks integrate dispersed production, engineering, product development and research across geographic borders. The paper *seeks to extend the analysis of SEPs to include challenges that companies from an emerging economy face when they are deeply integrated into these global networks of production (GPNs) and innovation (GINs)*.

The paper summarizes what we know about SEP-related market failures and their impacts on standard implementers, and highlight drivers and the hierarchical nature of GPNs and GINs, distinguishing network flagships and different layers of network suppliers. I will then discuss a new “gains from trade” doctrine for economic development, promoted by the OECD, the WTO, and the World Bank, which emphasizes the role of global network integration as “the 21<sup>st</sup> century’s fast lane to industrial development”. I will show that participation in these global corporate networks raises new challenges, especially for lower-tier suppliers, many of them based in emerging or developing countries. I will describe restrictions imposed by the new “gains from trade” doctrine on national innovation policies, especially with regard to patents and standards. These restrictions may well constrain the capacity of those companies to cope with the imperfect governance of SEPs.

It is on this basis that I will then sketch out a preliminary research agenda for exploring impacts that Chinese companies may face within GPNs or GINs. In the **Conclusions**, I will review suggested responses to some of these market failures, using illustrative examples from standard development organizations and competition policy.

## About the author

Dr. Dieter Ernst is an East-West Center senior fellow and a Non-Resident Senior Fellow at the Centre for International Governance Innovation/CIGI (Waterloo, Canada). He is an authority on trade, global production networks and the internationalization of research and development in high-tech industries, with a focus on standards and intellectual property rights. His research examines corporate innovation strategies and innovation policies in the United States and in China, India, Taiwan, Korea, and Malaysia. Dr. Ernst has provided testimony to U.S. Congress, and has served as a member of the United States National Academies “Committee on Global Approaches to Advanced Computing”; senior advisor to the Organisation for Economic Co-operation and Development, Paris; research director of the Berkeley Roundtable on the International Economy at the University of California at Berkeley; professor of international business at the Copenhagen Business School; and scientific advisor to governments, private companies, and international institutions.

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<sup>1</sup> An earlier version was presented at the First International Symposium on Standardization and Governance, Hunan University, Changsha, China, November 20, 2016.

## Introduction

A major policy issue in standard setting is that patents, by being included into a standard, may become standard-essential patents (SEPs). A company needs such patents in order to produce any product that meets the specifications defined in the standard. Patents are “essential” to a standard when it is not possible to comply with the standard without infringing that intellectual property right. Therefore, a company can make a standard-compliant product either by owning the SEPs or by licensing SEPs owned by others.

Suppose a Chinese company C produces product A (say a smart phone). Assume further that product A uses a specific standard X and patent M is essential to the standard X. If patent M is not owned by company C, but by a foreign patent owner, then our company C has to negotiate a license for patent M to avoid infringement.

But the challenge is much bigger. Growing technological complexity implies that standard X requires not one but many SEPs, giving rise to “patent thickets”. A smartphone today is typically covered by around 250,000 patents, up from “only” 70,000 in 2000. These patents are necessary to access a great variety of technologies - the LCD screen, antennas, Wi-Fi standards, processors, batteries, specific compound materials, etc. As a result, Company C now needs to negotiate license agreements with leading SEP owners like for instance Qualcomm, a company that dominates the critically important baseband chipset technologies.

We all know that efficient licensing of SEPs is crucial for achieving a rapid and broad-based diffusion of innovation. Owners of large SEP portfolios (and their supporters) argue that the governance of SEPs works reasonably well and that patent holdup and other negative effects are “purely theoretical”<sup>2</sup>. In reality however, the governance of SEPs remains highly inefficient.

Nobel prize laureate Jean Tirole as well as Carl Shapiro, Mark Lemley, Josh Lerner and many others have painstakingly documented that the licensing of SEPs is prone to market failures such as externalities (both positive and negative), information problems, market power and free-riding, which might hinder the realization of the economic and societal benefits of the affected standards<sup>3</sup>. A rich body of research examines how standardization and hence innovation are fundamentally constrained by multiple sources of uncertainty which result for instance from lack of transparency whether an SEP is really essential; from lack of clarity of what the so-called FRAND licensing conditions really mean; from a variety of

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<sup>2</sup> Sidak, J.G., 2008, *Holdup, Royalty Stacking, and the Presumption of Injunctive Relief for Patent Infringement: A Reply to Lemley and Shapiro*, [https://www.criterioneconomics.com/docs/holdup\\_royalty\\_stacking\\_reply\\_to\\_lemley\\_and\\_shapiro1.pdf](https://www.criterioneconomics.com/docs/holdup_royalty_stacking_reply_to_lemley_and_shapiro1.pdf)

<sup>3</sup> See Jean Tirole’s Nobel Prize Lecture “Market Failures and Public Policy”, (December 8, 2014) which argues that “competition is rarely perfect, markets fail, and market power – the firms’ ability to raise price substantially above cost or to offer low quality – must be kept in check, highlighting SEPs as a prominent example. [https://www.nobelprize.org/nobel\\_prizes/economic-sciences/laureates/2014/tirole-lecture.pdf](https://www.nobelprize.org/nobel_prizes/economic-sciences/laureates/2014/tirole-lecture.pdf). Pioneering contributions include \ Lerner, J. and J. Tirole, 2015, “Standard-Essential Patents”, *Journal of Political Economy*, Vol. 123, no.3; Shapiro, C., 2001, “Navigating the Patent Thicket: Cross Licenses, Patent Pools, and Standard Setting”, in: Adam B. Jaffe, Josh Lerner and Scott Stern, eds., *Innovation Policy and the Economy, Volume 1*, National Bureau of Economic Research; Lemley, M.A., 2002. Intellectual property rights and standard-setting organizations. *Calif. Law Rev.* 90 (6), 1889–1980; Lemley, M.A., Shapiro, C., 2007. Patent holdup and royalty stacking. *Texas Law Rev.* 85, 1991–2049; Farrell, J., Hayes, J., Shapiro, C., Sullivan, T., 2007. Standard setting, patents, and hold-up. *Antitrust Law J.* 74 (3), 603–670.

market-distorting patenting strategies, such as patent ambush, royalty stacking, and just-in-time patents; and from the increasing role that non-practicing entities [NPEs] (the so-called patent trolls) and patent consolidators, are now playing as SEP licensors. There is no doubt that SEP-related market imperfections continue to constrain standard implementers (both large and small) who are increasingly opposed to this form of “technology taxation”, to quote Carl Cargill, one of the pioneers in this discussion.

The purpose of this paper is to address two unresolved issues. *First*, most of the existing SEP research has focused on advanced countries. It is time to address growing concerns in emerging and developing countries that SEP-related market failures may create added uncertainty for their companies, generating unpredictable and often quite significant costs and delaying market entry of their products. *Second*, such SEP-related market failures are even more important in a world where increasingly complex and diverse global corporate networks integrate dispersed production, engineering, product development and research across geographic borders. The paper *seeks to extend the analysis of SEPs to include challenges that companies from an emerging economy face when they are deeply integrated into these global networks of production (GPNs) and innovation (GINs)*.

In the **first part of the paper**, I will summarize what we know about SEP-related market failures and their impacts on standard implementers. In **Part Two**, I will highlight drivers and the hierarchical nature of GPNs and GINs, distinguishing network flagships and different layers of network suppliers. A defining characteristic of these global networks is the sharing of data - information must flow and knowledge must be exchanged between network participants who are separated from each other, whether by methodologies, geography, language or culture. GPNs and GINs have increased the mobility of knowledge. Companies from an emerging economy can now access leading-edge technology and management practices wherever they exist. Our smartphone company C thus may rely on global knowledge sourcing for core components, software, tools, equipment, and critical support services.

In **Part Three**, I will discuss a new “gains from trade” doctrine for economic development, promoted by the OECD, the WTO, and the World Bank, which emphasizes the role of global network integration as “the 21<sup>st</sup> century’s fast lane to industrial development”. I will show that participation in these global corporate networks raises new challenges, especially for lower-tier suppliers, many of them based in emerging or developing countries. I will describe restrictions imposed by the new “gains from trade” doctrine on national innovation policies, especially with regard to patents and standards. These restrictions may well constrain the capacity of those companies to cope with the imperfect governance of SEPs.

It is on this basis that I will then sketch out in **Part Four** a preliminary research agenda for exploring impacts Chinese companies may face within GPNs or GINs. In the **Conclusions**, I will review suggested responses to some of these market failures, using illustrative examples from standard development organizations and competition policy.

## **1. SEP-related market failures and impacts on standard implementers**

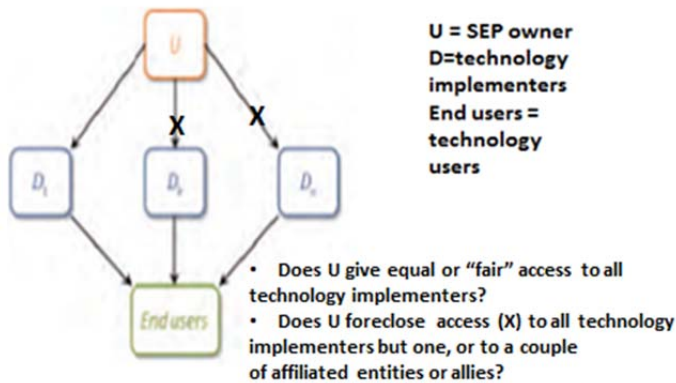
### **1.1. Access to SEPs – a simple framework**

A simple slightly adjusted framework from Jean Tirole’s Noble Prize lecture might be useful to lay out the issue (**Fig.1**)<sup>4</sup>

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<sup>4</sup> Tirole, 2014: pages 510 and 511.

**Fig. 1 - Access to SEPs – a simple framework**



Adjusted from Figures 1 and 2, Jean Tirole, Nobel Prize Lecture

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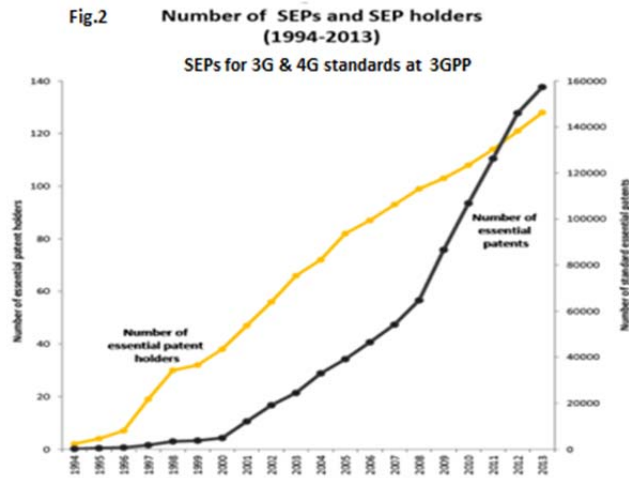
**Figure 1** sums up two basic questions for assessing SEP-related market imperfections: Does the SEP owner give equal or “fair” access to all technology implementers? Or does the SEP owner foreclose access (X) to all technology implementers but one, or to a couple of affiliated entities or allies? According to Tirole, if really equal access is granted to the SEP, technology implementers would erode the SEP owner’s market power. As a result, the SEP owner “often favors its downstream subsidiary (D1 in **Figure 1**) in myriad of ways, for example by refusing to deal with rivals or to grant them a license, by charging prohibitive access prices, or by making its technology incompatible with the rivals.

### 1.2. Key findings in the literature

Drawing on this framework, let us look at some findings in the literature. The first fact to note is the disclosure boom of SEPs. According to the 3GPP consortium, the number of SEP holders for 3G and 4G standards has grown from 2 in 1994 to 130 in 2013 and the number of SEPs rose from a fewer than 150 in 1994 to more than 150,000 in 2013 (**Figure 2**). As a result, SEP-related market failures and the search for effective governance have increased in importance.

The increasing number of SEP declarations reflects a combination of factors, including the growth in patenting; the growing demand for standards (driven by the growth of shared platforms such as the Internet and cellular telephony); increased antitrust enforcement; a strategic “race” to own essential patents; and vertical specialization through global networks of production and innovation<sup>5</sup>.

<sup>5</sup> See Bekkers, R., T. Simcoe et al, 2016, “Declared Essential Patents”, *Hoover IP<sup>2</sup> Working Paper 16003*: 38 pages; and Ramel, F., M. von Laer, and K. Blind, 2017, “Standard Essential Patents and the Distribution of Gains from Trade for Innovation”, forthcoming in Ernst, D. and M. Plummer (eds), *Megaregionalism – Innovation and Trade within Global Networks*, World Scientific Studies in International Economics/Imperial College Press.



Galetovic & Gupta 2016

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SEPs have emerged as a powerful tool for asset monetization. Companies license their SEPs to others to allow use – generating significant income. Increasingly SEP holders cross-license their SEP portfolios to one another, allowing each to manufacture standard compliant products without infringing on the other’s SEPs, and to receive compensation for its contributions to the standard. But outside this privileged circle, things are much less harmonious. For standard implementers, multiple SEP-related market failures may well have negative effects, as highlighted in an in-depth study prepared for the European Commission<sup>6</sup>. The study emphasizes that in particular smaller firms are struggling to cope with substantial and often unpredictable cost increases, delays in product commercialization and an increased risk of costly litigation. Of critical importance is the lack of clarity on what FRAND actually means (in terms of being *non-discriminatory* and in terms of *fair and reasonable*). This uncertainty gives rise to asymmetric information, and enables excess royalty rates or skewed cross-licensing agreements.

The combination of the disclosure boom of SEPs and the lack of transparency increases transaction costs for standard implementers, again primarily for small firms and new entrants from an emerging economy. The growing number of SEPs increases the likelihood of royalty stacking, i.e. the cumulative payable royalties for SEPs may rise more frequently above reasonable levels or may even become prohibitive for implementing products.

Of particular concern is over-inclusion of patented technologies in standards that are not really essential. Industry insiders estimate that only around 30% or less of declared SEPs are really needed for the implementation of a standard<sup>7</sup>. Overinclusion is widespread, because patent owners have strong incentives to include them, and because this is made easier by the use of blanket disclosures in many

<sup>6</sup> ECSIP Consortium, 2014, *Patents and Standards. A modern framework for IPR-based standardization*, a study prepared for the European Commission DG for Enterprise and Industry, Ref.Ares(2014)917720-25/03/2014. See also European Commission, 2015, *Public Consultation on Patents and Standards – A Modern Framework for Standardisation Involving Intellectual Property Rights. Summary Report*, Brussels, 27 October: 12 pages.

<sup>7</sup> Interviews with industry experts who have requested anonymity. According to RPX Corporation, alleged and declared SEPs are “relatively unlikely to succeed”. Plaintiffs won only slightly more than a quarter of Alleged and Declared SEPs in litigation proceedings across district court and ITC proceedings. (RPX, 2014, *Standard Essential Patents: How Do They Fare?*, <https://www.rpxcorp.com/wp-content/uploads/2014/01/Standard-Essential-Patents-How-Do-They-Fare.pdf> )

SDOs. As the discussions around a standard under development evolve, companies file ‘opportunistic’ patents relating to newly approved essential features in the standard. Inaccurate information is widespread in declaration lists.

The resultant uncertainty about exposure to licensing fees is a very significant deterrent for SMEs. The same is true for newcomers from emerging economies who wish to export or develop new products. Of particular interest are “just-in-time” patents. In an important recent article, Kang and Bekkers find that “companies ... apply for patents of low technical merit just before a standardization meeting, and then send the patents’ inventors to the meeting to negotiate this patented technology into the standard. ... [T]he inclusion of just-in-time patents may reduce competition and market entry, increase prices, and unnecessarily complicate the technological content of standards.”<sup>8</sup>

Another SEP-related market imperfection results from the increasingly frequent transfer of SEP ownership, due to the drastic increase in M&A, and fire sales of patent portfolios due to down-sizing. The new owner may not consider himself bound by an earlier FRAND licensing commitment or SEP licensing commitments may no longer be in force after bankruptcy proceedings of the owner. Various SDOs stipulate that patent obligations should “run with the patent” when patent rights are assigned, and that RAND commitments should be construed as encumbrances that bind all successors-in-interest to the RAND declarant. In reality however, “a transfer of SEPs to non-practicing entities often leads to increased royalty rates and more litigation.” (European Commission 2015, Public Consultation: p.7)

Standard implementers, especially SMEs and new entrants from an emerging economy, face multiple challenges from the increasing use of patents for strategic purposes. According to the 2014 European Commission report, “...[i]ncreasing competitive pressure forces firms to exploit all available opportunities for value creation. This implies a re-valuation of IP portfolios to increase the monetization of IP assets. Non-core IP is more often sold to a non-producing entity (NPE) that seeks to cash in on royalties. Also as firms exit certain product lines or even the industry, IP portfolios are sold (sometime by auction).” (ECSIP Consortium, 2014: p.107) With the growing number of NPEs, standard implementers are exposed more often to patent hold-up and patent ambush. Implementers are being disadvantaged in licensing negotiations (making excess payments or entering into skewed cross licenses) because of information asymmetry regarding the extent and value of the SEP portfolio of licensors.

Especially in the smartphone industry, access to SEPs may be made conditional to an exchange for the licensing of non-SEPs, so-called market-essential patents (MEPs). These are patents that cover a functionality that the majority of end users does expect on any phone in a given market segment. “They are claimed to be market essential because consumers highly value these designs and competitors feel they need to provide these as well, either by taking a license or developing a work-around.” (ECSIP Consortium, 2014: p.63) “Not being subject to any FRAND condition, market essential patents give considerable bargaining (or competitive) power.” (ibid.: p.67). In short, MEPs pose even greater governance challenges than SEPs.

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<sup>8</sup>Kang, B. and R. Bekkers, 2015, “Just-in-time patents and the development of standards”, *Research Policy*, 44 (2015): page 1948.



Finally, selective and discriminatory licensing of SEPs may actually constitute one of the most serious challenges for SMEs and for new entrants from an emerging economy<sup>9</sup>. Until a few years ago, SEP holders have charged SEP licensing fees primarily to the vendors of critical components within Smartphones<sup>10</sup>. However, large SEP owners now argue that patent holders should have the ability to select the appropriate level of the supply chain at which to license their intellectual property, and to refuse licenses to companies at other levels. A SEP holder might restrict SEP licenses to ‘end-user’ product manufacturers only, and not license directly the suppliers of the standard-practicing components that are incorporated into those products. In doing so, the SEP owners could tax a much larger royalty base than just the price of the component that is providing the patented performance features.

Some SEP holders seek to license only *consumers* that utilize devices practicing the standard. For instance, “Some SEP holders – mostly patent-assertion entities – have recently attempted this tactic, sending out thousands of licensing letters and filing dozens of separate lawsuits against small businesses seeking direct payment for their use of standardized consumer products.” (ITU 2014: note 96, p.68) In a number of cases, SEP owners or their intermediaries are now demanding royalties from coffee shops, restaurants, or hotels that offer WiFi-based connectivity to their customers.

To summarize the negative impact of selective and discriminatory SEP licensing, it is useful to quote the findings of the aforementioned 2014 ITU survey:

*“Many companies object to these types of selective licensing practices. First, they argue that companies supplying all levels within the supply chain have contributed to the technical and commercial development of the standard based on the expectation that they would be able to obtain RAND licensing. Selective licensing of the type described above may serve as a disincentive to contribute to and develop standardized technology. Secondly, opponents of this type of selective SEP licensing argue that allowing an SEP holder to target downstream levels of the supply chain – i.e. end-user products – and to avoid licensing component suppliers can be utilized to facilitate hold-up because SEP holders may attempt to tax revenues from the sale of an integrated device rather than the less-costly infringing component. For example, because end-user device manufacturers sell more expensive products, those end-user manufacturers may be more vulnerable to higher damages awards if royalties are adjudicated.*

*Thirdly, it is stated that a company that practises a standard should not have to rely on its suppliers or customers to negotiate and license SEPs, as that could constrain the scope of the market for its goods (e.g. if an injunction is sought against the company’s customer) or its certainty about ongoing supply (e.g. if an injunction is sought against the company’s supplier). In this sense, a company that wants to pay a RAND rate for its own licence should be entitled to do so and thus acquire the certainty that it will be free to purchase needed supplies and to market its products to any customer without constraint.*

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<sup>9</sup> For examples, see ITU, 2014, *Understanding patents, competition and standardization in an interconnected world*, Telecommunications Standardization Bureau, Geneva: pages 64-71. See also ECSIP Consortium, 2014: pages 112 ff.

<sup>10</sup> For details, see Armstrong, A., J.J. Mueller and T.D. Syrett, no date, *The Smartphone Royalty Stack: Surveying Royalty Demands for the Components Within Modern Smartphones*, [https://www.wilmerhale.com/uploadedFiles/Shared\\_Content/Editorial/Publications/Documents/The-Smartphone-Royalty-Stack-Armstrong-Mueller-Syrett.pdf](https://www.wilmerhale.com/uploadedFiles/Shared_Content/Editorial/Publications/Documents/The-Smartphone-Royalty-Stack-Armstrong-Mueller-Syrett.pdf)

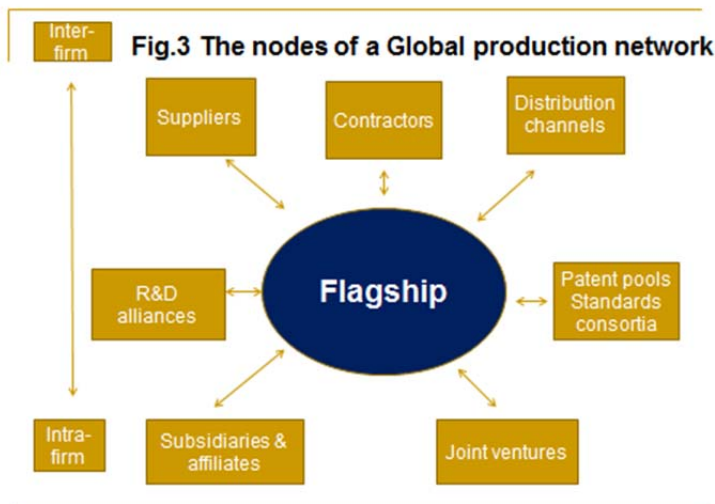
Fourthly, it is further argued that such licensing behaviour may also trigger reciprocity conditions, further diminishing the availability of licences to essential patents (i.e. if a particular company is denied a RAND licence, then it may have no obligation to offer RAND licences in return).” (ITU, 2014: p.68)

## 2. Global Production and Innovation Networks – Driving Forces and Characteristics

Let us now look at a fundamental transformation in economic geography – the proliferation of global production networks (GPNs) which gathered momentum during the 1970s. A lead firm (a “network flagship”) integrates its dispersed operations (“intra-firm”) and inter-firm relationships worldwide, both across functions and locations. Integration enables the flagship to internalize and combine resources and capabilities without running into the constraints of excessive centralization.

The electronics industry has been in the vanguard of this transformation, and is at the center of this paper. Today, however, global corporate networks are driving production, R&D and trade in myriad goods and services sectors, from clothing, food processing, motor vehicles, construction equipment, aviation, energy (fossil fuel, wind, and solar), medical technology, and pharmaceuticals, to accounting, finance and legal services.

GPNs cover both intra-firm and inter-firm transactions and forms of coordination (**Figure 3**): a GPN links together the flagship’s own subsidiaries, affiliates and joint ventures with its subcontractors, suppliers, service providers, as well as partners in strategic alliances. A network flagship like Apple breaks down the value chain into a variety of discrete functions (by product or by production process) and relies heavily on first-tier subcontractors like Foxconn’s gigantic production complexes in Shenzhen, Chengdu and other major locations in China, Vietnam, Mexico and India. As a result, Apple can locate production and product development wherever they can be carried out most effectively, where they can improve the flagship’s access to resources and capabilities, and where they are needed to penetrate important growth markets.



Ernst, D. and Linsu Kim, 2002,

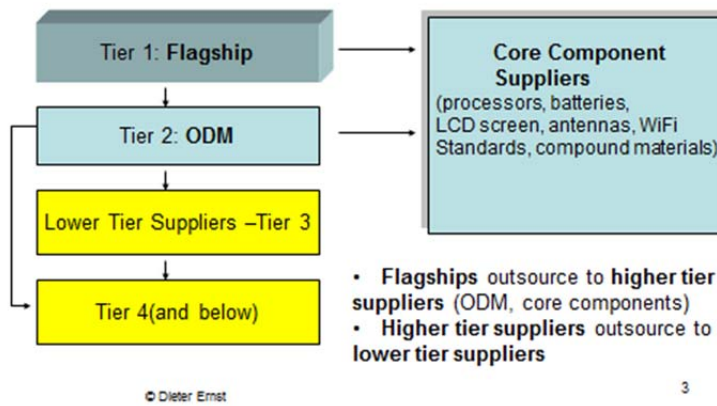
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Over time, the focus of outsourcing is shifting from assembly-type manufacturing to knowledge-intensive support services, like supply chain management, engineering services, the design of core components, and new product development. As we will see below, rising knowledge intensity confronts network participants with new challenges for patenting and licensing strategy.

GPNs thus are a major organizational innovation that enables “network flagships” to reap the combined advantages of outsourcing (“vertical disintegration”) and integration. Outsourcing allows for the separation of labor-intensive processes (that move to low-cost locations) from capital- and knowledge-intensive processes and their dispersion across firm boundaries and national borders. Integration of the dispersed production, supplier and customer, and knowledge bases is necessary to reduce the high costs and risks of coordinating cross-border exchanges of products, people, information and knowledge. In short, Network flagships increasingly rely on the skills and knowledge of specialised network suppliers to enhance their core competencies.

Asymmetry is a fundamental characteristic (see Fig.4 for smart phones) Network flagships dominate and define network organization and strategy<sup>11</sup>. Control over and coordination of network resources and decision-making enables the flagship to directly affect the growth, the strategic direction and network position of network suppliers. Flagships control distribution networks and brand names, but most importantly they have technology, and they will go out of their way to protect this technology by filing patents. And increasingly flagships use SEPs as a strategic weapon to shape standards as well as markets, and to reap monopoly rents through monetization.

**Fig.4 - Inter-Firm GPNs – smart phones**



Ernst and Kim (2002) distinguish two types of network suppliers<sup>12</sup>. Higher-tier suppliers like Foxconn play an intermediary role between flagships and lower-tier suppliers; possess valuable proprietary assets (including patents); they have sufficient resources (including patents) to upgrade their capabilities; and they often are tasked with supply chain management. Their patent portfolios however are likely to be smaller than those of flagships.

Thousands of “no-name” lower-tier suppliers are the weak links in the GPNs. Their main competitive advantage is low cost, speed, and flexibility of delivery. They are often used as “price breakers” and “capacity buffers” and can be dropped at short notice. Lower-tier suppliers normally lack IP, and hence

<sup>11</sup> Ernst, D. (2005) ‘The New mobility of knowledge: digital information systems and global flagship networks’, in: R. Latham and S. Sassen (eds), *Digital Formations. IT and New Architectures in the Global Realm*, Princeton and Oxford: Princeton University Press for the US Social Science Research Council.

<sup>12</sup> Ernst, D. and Linsu Kim, 2002, Global Production Networks, Knowledge Diffusion and Local Capability Formation, *Research Policy*, 31, no.8/9, special issue in honor of Richard Nelson and Sidney Winter.

need to license technology both from higher-tier suppliers, the flagship and outside technology suppliers. However, their financial means are limited. Left on their own, these lower-tier suppliers are often hard-pressed to license SEPs and to invest in training and complementary R&D needed to absorb the licensed technology and to comply with the relevant standards. The lower these companies are situated in GPNs, the less they can benefit from increased protection and enforcement of IP rights. They would actually benefit from a weaker regime.

A defining characteristic of GPNs is a two-way knowledge-sharing among network participants. As Ernst and Kim (2002) demonstrate, network flagships transfer both explicit and tacit knowledge to local suppliers through formal and informal mechanisms. Apart from licensing agreements (including cross-licensing if necessary), this may involve training and even sharing of intangible knowledge, such as trade secrets.

From the flagship's perspective, this knowledge sharing is necessary to upgrade the local suppliers' technical and managerial skills so that they can meet the flagships' specifications. Once a network supplier successfully upgrades its capabilities, this creates an incentive for flagships to transfer more sophisticated knowledge, including engineering, product and process development. This process however is not automatic: To establish such two-way knowledge-sharing, universally accepted and implemented interoperability standards must be in place. In turn, this requires mutually agreed rules for the licensing of SEPs. For the flagships, strong protection and enforcement of SEPs are the key to success.

The perspective of network suppliers however is different. For them, what matters most is whether and how integration into these networks might foster or erode their absorptive capacity<sup>13</sup> and innovation capabilities. For upgrading to run its course for the networks suppliers, supportive industrial and innovation policies are required to foster the absorptive capacity of local suppliers. This highlights a fundamental tension between, on the one hand *global knowledge sourcing* which requires trade liberalization and compliance with international patent rules and standards, and, on the other hand, *domestic capability development* which requires supporting industry and innovation policies<sup>14</sup>.

### **What distinguishes global innovation networks?**

A more recent development is the emergence of GINs, driven by the relentless vertical disintegration of engineering, product development, and research. A gradual opening of corporate innovations systems disperses R&D across firm boundaries and national borders.

By now, GINs have expanded well beyond the traditional high-tech regions in the United States, the EU, and Japan. There are now multiple locations for innovation, and even lower-order or less developed

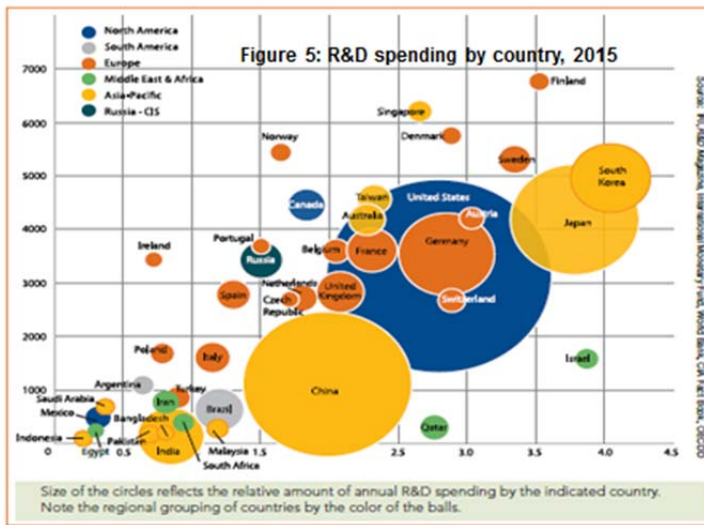
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<sup>13</sup> According to path-breaking research by Cohen and Levinthal, *absorptive capacity* is "a firm's ability to recognize the value of new information, assimilate it, and apply it to commercial ends" (Cohen and Levinthal (1990), "Absorptive capacity: A new perspective on learning and innovation", *Administrative Science Quarterly*, Volume 35, Issue 1 pg. 128-152.

<sup>14</sup> For an in-depth analysis, see Ernst, D., 2016, "Beyond Value Capture - Exploring Innovation Gains from Global Networks", paper prepared for the agenda-setting workshop, funded by the National Science Foundation, *Mega-Regionalism – New Challenges for Trade and Innovation (MCTI)*, at the East-West Center, Honolulu, January 20 and 21, 2016, [http://papers.ssrn.com/sol3/papers.cfm?abstract\\_id=2737055](http://papers.ssrn.com/sol3/papers.cfm?abstract_id=2737055) . . Forthcoming in Ernst, D. and M. Plummer, editors, *Megaregionalism – Innovation and Trade within Global Networks*, World Scientific Studies in International Economics/Imperial College Press.

centers can still be sources of innovation (Cantwell 1995: 172). Asia’s role in these networks, formerly quite minor, is increasing, especially in China. China is the largest “net importer” of R&D, and it is the third most important offshore R&D location (after the US and UK) of the 300 top R&D spending multinationals.<sup>15</sup> China is thus deeply integrated, albeit still unevenly, into the international circulation of technological and managerial knowledge needed to enhance its absorptive capacity.

However, the new geography of knowledge created by GINs is by no means a flatter world. A defining characteristic of GINs is a persistent inequality in the division of innovation tasks. A handful of established global centers of excellence in the United States, Japan, and the EU retain their dominance in science and high-impact intellectual property. In R&D, although China has improved quite significantly its position, the U.S. continues to be by far the largest single country in R&D investments with slightly more than a quarter of all global R&D spending. (Figure 5)

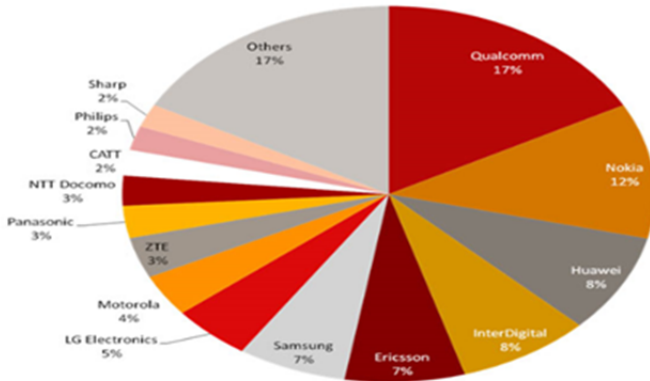


We also find a significant concentration of SEP ownership. Data from the ETSI data base show a high degree of concentration, with five companies responsible for roughly 60% of ETSI’s total of 155,474 declared SEPs (Figure 6).

However, China’s role is on the rise, at least for its two leading telecommunications companies, Huawei and ZTE. Among the 20 Top Owners of declared SEPs at leading SSOs, Huawei now occupies position # 6, and ZTE # 18 (Figure 7). For 4G LTE & LTE Advanced standards, Huawei and ZTE are now the second and third top SEP owners (Figure 8). For 4G LTE standards, China is now the third most important application country for declared SEPs (Figure 9).

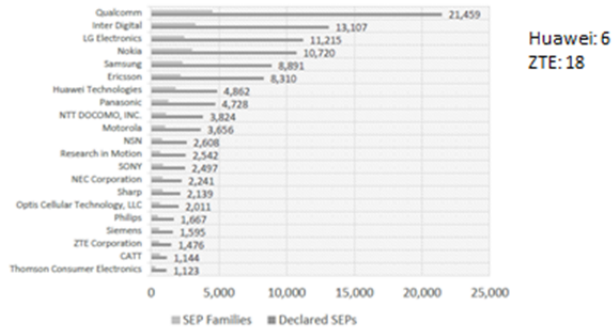
<sup>15</sup> Ernst, D. 2011. “Testimony To the US-China Economic and Security Review Commission Hearing on China’s Five Year Plan, Indigenous Innovation and Technology Transfers, and Outsourcing,” 15 June, note 17, <http://scholarspace.manoa.hawaii.edu/bitstream/handle/10125/20265/wire20110615testimony-PP.pdf?sequence=2>.

**Fig. 6 - Distribution of declared Standard-Essential Patents, ETSI data base (>155,474 declared SEPs)**



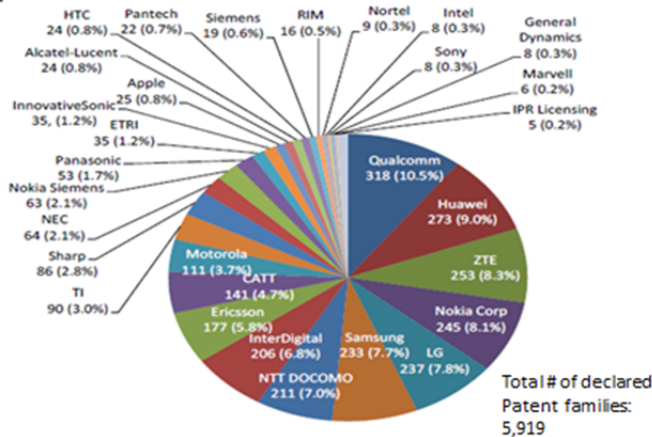
**Concentration - Top 3 companies have declared 37%; Top 5= 59%; Top Ten =74%**  
Thomson Reuters 2016

**Fig. 7- Number of declared SEPs per company (Top Twenty, ca 2014)**



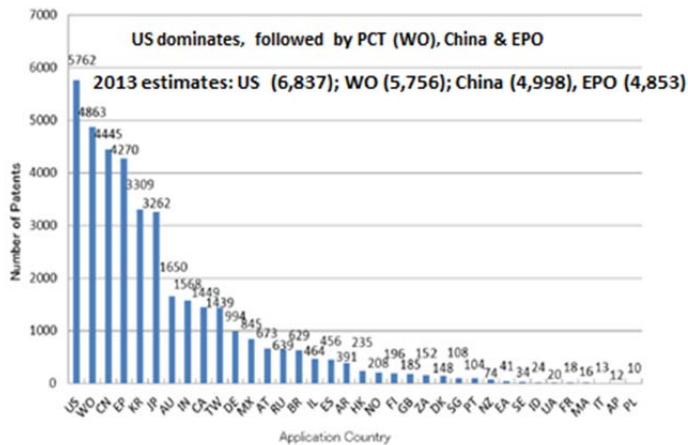
SEP declarations at ETSI, 3GPP, ISO, IEC, CEN, ITUT, ITUR, IEEE-SA, IETF, OMA, ANSI, SMPTE, ATSC, OASIS, TIA, Broadband Forum, ATIS, The BluRay Disc Association and the DVD Forum. As reported in: Baron and Pohlman, 2015

**Figure 8 - Number & % shares of declared SEPs for LTE & LTE Advanced standards, at ETSI, 2013**



ETSI list of LTE essential patents, 2013

Fig. 9 Breakdown of declared SEPs for LTE at ETSI, by application countries, 2012



ETSI list of LTE essential patents, 2015

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Since space is limited, a few examples must suffice to illustrate the systemic nature of the driving forces behind the spread of GINs – labor cost differentials matter, but they are only one among a package of competitive pressures. GIN flagships expect China’s integration into their GINs (either through their affiliates in China or through outsourcing to independent local suppliers) to:

- increase the return-on-investment on R&D, despite the rising cost, complexity, and uncertainty of R&D;
- facilitate the penetration of China’s high-growth emerging markets in compensation for the slow demand growth in core OECD countries;
- gain access to lower-cost pools of knowledge workers;
- tap into the resources and innovative capabilities of new competitors and emerging new innovation hubs.

All of these considerations have shaped China’s progressive integration into GINs. Today however, as foreign flagships seek to retain and expand their penetration of the China market, they need to decide whether to upgrade their R&D in China, and if so, how. Such decisions increasingly focus on the existence of regulatory framework conditions, such as strong protection and enforcement of intellectual property rights, tax laws that facilitate transfer pricing, and business friendly regulations and investor protection. And that’s the rub for China. As we will see, these new requirements may create important additional impediments for Chinese companies and their efforts to reap the benefits from global network integration.

### 3. A new “gains from trade” doctrine – Global network integration and restrictions on national policies

According to the OECD, the WTO and the World Bank, these global networks have opened up a new pathway to industrialization. Developing countries and especially emerging economies like China no longer need to construct their own value chain from scratch, as Japan and the Republic of Korea had to do in the 20th century. A new “gains from trade” doctrine for economic development has emerged that emphasizes the role of global network integration as “the 21<sup>st</sup> century’s fast lane to industrial

development”<sup>16</sup>. By joining global production networks, it is argued that “developing countries can benefit from foreign-originated intellectual property, trademarks, managerial and business practices, marketing expertise, and organizational models.”<sup>17</sup>

### 3.1. Gains from trade are not automatic

There is ample reason to doubt the validity of such sweeping and broad-brushed propositions. As stated by Susan Helper, the former chief economist of the US Commerce Department: “*There is little reason to believe that participation in global value chains will automatically allow emerging economy firms to capture wealth.*”<sup>18</sup> In fact, the proponents of the new “gains from trade” doctrine are quite explicit that countries participating in these networks need to accept significant restrictions (“disciplines” in the parlance of trade diplomacy) on their national policies in support of innovation and industrial development. Such restrictions however are creating new, yet little understood challenges for national policies that seek to foster economic growth, and prosperity through productivity-enhancing innovation. As a result, concerns are growing in China and other emerging economies that integration into GPNs and GINs may be a poisoned chalice.

Let us take a quick look at what economic theory has to say, first about the link between trade and innovation, and second about the role of public policy in securing benefits from global network integration. It is on this basis that I will highlight restrictions proposed by the new “gains from trade” doctrine and possible impacts.

There is a broad consensus among development economists that, in principle, integration into global networks may facilitate access to knowledge. Participation in GPNs and GINs might provide powerful mechanisms for global technology sourcing and learning for suppliers who are latecomers to these networks. In principle, integration into global networks thus could enable developing countries to overcome “barriers to exporting by accommodating specialization in narrow business functions and niche activities and ... [to] ... limit dependence on the degree of industrial development and broader skills set in the country.”<sup>19</sup>

This is in line with important insights from Paul Romer’s *endogenous growth theory* that trade provides access to “new types of goods and new types of productive activities being introduced from abroad” and thus stimulating productivity and technology diffusion<sup>20</sup>. Romer’s proposition however needs to be

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<sup>16</sup> Baldwin, R., 2014, *Multilateralising 21<sup>st</sup> Century Regionalism*, Global Forum on Trade Reconciling Regionalism and Multilateralism in a Post-Bali World, OECD, 11-12 February, 2014: p.39. See also Baldwin, R., 2013, “Trade and industrialization after globalisation’s second unbundling: How building and joining a supply chain are different and why it matters”, in: Feenstra, R. and A. Taylor (eds.), *Globalization in an Age of Crisis: Multilateral Economic Cooperation in the Twenty-First Century*, University of Chicago Press, Chicago.

<sup>17</sup> Taglioni, Daria and Deborah Winkler. "Making Global Value Chains Work for Development." The World Bank, Economic Premise. No. 143, May 2014 (page 2).

<sup>18</sup> Helper, Susan and Krueger, Timothy, “Promoting win/win development of global value chains”, *paper prepared for the agenda-setting workshop Mega-Regionalism - New Challenges for Trade and Innovation, funded by the National Science Foundation, East-West Center, Honolulu, 20-21 January, 2016*. Forthcoming in Ernst, D. and M. Plummer, editors, *Megaregionalism – Innovation and Trade within Global Networks*, World Scientific Studies in International Economics/Imperial College Press.

<sup>19</sup> OECD and World Bank, 2015, *Inclusive Value Chains. Policy options in trade and complementary areas for GVC integration by SMEs and low-income developing countries*, Report prepared for G20 Trade Ministers Meeting, Istanbul, Turkey, 6 October: p.14.

<sup>20</sup> Romer, P., 1994, “New goods and the welfare costs of trade restrictions”, *The Journal of Development Economics*, 43: page 6.



balanced with the “infant economy” argument, as formalized by Greenwald and Stiglitz<sup>21</sup>. Philippe Aghion summarizes the argument as follows: For developing countries with a nascent industrial sector, “full trade liberalization will make it very costly for domestic industrial sectors to invest in learning by doing ... since domestic costs are initially higher than foreign costs ... [and] ... the social benefits from learning by doing are not fully internalized.”<sup>22</sup>

At the same time, innovation theory tells us that strengthening national innovation capabilities improves a country’s ability to engage in and benefit from the international trading system.”<sup>23</sup> In fact, the gains from trade through global network integration are contingent -- or a country’s capacity to capture those gains depends -- “on the structure of specialization and the level of development.”<sup>24</sup> In a recent report for the UK’s Overseas Development Institute (ODI), Dani Rodrik argues that global network integration might erode absorptive capacity and innovation capabilities “because of disconnect to the rest of the economy”<sup>25</sup>. In a similar vein, a recent World Bank study observes that “foreign investors do not actively pursue – and sometimes resist – such integration for several reasons ranging from economic constraints to technological and quality gaps with domestic suppliers to shortages in specialized workers and skills.” (Taglioni and Winkler , 2014: p.6).

In short, public policies are required to enable local companies (the network suppliers) to reap the potential gains for innovation from global network integration. The World Bank argues that “GVC participation is a necessary but not a sufficient condition for development. While GVCs open doors, they are not magical. Most of the work still has to be done at home with domestic pro-investment, pro-skills, pro-jobs, and pro-growth reforms.” (Taglioni and Winkler, 2014: p.3). For Rodrik, such policies need to include for instance “protection of home market, subsidisation of exports, managed currencies, local-content rules, development banking, special investment zones.”(Rodrik, 2015)<sup>26</sup> And Aghion argues that “adequately targeted sectoral intervention, e.g. to more skill-intensive or to more competitive sectors, can enhance growth”, especially for developing countries who seek to benefit from global network integration (Aghion, 2014: p.498).

### 3.2. New restrictions

However, these policies are anathema to the new “gains from trade” doctrine. Many trade agreements forbid such policies, especially local content rules. For instance, the WTO Agreement on Trade-Related Investment Measures (TRIMs) prohibits local-content requirements because they might “restrict and

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<sup>21</sup> Greenwald, B. C. and J.E. Stiglitz, 2006, “Helping Infant Economies Grow: Foundations of Trade Policies for Developing Countries”, *AEA Papers and Proceedings*, May: pages 141-146.

<sup>22</sup> Aghion, P., 2014, “Afterword: Rethinking Industrial Policy”, in: Stiglitz, J.E. and B.C. Greenwald, *Creating A Learning Society. A New Approach to Growth, Development, and Social Progress*, Columbia University Press, New York: p. 498.

<sup>23</sup> See Kim, Linsu and R.R. Nelson (eds), 2000, *Technology, Learning and Innovation. Experiences of Newly Industrializing Economies*, Cambridge University Press, Cambridge; and Ernst, D., T. Ganiatsos, and L. Mytelka, eds. 1998. *Technological Capabilities and Export Success: Lessons from East Asia*. London: Routledge.

<sup>24</sup> Kowalski, P. et al., 2015, *Participation of Developing Countries in Global value Chains. Implications for Trade and Trade-related Policies*, OECD Trade Policy papers, No. 179, OECD, Paris: page 36.

<sup>25</sup> Rodrik, D., 2015, *Past, Present, and Likely Future of Structural Transformation*, Presentation at ODI, 23 June, <http://www.odi.org/events/4213-economic-transformation-growth-dani-rodrik>.

<sup>26</sup> For a negative assessment of local content requirements, see Hufbauer, G. J. Schott, C. Cimino, 2013, *Local Content Requirements: Report on a Global Problem*, presentation at PIIE, October 7. <http://www.iie.com/publications/papers/hufbauer20131007ppt.pdf>

distort trade”.<sup>27</sup> And the TPP, in its chapter 9 specifically prohibits “performance requirements’ such as local content or technology localization requirements.”<sup>28</sup>

In essence, the new “gains from trade” doctrine is based on a Grand Bargain that offers emerging economies and developing countries FDI and integration into global networks. But there is a high price to pay. Proponents of this new doctrine emphasize a *quid pro quo*: If a country wants to reap the gains from global network integration, its policies need to comply with two types of restrictions<sup>29</sup>:

- “Disciplines that assure the two-way flows of goods, information, capital and people that are necessary to run an international production network.
- Disciplines that guarantee tangible and intangible property rights, and a favourable business climate.

*The former include liberalisation of infrastructure services, some financial services, capital flows, and barriers to trade in parts and components. The latter include assurances on movement of capital, IPR, investor rights, and competition policy or some other policies that guard against ill treatment of foreign-owned firms.”*

For Baldwin, “the best strategy for the developing-nation government is to adopt strict disciplines – and this regardless of what the advanced technology firm decides to do. If the investment happens, the government wins rapid industrialisation. If no engagement happens, the government loses little.” This bold assertion is doubly wrong. Neither will such passive reliance on FDI bring “rapid industrialization.” Nor will voluntary compliance with strong protection and enforcement of intellectual property rights be in the interest of local companies. Instead the primary beneficiaries are large MNCs with large patent portfolios, while local innovation efforts are stifled<sup>30</sup>.

In fact, patents and standards are at the center of the new “gains from trade” doctrine, but their role has received little attention thus far in research on development effects of global network integration. Strong protection and enforcement of intellectual property rights *everywhere* within these global networks is considered to be a *sine quo non* for attracting FDI. Equally important in this view is compliance with the international rules of standardization, in line with the WTO Agreement on Technical Barriers to Trade (TBT), as well as the established procedures of standard development organizations (SDOs) and consortia. According to a report submitted to the G20 Trade Ministers in 2014, “standards and certifications previously played marginal roles in international trade, but they are now front and center.”<sup>31</sup>

It is important to understand the strategic rationale behind this new “gains from trade” doctrine. Fear is an important determinant. The United States, European Union, Japan, and Canada (known as the Quad) have lost their erstwhile unquestioned dominance – their share in world imports declined from two-

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<sup>27</sup> [https://www.wto.org/english/tratop\\_e/invest\\_e/invest\\_info\\_e.htm](https://www.wto.org/english/tratop_e/invest_e/invest_info_e.htm)

<sup>28</sup> <https://ustr.gov/about-us/policy-offices/press-office/press-releases/2015/october/summary-trans-pacific-partnership>

<sup>29</sup> Baldwin, R., 2012, *WTO 2.0: Global governance of supply, chain trade*, Policy Insight No.64, Centre for Economic Policy Research, December: p.5

<sup>30</sup> Ernst, D., 2017, *Patenting within Global Production and Innovation Networks – Contrasting Capabilities and Strategies*, CIGI Working paper, The Centre for International Governance Innovation, Waterloo, Canada.

<sup>31</sup> OECD, WTO, World Bank, 2014, *Global Value Chains: Challenges, Opportunities, and Implications for Policy*, Report submitted to G20 Trade Ministers Meeting, Sydney Australia, 19 July: p.19.

thirds during the GATT period to less than half today, reflecting the rise of emerging economies, especially China. The growing number of WTO members from developing countries, and especially China's accession in 2001, dramatically increased the complexity of negotiations. For the US, the decline of the Doha round is definitive.<sup>32</sup> In its place, the US has sponsored a massive expansion of regional trade agreements. Many of these new RTAs went beyond tariff-cutting and included legally binding assurances aimed at making signatories more business-friendly to trade, foreign investment and the protection of IPR.

Combined with the proliferation of around 3,000 bilateral investment treaties (BITs)<sup>33</sup>, this has left emerging economies and developing countries with little choice but to reduce trade barriers in order to attract industrial FDI and to upgrade their position in GNs. The underlying logic is straightforward: "Many developing nations sought and are still seeking to attract this offshoring activity. Firms in the high-income nations are interested in providing it—as long as they have assurances that host nations will respect their tangible and intangible property rights, and ensure that the necessary flows of goods, services, investment, capital, and people will be unimpeded." (Baldwin, 2016: p.111)

In short, for proponents of the new "gains from trade" doctrine, "world trade governance is heading towards a two-pillar system. The first pillar, the WTO, continues to govern traditional trade as it has done since it was founded in 1995. The second pillar is a system where disciplines on trade in intermediate goods and services, investment and intellectual property protection, capital flows, and the movement of key personnel are multilateralised" through regional and mega-regional trade agreements, like the Trans-Pacific Partnership (TPP). (Baldwin, 2016: 114) What I find striking is the somewhat naive assumption that such a vision of world trade governance could ever be stable, despite the fact that TPP (if it would ever materialize) would not include major trading nations like China and India. After the recent presidential election in the US, there is even less reason to assume a stable regime of world trade governance.

#### **4. Exploring impacts for Chinese companies – a preliminary research agenda**

##### **4.1. China's patent boom**

China's patent boom is signaling an important shift in the international patent system - since 2011, more patents are filed at the patent office of China (SIPO) than at any other office in the world. In 2013, China (32.1% of world total) and the US (22.3%) received more than half of global filings, while the European Patent Office (EPO) saw its share of the world total fall to 5.8%.<sup>34</sup>

Recent WIPO data show that China's patent boom "is mainly driven by a greater activity and propensity of Chinese firms - as opposed to foreign firms or Chinese universities and public research institutions - to use the domestic

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<sup>32</sup> For USTR Michael Froman, "moving beyond Doha... [and] freeing ourselves from the strictures of the Doha framework", was the main theme of his remarks to the 10th Ministerial Conference of the World Trade Organization in Nairobi, Kenya, December 17, 2015, <https://ustr.gov/about-us/policy-offices/press-office/speechestranscripts/2015/december/remarks-ambassador-froman>

<sup>33</sup> In essence, these BITs are "concessions of sovereignty undertaken to encourage inward investment. For example, signatories usually commit to resolve investor-state disputes in a forum based in Washington, DC, rather than in national courts." (Baldwin, R., 2016, "The World Trade Organization and the Future of Multilateralism", *Journal of Economic Perspectives*, Volume 30, Number 1, Winter: p.107)

<sup>34</sup> China's patent boom is truly breath-taking – "In the 20 years from 1991 to 2011, the number of patent filings increased more than 46-fold – from around 10,000 to more than half a million.... From 2009 to 2011, China accounted for close to three-quarters of the ...[patent application]...growth worldwide." (Fink, C., 2013, "Intellectual property activity worldwide- key trends, facts, and figures", chapter 2 in Abott, F.M., C.M. Correa, P. Drahos, eds, *Emerging Markets and the World Patent Order*, Edward Elgar, Cheltenham, UK.: p.39)

patent system.”<sup>35</sup> As for the quality of China’s patents, a useful indicator is the average citations per invention. At 1.17 citations in the IT industry, China continues to lag far behind the United States for the same metric (6.72 average forward cites per invention). But China’s citation rate now compares favorably with Japan (1.82 average forward cites), Europe (1.31 average forward cites), and it exceeds the South Korean rate (0.76 average forward cites)<sup>36</sup>. It is certainly time to reassess earlier statements that Chinese patents are mostly “junk”.

Patenting by Chinese residents remains highly concentrated among a few Chinese firms and regions, and in a handful of sectors only. A handful of China’s large firms and research institutes are becoming increasingly sophisticated in the development, protection and use of patents. There are also signs of a shift to a more strategic approach to patenting. According to a recent SIPO study, motives such as occupying a technological space, averting litigation, increasing bargaining power in IP negotiations, improving their corporate image and deriving revenues from royalty and license fee income. SIPO emphasizes that “the strategic motives are becoming increasingly relevant.”<sup>37</sup>

The SIPO study also adds two important qualifications: First, the percentage of large enterprises (including central government-owned enterprises) whose patented technologies are adopted into standards or patent pools as SEPs is notably higher than that of SMEs. And second, revenues from patent licensing remain low by international standards. In 2011, “64.0% of the Chinese companies received less than 500,000 yuan (77,400 USD) of royalties from patent transfer or licensing; 76.6% paid royalties in this bracket. In both cases, most companies fell within the below-50,000 yuan bracket. Apparently, high patent implementation rate does not mean high market value and profitability.” (ibid.: p.2)

Much of China’s patent boom has occurred in the IT industry. A defining characteristic of this industry in China is its deep integration into GPNs and GINs. A proxy for China’s high degree of GPN integration is that 44% of its exports are produced under so-called “processing trade” arrangements, in which imported inputs are assembled into exports.<sup>38</sup> Another indicator is that two-thirds of China’s production of goods and services are intermediates, which is substantially higher than the world average<sup>39</sup>. As indicated in **Part Two** of this talk, China is also deeply integrated into GINs.

In order to understand how SEP-related market failures might affect Chinese companies, it is necessary to conduct this research in the context of China’s deep integration into GPNs and GINs. Specifically, I’d suggest to organize empirical research around the distinction, introduced in **Part Two**, between network flagships, higher-tier and lower-tier network suppliers (as described in **Figures 3 and 4**).

### **Network flagships**

Huawei, the world’s largest telecommunications equipment vendor and a rising force in smart phones, fits all the criteria of a network flagship. Huawei’s own GIN now includes, in addition to at least eight R&D centers in China, five major overseas R&D centers in the US, and around 14 R&D centers in Europe (**Fig.10**)

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<sup>35</sup> Kashcheeva, M., S. Wunsch-Vincent, Hao Zhou, 2014, *International Patenting Strategies of Chinese Residents: an analysis of foreign-oriented patent families*, WIPO, ERWP20, September: page 11.

<sup>36</sup> Thomson Reuters, 2014, *CHINA’S IQ (INNOVATION QUOTIENT). TRENDS IN PATENTING AND THE GLOBALIZATION OF CHINESE INNOVATION*, <http://ip.thomsonreuters.com/sites/default/files/chinas-innovation-quotient.pdf> : p.9.

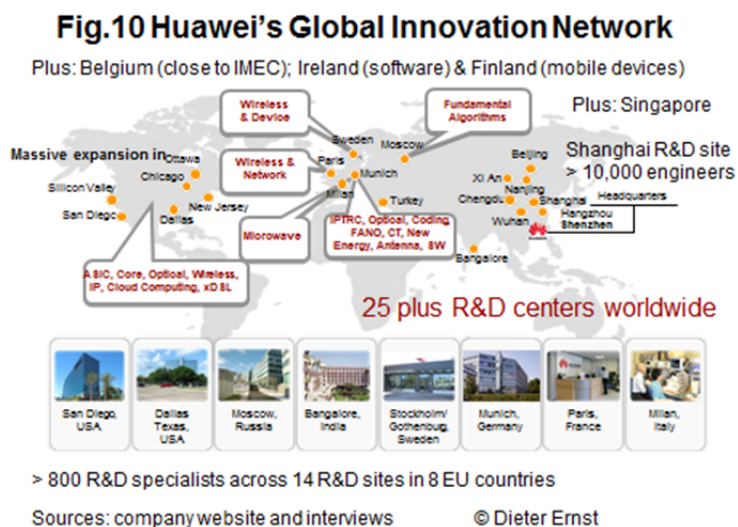
<sup>37</sup> WIPO 2014, Committee on Development and Intellectual Property (CDIP), CDIP/13/INF/8, Thirteenth Session Geneva, May 19 to 23, 2014, *SUMMARY of the study ON PATENT’S role in business strategies: research on Chinese companies’ patenting motives, patent implementation and patent industrialization, prepared by the Intellectual Property Development and Research Center, State Intellectual Property Office (SIPO), Beijing, the People’s Republic of China*: page 1.

<sup>38</sup> General Administration of Customs, PRC, “2011 Trade by Trade Regime,” <http://www.customs.gov.cn/publish/portal0/tab44604/module109000/info353199.htm>.

<sup>39</sup> Baldwin, R. and J. Lopez-Gonzalez, 2013, *Supply-Chain Trade: A Portrait of Global Patterns and Several Testable Hypotheses*, NBER Working Paper No. 18957, April: p. 13.

Huawei's extensive experience in standards setting and its significant investments in IP are documented in the following data<sup>40</sup>: With a team of over 400 experts in standardization (of which 300 plus are working on mobile communications standards), Huawei is active in 150 domestic and international industry standards bodies (including the 3GPP, IETF, IEEE, ITU, BBF, ETSI, ATIS, TMF, WFA, CCSA and OMA), and occupying 180 leadership positions (including chairpersons of the ETSI, ATIS, IEEE, OMA, CCSA, WFA, WiGig and OASIS). In 2012, Huawei submitted more than 5,000 international standard proposals.

In mobile communications, the company has filed over 57,800 patent applications in China, U.S., Japan, European Union, South Korea, and Brazil, of which approximately 15000 are in the area of wireless communications. Huawei has declared 2,137 SEPs in the area of wireless communications. In compliance with ETSI's IPR Policy, Huawei has declared 865 SEPs in LTE/EPC, holding about 15% of all SEPs related to LTE/EPC standard; 778 SEPs in UMTS, holding 6% of all essential patents related to UMTS standard; and 145 essential patents GSM, holding 2% of all SEPs related to the GSM standard. As we saw in **Part Two**, Huawei now is #6 among the 20 top owners of declared SEPs at leading SSOs, and #2 for declared SEPs for 4G LTE and LTE advanced standards.



These impressive achievements have enabled Huawei to sign cross-licensing agreements with all major IPR holders in the wireless industry, including Ericsson, Nokia-Siemens, Alcatel-Lucent, Qualcomm, Nokia, Sony-Ericsson, Sisvel and other leading players. As a global network flagship, Huawei thus does what all large SEP holders do – they cross-license their SEP portfolios to one another, allowing each to manufacture standard compliant products without infringing on the other's SEPs, and to receive compensation for its contributions to the standard.

But even among those privileged players, cross-licensing of SEPs may well give rise to an unequal distribution of rents. This issue came up during a recent *CNIS Forum on Standards and Patents* in Beijing earlier this month. Huawei – a company that is involved in cross-licensing agreements as both patentee and patentor – complained that the licensing fees that Huawei earns in those agreements are far lower than the fees that it had to pay. At present, there are no data available in the public domain on this imbalance, nor do we know the underlying causes. It is however plausible to assume that top owners of declared SEPs, like Qualcomm or Interdigital, have accumulated large SEP portfolios. Simply put, the party whose SEP portfolio contributes less value to the relevant standards (in this case, presumably Huawei) will pay the net-balancing royalty<sup>41</sup>. In addition, companies like Qualcomm and Interdigital are years ahead in developing best-practice management approaches to maximizing gains from such cross-licensing agreements.

<sup>40</sup> [http://www.huawei.com/us/industry/standards-contributions/hw-u\\_167829.htm](http://www.huawei.com/us/industry/standards-contributions/hw-u_167829.htm)

<sup>41</sup> This assumes of course that the declared value of the patent is real – a somewhat heroic assumption.

It is time to conduct systematic empirical research to examine this unequal distribution of gains from cross-licensing that seem to affect even a successful Chinese global network flagship like Huawei.

### Higher-tier suppliers

Next in line are higher-tier suppliers like Foxconn. While incorporated in Taiwan, Foxconn has played a critical role as higher-tier supplier for China's IT industry. In order to upgrade beyond low-margin contract manufacturing as an ODM, Foxconn is searching for ways to diversify into higher-value added knowledge-intensive activities. To achieve this objective, the company claims that it has accumulated over 55,000 patents worldwide<sup>42</sup>.

However, in their role as subcontractors, higher-tier suppliers like Foxconn are often stuck in a position of "passive innovators" – they innovate in collaboration with the flagships that are typically brand marketers of final goods and services and hence "remain weak in making market-oriented innovations in the sense of putting together different technologies to independently create final products for consumers."<sup>43</sup> Chen Tain-Jy raises important and largely under-researched questions for the study of how SEP-related market failures may affect higher-tier suppliers in global networks: How does a firm's position in global networks affect their ability to cope with and to benefit from SEP-related market failures? And what are the specific challenges that these higher-tier suppliers might face when they seek to upgrade their position within these global networks?

A possible candidate for such a higher-tier supplier from China might be Spreadtrum Communications, a Shanghai-based chip design company that develops mobile chipset platforms for smartphones and other mobile devices supporting 2G, 3G and 4G wireless communications standards. Located at the center of the global semiconductor value chain (**Figure 11**), Spreadtrum depends both on requirements and specifications from the demand chain, as well as technology and capabilities from the supply chain. According to the company's CEO, the availability of IC design tools, semiconductor fab services, and open source smartphone software [Android] has enabled Spreadtrum to circumvent its weak spots and and develop its strengths in hardware, IC design and integration<sup>44</sup>.

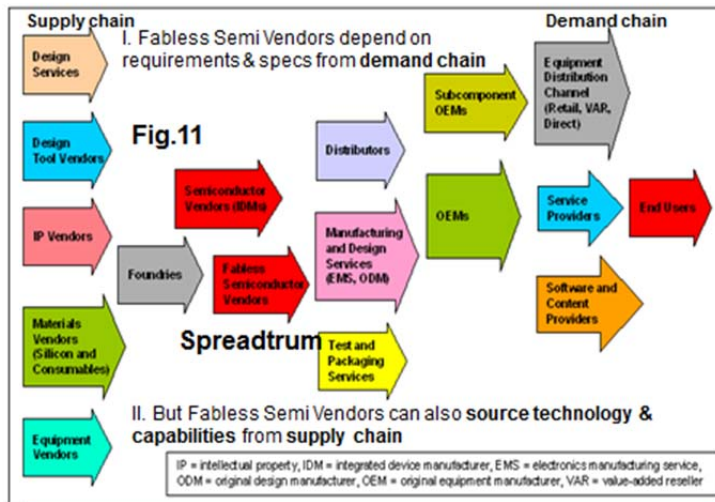
To enable knowledge exchange between Spreadtrum and its technology suppliers and customers, many different standards are needed, and many SEPs are included in these standards. It is time to conduct in-depth empirical research that traces important knowledge flows and the standards that overlay these knowledge flows, and to construct patenting landscapes for important SEPs. It is on that basis then that an assessment will become possible of impacts of some of the afore-mentioned SEP-related market failures on higher-tier suppliers.

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<sup>42</sup> <http://www.foxconn.com/GroupProfile/En/GroupProfile.html>

<sup>43</sup> Chen, Tain-Jy, 2016, "Supply Chain Positioning and Innovation: Taiwan's Challenge", <http://www.eastwestcenter.org/sites/default/files/filemanager/pubs/pdfs/7-3Chen.pdf> : p.14. Forthcoming in Ernst, D. and M. Plummer, editors, *Megaregionalism – Innovation and Trade within Global Networks*, World Scientific Studies in International Economics/Imperial College Press.

<sup>44</sup> Interview, June 22, 2012.



Adapted from Gartner, 2008

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### Lower-tier suppliers

As described in **Figure 4**, these companies have to survive on razor-thin margins and lack the capacity to invest in R&D and the development of their own IP. Their position in global networks is the equivalent of Dante’s *Inferno* – lost, with little hope to move up to the *Purgatorio* of higher-tier suppliers or the *Paradiso* of network flagships<sup>45</sup>. Nor do they have the capacity to improve their lot through participation in SDOs or standard consortia.

However, they need to license technology both from higher-tier suppliers, the flagship and from outside technology suppliers. These companies simply don’t have the means to negotiate on their own fair access to SEPs. Nor do they have what it takes to comply with the relevant standards. In short, public policy support is of the essence to provide lower-tier suppliers with enough space to accumulate the means and capabilities to move up to the *Purgatorio* level.

One possible way to provide such focused support may be through the establishment of a *Sovereign Patent Fund (SPF)*. But it would only work for lower-tier suppliers who are genuinely motivated to invest in IP development and management capabilities. If the companies are not the drivers, SPFs can achieve very little.

Critics argue that SPFs “could end up with a large number of valueless patents aggregated at high cost.”<sup>46</sup> In addition, SPFs could have a disruptive impact on trade as a new type of technical barrier to trade (TBT). Some observers emphasize that the US government takes a negative view of SPFs as an unwarranted and inherently inefficient government intervention into the free market. Hence, “establishing an SPF could theoretically make the creator of such funds a target for US legal action in

<sup>45</sup> <http://www.fullbooks.com/Dante-s-Inferno.html>

<sup>46</sup> Expert Group on IPR Valorisation, 2012, *Options for an EU Instrument for Patent Valorisation*, [http://ec.europa.eu/enterprise/policies/innovation/files/options-eu-instrument-patent-valorisation\\_en.pdf](http://ec.europa.eu/enterprise/policies/innovation/files/options-eu-instrument-patent-valorisation_en.pdf)

forum such as the WTO. More broadly, the establishment of such a fund could undermine relations with the US policy-makers and expose the creating country to the risk retaliatory action. ”<sup>47</sup>

Probably the most important impediment to the establishment of SPFs are under-researched implementation issues, especially with regard to obtaining sufficient financial and human capital and the organizational design and governance structure of such SPFs. In fact, despite the hype created in the media about the threat from SPFs as “state-sponsored patent trolls”, SPFs are facing considerable birth pains. Nevertheless, three such SPFs seem to work with a clear strategic focus: *France Brevets*, *IPBridge Japan*, and *Intellectual Discovery Korea*.

In the end, SPFs seem to work only if the following conditions are in place:

- The primary task of SPFs is to support the efforts of those lower-tier suppliers (especially young, small companies with new ideas) to develop a broad portfolio of IP development and management capabilities.
- The industry structure and business culture must be conducive for this type of public-private dialogue and partnership.
- These support institutions and incentives must be limited in duration (but we know how difficult it is to discontinue such support programs).

## Conclusions

A recent conference organized by David Teece at UC Berkeley on October 29, 2016, continues to deny the existence of patent thickets and patent hold-up and argues that SEP licensing policies have shifted too much in favor of implementers<sup>48</sup>. In contrast to such claims, I have argued in this paper that SEP-related market imperfections are real. I argue in particular that these market imperfections have increased in importance in a world where increasingly complex and diverse global corporate networks integrate dispersed production, engineering, product development and research across geographic borders. I also argued that we need to fill an important knowledge gap. We need research that addresses head-on the growing concerns in emerging and developing countries that SEP-related market failures may create added uncertainty for their companies, generating unpredictable and often quite significant costs and delaying market entry of their products.

To me, this implies that research should focus now primarily on two questions:

- How precisely are standard implementers affected (especially SMEs and new entrants from emerging economies) who are deeply involved in GPNs and GINs?
- And what suggested solutions might help to improve the governance of SEPs?

On the first question, I have sketched out an admittedly very preliminary research agenda for assessing possible impacts on Chinese firms. On the second question, it is useful to start with the concept of “Structured Price Commitments”, proposed by Jean Tirole and Josh Lerner<sup>49</sup>. For them, a licensing “price

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<sup>47</sup> Clarke, 2014, *The Rise of Sovereign Patent Funds – Insights and Implications*, September, [http://deepcentre.com/wordpress/wp-content/uploads/2014/09/DEEP-Centre-The-Rise-of-Sovereign-Patent-Funds\\_SEPT-2014.pdf](http://deepcentre.com/wordpress/wp-content/uploads/2014/09/DEEP-Centre-The-Rise-of-Sovereign-Patent-Funds_SEPT-2014.pdf) :p.10

<sup>48</sup> <http://businessinnovation.berkeley.edu/intellectual-capital/antitrust-october-2016/>

<sup>49</sup> See Lerner, J. and J. Tirole, 2015, “Standard Essential Patents”, *Journal of Political Economy*, Vol. 123, no.3: pp.547-586; and Lerner, J. and J. Tirole, 2014. “A Better Route to Tech Standards”, *Science*, Vol.343, 28 February: pp.972 and 973.



commitment made prior to standard selection can restore *ex ante* competition and efficiency”...[But] ... price commitments are unlikely to emerge in the absence of regulation”. (Lerner and Tirole, 2015: p.550) As forum shopping enables IP owners to shun SSOs that force them to charge competitive prices, public policy is required to impose mandatory structured price commitments on SSOs.

“Structured price commitments” is defined as follows: “Before the standard is finalized (and unlike today’s practice), there is a recess, during which firms commit to a price cap at which they will grant nondiscriminatory licenses to their patents. Firms make commitments to the maximum price (and most restrictive terms) that they would charge before the patent is included in the standard.” (Lerner and Tirole, 2014: p.972)

The authors admit that this may not be feasible or it may produce unintended negative side effects. They conclude experimenting with this approach might be better than doing nothing. “If practice does not work according to theory (only experimentation can tell), the hazard is that IP owners will set too high a cap. But it cannot be worse than the current policy, which is formally an infinite price cap. The combination of a cap with FRAND cannot be worse than only FRAND. So this is rather low-risk. ...Requiring price commitments is theoretically appealing, rather risk-free, and worth experimenting with.” (Science: p.973). I agree. But we should also note that SEP owners and their supporters have largely ignored these suggestions, as they would erode their highly profitable royalty income.

The “Structured Price Commitments” proposal builds on the policy, introduced a few years earlier by VITA, supported by the DoJ. **Figure 12** lays out in detail the quite extensive requirements for *ex ante* disclosure.

**VITA** **Figure 12** **VITA Patent Policy**

- All VITA members are obligated to disclose any patent applications or patents owned, licensed, or known that directly relate to any essential elements in any standard under development.
- VITA members are also obligated to disclose their maximum fees and royalties associated with licensing those patents.
- VITA members are also obligated to disclose all contractual terms of the licensing agreement.
- VITA members are bound by arbitration in any disputes (violations of procedures).
- Fee and royalty rates are NOT decided by arbitration. Competition, individual negotiations, or collective negotiations decide those rates.

VITA’s *ex ante* disclosure policies have been successfully implemented, so far however only in the closed community of companies that are active in the defense and related industries. Ray Alderman, who was instrumental in pushing through VITA’s *ex ante* policy, explains the difference to the Structured Price Commitments as follows: “FRAND only works when there is competition, among the IP owners. If patent holders are forced to declare their SEPs up front with their fees and royalties, that inspires other IP owners to declare theirs with their financial and licensing conditions. I do not see how this recess

...[ i.e. the structured price commitment] ...does that. Competition is the mechanism that negates ambush and exorbitant fees and royalties.”<sup>50</sup>

Another important suggestion on how to improve the governance of SEPs is IEEE’s amended licensing policy, supported again by the DoJ. The IEEE policy states that IEEE members holding patents covering IEEE standards<sup>51</sup>:

- must offer to license those patents to all applicants requesting licenses to implement the standard, and cannot pick and choose among licensees,
- may not seek, or threaten to seek, injunctions against potential licensees, until an enabling court decision, sustained in an appeal,
- may insist that licensees offer them reciprocal licenses for same standard under their own patents,
- may arbitrate disputes over FRAND terms,
- may charge a reasonable royalty that is based on the value attributable to the patented invention, excluding the value of that SEP’s inclusion in an IEEE standard, and
- should ensure that subsequent purchasers of these patents agree to abide by the same commitments.

In essence, IEEE’s amended policy seeks to reduce uncertainty about what constitutes a reasonable royalty rate under FRAND conditions. When determining the reasonable rate, the key suggestion is to consider the value of the relevant functionality of the smallest salable compliant (SSC) implementation that practices the essential patent claim.

In conclusion, it is important to emphasize that all of the above suggestions emphasize a more active role for competition policy which now has joined patent and standards policies in the arsenal of standardization governance. This is happening not just in China but also in the US. Given the broad array of companies that are negatively affected by the current status quo of SEP governance, I am convinced that large SEP owners and their defenders are fighting rearguard battles. Even if the incoming Trump administration will try to slow-down and reverse current reform activities, the rising pressure from implementers and consumers will in the longer run shift the tide against the current SEP-related market failures. And China will play an important role in this process, as illustrated by the increasingly active role of Chinese courts and the anti-monopoly policy implemented by the National Development and Reform Commission of the People's Republic of China (NDRC).

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<sup>50</sup> Ray Alderman, email to the author, dated November 8, 2016.

<sup>51</sup> IEEE-SA web site. See also Contreras, J., 2015, “IEEE Amends its Patent (FRAND) Policy”, February 9, <http://patentlyo.com/patent/2015/02/amends-patent-policy.html>