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The World's Laboratory: China's Patent Boom, IT Standards and the Implications for the Global Knowledge Economy

Christopher McElwain, *LaRiviere Grubman P.C.*

Abstract:

Just as China's factories disrupted the economics of IT hardware, its research labs have the potential to disrupt the economics of the technology itself. In 2014, China's patent office received nearly 2.4 million patent applications, 93% from domestic applicants. China has also climbed to third place in terms of international applications, with over 21,000 WIPO PCT applications. Meanwhile, China has taken an assertive role in setting technology standards, both at the national and international levels. In the past, this has included developing and promoting alternatives to important IT standards as a means of challenging perceived monopolies by certain (foreign-dominated) technologies. More recently, China's 2008 Anti-Monopoly Law and 2014 Regulatory Measures on National Standards Involving Patents have codified a national policy aversion to closed standards. China's burgeoning patent portfolio, providing currency to negotiate into and around multinational patent pools, combined with the impact of its policies on standards-setting norms, could shift the economics of patent monetization in dramatic ways, foremost by putting downward pressure on royalty rates. Like previous market disruptions, China's effect on the global knowledge economy is likely to challenge some foreign firms and benefit others.

I. Introduction

In 2014, China's patent office received nearly 2.4 million patent applications. 93% were from domestic applicants. China has also climbed to third place in terms of international applications, with over 21,000 WIPO PCT applications.

China's rise to its position as the "World's Factory"¹ shifted manufacturing capacity away from developed countries² but more importantly, it changed the economics of global production generally. In information and communications technology (ICT or IT)—the sector that makes up 94.9% of China's high technology exports and upon which this paper focuses³—the globalized, geographically fragmented supply chain that distributes a huge variety of highly-specialized, affordable devices would not be possible without China's novel capacity for "ultra mass-flexible production."⁴ It's a capacity that foreign firms have put to highly-profitable use even as changing dynamics made certain business models no longer

1. Mary Hennock, *China: The World's Factory Floor*, BBC (Nov. 11, 2002, 07:52 GMT), <http://news.bbc.co.uk/2/hi/business/2415241.stm>.

2. For example, China's share of global exports of telecommunications and office equipment rose from around .08% in 1980 to approximately 34% in 2013, according to WTO statistics. See Statistics Database, WORLD TRADE ORG., <http://stat.wto.org> (last visited Mar. 23, 2016).

3. DAN BREZNITZ & MICHAEL MURPHREE, *RUN OF THE RED QUEEN* 8 (Yale Univ. Press) (2011).

4. Its ability to cheaply churn out a huge variety of highly-specialized products using the same manufacturing infrastructure is exemplified in the Pearl River Delta's Foxconn factories. See BREZNITZ & MURPHREE, *RUN OF THE RED QUEEN*, *supra* note 3, at 13-16.

feasible.

Just as China's factories disrupted the economics of IT hardware, its research labs could easily disrupt the economics of the technology itself. These economics are driven by intellectual-property licensing and the adoption of technology standards (a popular business aphorism in China has it that "third-rate companies build products, second-rate companies build technology, first-rate companies build standards."⁵).

Despite the startling scale of China's patent activity, which is explored in Part II, there are reasons to think the Chinese IT industry—which is more structurally inclined to view patents as an aspect of production rather than a free-standing source of revenue—may leverage its rights differently than comparable western firms, and the impact of integrating this massive new fount of intellectual property into the global innovation economy remains to be seen.

Part III examines China's increasingly assertive role in setting technology standards, both at the national and international levels. Chinese standards-setting organizations attracted significant international attention in the mid-to-late 2000s when they began putting forward home-grown alternatives to market-dominant technologies and expensive foreign patents. More recently, Chinese agencies have put forward regulations that reflect a particularly militant stance on licensing terms and on proprietary standards generally.

China's burgeoning patent portfolio, providing currency to negotiate into and around multinational patent pools, combined with the impact of its policies on standards-setting norms, could shift the economics of patent monetization in dramatic ways. Like previous market disruptions, China's effect on the global knowledge economy is likely to challenge some foreign firms and benefit others.

II. China's Patent Boom

A. *Indigenous Innovation*

In February 2006, the State Council of China issued a document styled "The National Medium- and Long-Term Science and Technology Development Plan (2006-2020)."⁶ Setting forth an ambitious transformational vision of a technology-

5. 三流企业做产品; 二流企业做技术; 一流企业做标准. See Ying Zhan & Xuezhong Zhu, *Intellectual Property Right Abuses in the Patent Licensing of Technology Standards*, 10 J. OF WORLD INTELL. PROP. 187, 187-200 (2007).

6. Guójiā zhōng cháng qī kēxué hé jìshù fāzhǎn guīhuà gāngyào (2006-2020 Nián) (国家中长期科学和技术发展规划纲要 (2006-2020年)) [The National Medium- and Long-Term Science and Technology

centric Chinese economy by 2020,⁷ the Plan was quickly cited in the west as evidence of China's "techno-nationalist" agenda.⁸ In particular, the 15-Year Plan established a new guiding principle for the country's economic development: *Zìzhǔ chuàngxīn* (自主创新) or "Indigenous Innovation."⁹

The goal of the Indigenous Innovation push is to reduce China's reliance on foreign technology (from an estimated 60% in 2006 to less than 30% by 2020).¹⁰ Indigenous Innovation has since been promoted by government policy on both the national and local level.¹¹ In addition to direct R&D support through state-funded research institutes, R&D investments by Chinese firms is encouraged through government procurement, tax breaks, subsidies and other incentives.¹² Indigenous Innovation has also emphasized consolidating the fruits of this research through increasing Chinese involvement both nationally and internationally in patent filing and standard setting.¹³

B. Patent Activity in China: Growth and Scale

Measured in raw patents, China's Indigenous Innovation has blown past expectations. The 15-year Plan's aim to increase domestic inventors' share of annual invention-patent grants from roughly 40% to 70%¹⁴ came achingly close to fruition 6 years ahead of schedule in 2014, with 69.8% of the 233,228 invention patents granted by China's State Intellectual Property Office (SIPO) awarded to domestic applicants.¹⁵

Development Plan (2006-2020)], available at http://www.gov.cn/jrzq/2006-02/09/content_183787.htm. Non-official translation available at [http://www.etiea.cn/data/attachment/123\(6\).pdf](http://www.etiea.cn/data/attachment/123(6).pdf)

7. See *China issues S&T development guidelines*, THE CENT. PEOPLE'S GOV'T OF THE PEOPLE'S REPUBLIC OF CHINA (Feb. 9, 2006), http://www.gov.cn/english/2006-02/09/content_183426.htm.
8. Sylvia Schwaag Serger & Magnus Breidne, *China's Fifteen-Year Plan for Science and Technology: An Assessment*, 4 ASIA POLICY 135, 145-147 (2007); James McGregor, U.S. Chamber of Commerce, *China's Drive for 'Indigenous Innovation': A Web of Industrial Policies* 6 (2010).
9. McGregor, *supra* note 8, at 13.
10. Serger & Breidne, *supra* note 8 at 147.
11. McGregor, *supra* note 8, at 17-19.
12. *Id.*
13. *Id.* at 26-30; Like R&D spending, it's thought that China incentivizes patent activity by "financial remuneration, tax breaks and other benefits offered by the government in exchange for the filing of patents." Chris Neumeyer, *China's Great Leap Forward in Patents*, IPWATCHDOG (April 4, 2013), <http://www.ipwatchdog.com/2013/04/04/chinas-great-leap-forward-in-patents/id=38625/>. See also *Patents, yes; ideas, maybe*, THE ECONOMIST (Oct. 14, 2010), <http://www.economist.com/node/17257940> (describing China's "ecosystem of incentives for its people to file patents"). The state's role in stand setting is explored in Part III *infra*.
14. Serger & Breidne, *supra* note 8 at 147.
15. *Comparative Table 1 Contemporary Quantity Comparison of Three Kinds of Patents Received from Home and Domestic between 2013 and 2014 (2013-2014 SIPO Application Statistics)*, STATE INTELL.

SIPO now receives more applications than any patent office in the world,¹⁶ with 928,177 invention-patent applications received in 2014.¹⁷ 86.3% were from domestic applicants.¹⁸ In addition to invention patents, China also grants a second type of patent called a “utility model patent,” a category of intellectual property similar to rights granted in Germany, Japan and other nations but absent from U.S. law.¹⁹ China received another 868,511 utility model applications in 2014 (99.1% domestic),²⁰ bringing the total number of SIPO patent applications (including design patents) to a staggering 2.4 million.²¹ While utility models are often disparagingly characterized as “petty patents” or “junk patents” due to the lower examination standards they entail,²² they cover largely the same subject matter as invention patents and are valid, enforceable intellectual property rights in China and elsewhere.²³

Meanwhile, Chinese patent activity has also boomed internationally. In 2013, 21,516 international Patent Cooperation Treaty (PCT) applications originated in China,²⁴ up from only 1,731 in 2005,²⁵ an average annual growth rate of 36.7% (by far the highest in the world),²⁶ and making China the third most prolific country of origin for PCT applications overall, behind only the United States and Japan.²⁷

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- PROP. OFF. OF THE P.R.C., http://english.sipo.gov.cn/statistics/2014/12/201502/t20150204_1071538.html (last visited Mar. 24, 2016).
16. WORLD INTELL. PROP. ORG., WORLD INTELLECTUAL PROPERTY INDICATORS (2014), http://www.wipo.int/edocs/pubdocs/en/wipo_pub_941_2014.pdf.
17. *Table 1 Distribution of Applications for Inventions Received from Home and Abroad: December 2014*, STATE INTELL. PROP. OFF. OF THE P.R.C. (Feb. 4, 2015), http://english.sipo.gov.cn/statistics/2014/12/201502/t20150204_1071541.html.
18. *Id.*
19. *Where Can Utility Models Be Acquired?*, WORLD INTELL. PROP. ORG., http://www.wipo.int/sme/en/ip_business/utility_models/where.htm (last visited Mar. 5, 2016).
20. *Table 16 Distribution of Applications for Patents for Utility Model and Design Received from Home and Abroad: December 2014*, STATE INTELL. PROP. OFF. OF THE P.R.C. (Feb. 4, 2015), http://english.sipo.gov.cn/statistics/2014/12/201502/t20150204_1071524.html.
21. Interestingly, these numbers seem to be leveling off. After a decade of double-digit annual growth, the total number of patent applications actually slipped between 2013 and 2014 (mainly due to a decline in design patent applications). State Intellectual Patent Office, *supra* note 15.
22. *See* Neumeyer, *supra* note 13; McGregor, *supra* note 8 at 26.
23. When Chinese electrical-equipment manufacturer Chint Group was sued for patent infringement in Europe, it retaliated with a suit in Chinese court on the basis of its utility model patent. It was awarded a \$45 million judgment. Neumeyer, *supra* note 13.
24. WORLD INTELL. PROP. ORG., PATENT COOPERATION TREATY YEARLY REVIEW: THE INTERNATIONAL PATENT SYSTEM (2014), http://www.wipo.int/edocs/pubdocs/en/patents/901/wipo_pub_901_2014.pdf [hereinafter 2014 PCT YEARLY REVIEW].
25. WORLD INTELL. PROP. ORG., THE INTERNATIONAL PATENT SYSTEM IN 2005: PCT YEARLY REVIEW 3, http://www.wipo.int/export/sites/www/pct/en/activity/pct_2005.pdf.
26. 2014 PCT YEARLY REVIEW, *supra* note 24.
27. While still significantly less than the U.S. and Japan (who together accounted for almost half of PCT applications worldwide), China's PCT activity is unique among countries WIPO classifies as “middle

Chinese telecoms ZTE and Huawei were the second and third largest individual filers respectively, trailing only Japan's Panasonic.²⁸ In the U.S. Patent and Trademark Office (USPTO), Chinese patent applications have soared 1,000% in the last decade.²⁹

These metrics come with inevitable caveats. Given the government incentives to patent, many Chinese inventors may be filing just to file rather than to protect a genuine innovation.³⁰ Fewer SIPO patents are filed in multiple jurisdictions than patents in other countries, further indication, perhaps, of their comparative lack of quality.³¹ As for WIPO and USPTO applications originating in China, it's been pointed out that many of these are filed by multinational corporations with R&D centers merely *based* in China, a testament more to the globalization of research than to a surge in indigenous innovation.³²

Nevertheless, given the sheer scale of Chinese patent activity, its sudden growth seems bound to effect the economics of technology licensing one way or another.

III. Standards

A. Standards in China

Technical standards—model specifications or criteria that encourage uniformity and compatibility within a given technical field—can have a dramatic impact on the value/cost of patent rights.³³ Where a standard is adopted that incorporates propriety methods or configurations (a “closed” standard), licensing these rights becomes mandatory for any business wishing to create a standard-compliant product. The effect is particularly acute in IT, which, due to the nature of the often-complex systems involved, tends to evolve standards with multiple layers of interlocking inventions.³⁴

The Standardization Administration of China (SAC, 标准委), established in 2001 during the departmental reshuffling in anticipation of the country's WTO accession,

income,” with nearest-rival India clocking in an order of magnitude lower at 1,392 applications. *Id.* at 31.

28. *Id.* at 10.

29. Neumeyer, *supra* note 13; McGregor, *supra* note 8.

30. *Patents, yes; ideas, maybe*, THE ECONOMIST, Oct. 14 2010, available at <http://www.economist.com/node/17257940>.

31. *Valuing Patents*, THE ECONOMIST, Jan. 3, 2013, available at <http://www.economist.com/news/business/21569062-valuing-patents>.

32. Lee Branstetter, Guangwei Li & Francisco Veloso, *The Polyglot Patent Boom*, 309 SCI. AM. 62, 62 (2013).

33. Mark A. Lemley, *Intellectual Property Rights and Standard-Setting Organizations*, 90 CAL. L. REV. 1889, 1893 (2002).

34. *See infra* note 81.

establishes national standards (国标, *guóbiāo* or GBs).³⁵ GBs can either be recommended or mandatory, though the latter is theoretically limited to standards involving health or safety and those necessary to enforce other laws and regulations.³⁶ Of the 32,085 GBs listed in SAC's database as of February 1, 2015, about 12% (3,894) are mandatory.³⁷ Where no GB has been set by SAC, other ministries, such as the Ministry of Industry and Information Technology (MIIT, the ministry with responsibility for the IT sector) will set industry standards (业标, also translated as "trade standards"), which can also be either recommended or mandatory.³⁸

In addition, SAC represents China within international standard-setting organizations such as the International Organization for Standardization (ISO).³⁹ Chinese involvement in international standards setting has become increasingly vigorous. As of February 1, 2015, SAC participates in 737 of ISO's technical committees (for comparison, the American National Standards Institute (ANSI), the corresponding U.S. body, participates in 607),⁴⁰ and initiatives by research bodies such as the China National Institute for Standardization (CNIS) focusing on increasing domestic expertise in standards development suggest a strong national commitment to increasing Chinese input into future international standardization efforts.⁴¹

In contrast to the U.S. approach to technical standards, standards setting in China is unambiguously a matter of state policy. Unlike ANSI, a private non-profit organization, SAC is closely supervised by China's State Council and is usually considered an arm of the state for all practical purposes.⁴² Indeed, China's 1989 Standardization Law explicitly charges the government with responsibility for

35. See generally STANDARDIZATION ADMIN. OF THE PEOPLE'S REPUBLIC OF CHINA, <http://www.sac.gov.cn/sacen> (last visited Mar. 13, 2016).

36. Zhōnghuá Rénmín Gònghéguó Biāozhǔnhuà Fǎ (中华人民共和国标准化法) [STANDARDIZATION LAW] (promulgated by the Standing Comm. Nat'l People's Cong., Dec. 29, 1988, effective Apr. 1, 1989), ch. 3, art. 7 (China). For concerns about China's mandatory GBs, see *infra* p. 13.

37. *National Standard Query* (国家标准查询), STANDARDIZATION ADMIN. OF THE PEOPLE'S REPUBLIC OF CHINA [hereinafter SAC National Standard Query], <http://www.sac.gov.cn/SACSearch/outlinetemplate/gjbzcx.jsp> (last visited Mar. 13, 2016).

38. STANDARDIZATION LAW, ch. 3, art. 2; see also DAN BREZNITZ & MICHAEL MURPHREE, U.S.-CHINA ECON. & SEC. REVIEW COMM'N, THE RISE OF CHINA IN TECHNOLOGY STANDARDS: NEW NORMS IN OLD INSTITUTIONS 3 (2013) [hereinafter BREZNITZ & MURPHREE, THE RISE OF CHINA], available at <http://origin.www.uscc.gov/sites/default/files/Research/RiseofChinainTechnologyStandards.pdf>

39. *ISO Members*, INT'L ORG. FOR STANDARDIZATION, http://www.iso.org/iso/home/about/iso_members.htm (last visited Mar. 13, 2015).

40. *Id.*

41. BREZNITZ & MURPHREE, THE RISE OF CHINA, *supra* note 38, at 50.

42. *Id.* at 16.

formulating and implementing technical standards.⁴³

B. Standards and Protectionism

Given the Chinese government's active role in standards setting and its undisguised goal of fostering indigenous innovation, critics inevitably see the efforts of Chinese SSOs as animated by a protectionist agenda, especially where those efforts lead to national standards which differ from international ones.⁴⁴ For more than a decade, the United States has repeatedly reiterated its concerns that "China seems to be actively pursuing the development of unique requirements, despite the existence of well-established international standards, as a means for protecting domestic companies from competing foreign standards and technologies."⁴⁵

The U.S. preoccupation with China's "unique requirements" is more than just grousing, since a country's adoption of national technical standards can implicate its WTO commitments. In particular, China is subject to the Agreement on Technical Barriers to Trade ("TBT Agreement"). The TBT Agreement explicitly extends to both "technical regulations" (i.e. mandatory standards) and "standards" (i.e. voluntary standards) the core WTO principles prohibiting discriminatory trade practices⁴⁶ and unnecessarily trade-restrictive regulations.⁴⁷ More importantly, it creates an

43. STANDARDIZATION LAW, ch. 1, art. 3.

44. See Osama Hussain & Dennis Fernandez, *Strategic Intellectual Property and Emerging Standards for Entering the Chinese Market*, 6 U.C. DAVIS BUS. L.J. 1 (2005) (attributing China's actions "establishing high technology standards that differ from the international community" to "a policy to obtain its own domestic intellectual property rights").

45. U.S. TRADE REPRESENTATIVE, 2014 REPORT TO CONGRESS ON CHINA'S WTO COMPLIANCE 65 (2014) [hereinafter 2014 USTR REPORT]. A nearly-identical line has been trotted out on a yearly basis by the USTR in its annual reports to Congress since at least 2003. U.S. TRADE REPRESENTATIVE, 2003 REPORT TO CONGRESS ON CHINA'S WTO COMPLIANCE 36 (2003) ("China is actively pursuing the development of unique requirements, despite the existence of well-established international standards. This course of action will create significant barriers to entry into its markets, as the cost of compliance will be high for foreign companies.").

46. Agreement on Technical Barriers to Trade art 2.1, Apr. 15, 1994, 1868 U.N.T.S. 120 [hereinafter TBT Agreement] ("Members shall ensure that in respect of technical regulations, products imported from the territory of any Member shall be accorded treatment no less favourable than that accorded to like products of national origin and to like products originating in any other country."); TBT Agreement art. 4.1, Annex 3 ¶ E (tasking Member States with ensuring that SSOs within their territories abide by the same principle with respect to standards). This rule essentially extends the most-favored-nation and national-treatment principles of Article I and Article III of the General Agreement on Tariffs and Trade (GATT).

47. TBT Agreement, *supra* note 46, art. 2.2. ("Members shall ensure that technical regulations are not prepared, adopted or applied with a view to or with the effect of creating unnecessary obstacles to international trade . . ."); *Id.* art. 4.1, Annex 3 ¶ E. (tasking Member States with ensuring that SSOs within their territories abide by the same principle with respect to standards). This reiterates the principles articulated in GATT Article XX that government measures must not be a "means of arbitrary or unjustifiable discrimination" or a "disguised restriction on international trade" and must be "necessary" to accomplish some legitimate purpose (though the TBT Agreement provides only a non-

additional obligation on member states to use “relevant international standards . . . as a basis for” setting national standards,⁴⁸ reflecting member consensus that—regardless of whether divergent technical standards are discriminatory trade obstacles *per se*—uniform standards facilitate trade by, for example, encouraging economies of scale.⁴⁹

In terms of treaty interpretation, tension between the U.S. and China tends to center around what constitutes a “relevant international standard” for purposes of the TBT Agreement.⁵⁰ China takes the position that only inter-governmental organizations like ISO can set international standards triggering TBT obligations, whereas the U.S. insists that the Agreement includes industry standards set by NGOs such as IEEE.⁵¹ In any event, however, the U.S. and other critics of alleged Chinese protectionism point to examples of national standards that would violate WTO/TBT principles under either criteria.⁵²

China, for its part, sees technical trade barriers differently. Flipping the script, Chinese commentators have implied that the threat to free trade lies less in allowing competing national standards and more in imposing a uniform international standard that entails paying mandatory rents to entrenched (western) market participants.⁵³

C. WAPI, TD-SCMA, EVD and China's Other Non-Conforming Standards

The vast majority of Chinese standards are based upon international or foreign

exclusive list of legitimate objectives, whereas GATT Article XX's exceptions are exhaustive). General Agreement on Tariffs and Trade art. XX, Oct. 30, 1947, 1986 U.N.T.S. 194.

48. TBT Agreement, *supra* note 46, art. 2.4; *Id.* art. 4.1, Annex 3 ¶ F (standards).

49. TBT Agreement, *supra* note 46, Preface (recognizing the importance of international standards in “improving efficiency of production and facilitating the conduct of international trade”); *see also* Christopher S. Gibson, *Globalization and the Technology Standards Game: Balancing Concerns of Protectionism and Intellectual Property in International Standards*, 22 BERKELEY TECH. L.J. 1403, 1464 (2007).

50. BREZNITZ & MURPHREE, *THE RISE OF CHINA*, *supra* note 38, at 12-13.

51. *Id.*

52. *See infra* part II.C for discussion of WAPI. Wi-fi is an ISO standard, and therefore the only plausible legal defense of the non-conforming WAPI standard is that it fits within the security-interest exception to the TBT Agreement.

53. *See Review on Technology Barriers Related with Intellectual Property*, SIMMTESTER.COM (Dec. 17, 2003), <http://www.simmtester.com/page/news/showpubnews.asp?title=Review+on+Technology+Barriers+Related+with+Intellectual+Property&num=103> (“[T]echnology standard[s] [have] become a barrier for importing goods”); *see* Ying Zhan & Xuezhong Zhu, *IPR Abuses in the Patent Licensing of Technology Standards*, 10 J. WORLD INTELL. PROP. 187-200, 187 note 5 (2007).

standards or are otherwise uncontroversial.⁵⁴ In fact—according to the 2013 report prepared by Dan Breznitz and Michael Murphree for the U.S.-China Economic and Security Review Commission—of the tens of thousands of Chinese standards developed “in the last fifteen years to 2010, there were only twenty controversial or unique standards, all in ICT.”⁵⁵ Nevertheless, these handful of IT standards have caused significant consternation, possibly because IT is a particularly globalized industry where interoperability is particularly crucial.⁵⁶

The most often-cited grievance⁵⁷ is China’s advocacy of WLAN Authentication and Privacy Infrastructure (WAPI), a wireless security protocol calculated to address widely-acknowledged vulnerabilities in Wired Equivalent Privacy (WEP), formerly the security specification for the IEEE 802.11 wireless standard (a/k/a Wi-Fi).⁵⁸ In 2003, SAC and the Ministry of Information Industry (MII, MIIT’s predecessor) adopted WAPI as a mandatory encryption standard for wireless devices sold in China.⁵⁹ However, following complaints by the U.S. and resulting bilateral trade talks, this mandate was abandoned in 2004 before it was ever implemented.⁶⁰

China then began to push for adoption of WAPI as an international standard by ISO, but the technology was rejected in favor of a security protocol put forward by IEEE known as 802.11i (eventually implemented as WPA2).⁶¹ Still, China clung to WAPI, appealing ISO’s decision,⁶² promoting the technology through alternative channels,⁶³ and even resubmitting the standard for international consideration as

54. BREZNITZ & MURPHREE, *THE RISE OF CHINA*, *supra* note 38, at 34-35, n. 28. Of the 32,085 GBs listed in SAC’s database as of February 1, 2015, 13,233 purport to be adoptions of standards set by international SSOs (mostly ISO or the International Electrotechnical Commission (IEC)); SAC National Standard Query, *supra* note 37.

55. BREZNITZ & MURPHREE, *THE RISE OF CHINA*, *supra* note 38, n. 28.

56. Andrew Updegrave, *ICT Standard Setting Today: A System Under Stress*, 6 CONSORTIUM STANDARDS BULLETIN 4 (Apr. 2007), <http://www.consortiuminfo.org/bulletins/apr07.php#feature> (noting that “[u]nlike physical products, the fruits of ICT technologies require a large number of interoperability standards in order to function and flourish” and that, due to the global nature of trade, travel, production and utilization, “[i]n ICT in particular, the concept of a national standard has become archaic.”).

57. BREZNITZ & MURPHREE, *THE RISE OF CHINA*, *supra* note 38, at 23; *see also, e.g.*, USTR 2014 REPORT, *supra* note 45, at 65-66; Hussain & Fernandez, *supra* note 44, at 2; Gibson, *supra* note 49; McGregor, *supra* note 8.

58. For a detailed history of WAPI from 2003-2006, *see generally* Brian J. DeLacey et al., *Government Intervention in Standardization: The Case of WAPI* (Sept. 2006), <http://ssrn.com/abstract-930930>.

59. *Id.* at 11-12.

60. *Id.*

61. *Id.* at 13-15.

62. *Id.*

63. For example, in 2009, all three of China’s mobile carriers included WAPI-capability as a requirement for handsets on their networks. Government influence was widely suspected. *See* Owen Fletcher, *Years on, China Pushes WAPI in Mobile Phones*, CIO (May 8, 2009), <http://www.cio.com/article/2428329/infrastructure/years-on--china-pushes-wapi-in-mobile-phones.html>.

recently as 2009.⁶⁴

Given the technology's distinctively home-grown character and the government's dogged support for it in the face of international political and commercial resistance,⁶⁵ it's no wonder that WAPI is the poster child for China's use of standards in the service of techno-nationalism.⁶⁶ However, it's probably appropriate to think of WAPI as something of an outlier.⁶⁷ It is a fixation that China developed while its new standardization regime was in its infancy and one that is arguably rooted as much in the security paranoia of particular state actors as in a broad national economic policy designed to give domestic companies a leg up.⁶⁸

Past WAPI, China's controversial IT standards become more nuanced. For one thing, these "Chinese" standards often incorporate significant amounts of foreign technology, making their effectiveness questionable as pure tools of techno-nationalism.⁶⁹ Moreover, in nearly every case, government efforts to promote the standard have been far from unequivocal and have failed to result in the commercial success that Indigenous Innovation proponents supposedly crave.⁷⁰

For example, a continued point of contention in Chinese-U.S. trade relations is the Chinese government's role in 3G mobile technology, where it has consistently given preferential treatment to the TD-SCDMA⁷¹ standard over competing standards like CDMA2000 and W-CDMA.⁷² It's a dispute that appears to be following the mobile industry into the next generation, as China is accused of preferentially licensing 4G spectrum to companies using the favored TD-LTE standard at the expense of the disfavored FDD-LTE standard.⁷³

64. See *Watch Out: WAPI is back on the Wi-Fi agenda*, EE TIMES (June 19, 2009), available at http://www.eetimes.com/document.asp?doc_id=1254041.

65. WAPI has failed to be adopted by consumers even in China, where "laptop users almost universally use Wi-Fi in coffee shops to surf the Web." Fletcher, *supra* note 63.

66. See, e.g. Zia K. Cromer, *China's WAPI policy: security measure or trade protectionism?*, 4 DUKE L. & TECH. REV. 1 (2005); Richard P. Suttmeier, *A New Technonationalism? China and the Development of Technical Standards*, 48 COMM'N OF THE ACM 35 (2005), available at <http://china-us.uoregon.edu/pdf/newTechnNatChina.pdf>.

67. BREZNITZ & MURPHREE, *RUN OF THE RED QUEEN*, *supra* note 3, n.37.

68. *Id.* at n.15 (quoting a "long-time observer of Chinese standards" as speculating that the WAPI case arose as a "result of pressures from parts of former military bureaucracies which had been absorbed into MIIT but not Assimilated").

69. *Id.* at 37 (TD-SCMA, discussed *infra* notes, incorporates 148 patents, of which only 30% are owned by Chinese firms).

70. *Id.*

71. Time Division Synchronous Code Division Multiple Access.

72. 2014 USTR REPORT 2014, *supra* note 45, at 66-67.

73. According to the 2014 USTR Report, "In November 2013, however, China licensed 4G spectrum in a manner that is not technology neutral, as it licensed only the domestically favored Long-Term Evolution (LTE) standard known as LTE-TDD and not the other common standard known as LTE-FDD." *Id.*

Yet, at no point have “foreign” telephony standards been actually excluded from China. As with other divergent Chinese standards, market forces are frequently enough to outweigh whatever favoritism is inconsistently bestowed by the state.⁷⁴ Government favor (not to mention arguably superior technology) has not been enough to keep China Mobile’s TD-SCDMA network from losing market share to China Telecom’s CDMA2000 network and China Unicom’s WCDMA network.⁷⁵ Though currently market-dominant in 4G, China Mobile’s TD-LTE network will face increasing competition in 2015 as China Telecom rolls out its FDD-LTE network⁷⁶ and China Unicom expands its mixed TD/FDD network.⁷⁷ Regardless of which standard wins out, it is unlikely to be a satisfying victory for Indigenous Innovation, since both 4G specifications are multinational in origin and, in fact, are identical in 90 percent of their core technology.⁷⁸

Similarly, in the field of video compression, efforts to develop alternative standards to DVD and Blu-Ray—encouraged directly by the Chinese government—led to the introduction of EVD (Enhanced Versatile Disc) and CBHD (China Blue High Definition), respectively.⁷⁹ Both standards incorporated significant amounts of foreign technology and neither enjoyed much commercial success, even within China.⁸⁰

WAPI aside, China’s willingness to let its homegrown technologies (to the extent they can be described as such) founder suggests that its standards agenda is more complicated than simply fostering Indigenous Innovation for its own sake. While the policies of the Chinese state are obviously multi-faceted, the primary driver of its aggressive involvement in standards setting may not be protectionism, at least in the narrow sense of sheltering particular domestic industries. And, whether or not by design, the more striking effect of this push may be to nudge international norms

74. BREZNITZ & MURPHREE, *THE RISE OF CHINA*, *supra* note 38, at 37.

75. *Id.* n.31.

76. Trefis Team, *FDD-LTE 4G Licenses Could Get China Telecom Back In The Race*, FORBES (June 25, 2014, 1:36 PM), <http://www.forbes.com/sites/greatspeculations/2014/06/25/fdd-lte-4g-licenses-could-get-china-telecom-back-in-the-race/>.

77. Trefis Team, *China Unicom Announces Ambitious 4G Goals For 2015 Despite Sluggish Current Performance*, FORBES (Nov. 26, 2014, 8:43 AM), <http://www.forbes.com/sites/greatspeculations/2014/11/26/china-unicom-announces-ambitious-4g-goals-for-2015-despite-sluggish-current-performance/>.

78. See Nokia Siemens Networks, *TD-LTE Whitepaper* (2010) at p. 4., available at http://www.mforum.ru/arc/20110319_NSN_TD-LTE_WhitePaper_MForum.pdf. Notably, Finnish multinational Nokia has been a vocal advocate for TDD-LTE. See also Nokia Solutions and Networks, *TD-LTE Fact Sheet* (2014), available at http://networks.nokia.com/sites/default/files/document/nokia_td-lte_fact_sheet_0.pdf.

79. See Dan Breznitz & Michael Murphree, *Innovation in China: Fragmentation, Structured Uncertainty, and Technology Standard*, 2013 CARDOZO L. REV. DE NOVO 196, 206, 210 (2013) [hereinafter Breznitz & Murphree, *Innovation in China*].

80. *Id.*

towards a paradigm more broadly favorable to China's economic interests and perhaps more consonant with Chinese attitudes towards proprietary technology generally.

D. Standardization and Its Discontents

China's manufacturing industry, the engine of its economic miracle, is haunted by the threat of ballooning production costs due to patent royalties, their already-thin profit margins choked by the increasingly dense foliage of the modern patent thicket.⁸¹

This concern is illustrated especially well in the digital-video cases mentioned above. By 2003, China was manufacturing 75% of the world's DVD players.⁸² However, adhering to DVD's rigid video-encoding standards meant paying substantial patent royalties to the Japanese, American and European companies that had developed and (in the Chinese view) imposed the standard internationally.⁸³ With no leverage to negotiate lower rates for this monopolized asset, fierce price competition and the high variable costs of this production input drove profits down to one dollar per unit by 2004.⁸⁴ The development of EVD, while ultimately a commercial failure, broke DVD's monopoly, and the presence of a much-cheaper competitor drastically drove down licensing rates for the embedded technology.⁸⁵ A similar sequence played out with Blu-Ray and CBHD.⁸⁶

Using competing technologies to force royalty concessions—effectively, driving

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81. See BREZNITZ & MURPHREE, *THE RISE OF CHINA*, *supra* note 38 at 2. Once again, this concern is especially acute with respect to ICT, which, by its nature, not only requires a particularly high degree of interoperability—*supra* note 38 at 2—but also usually incorporates a particularly weighty catalogue of patented technology, particularly software. See Andrew Updegrove, *ICT Standard Setting Today: A System Under Stress*, 6 CONSORTIUM STANDARDS BULL. (2007), available at <http://www.consortiuminfo.org/bulletins/apr07.php#feature> (ICT standards unusually susceptible to infringing patents). While the causes are disputed, the staggering increase in software patents is undeniable. See James E. Bessen, *A Generation of Software Patents* 26 (B.U. Sch. of Law Working Paper No. 11-31, 2011), <http://ssrn.com/abstract=1868979> (showing the annual grant of U.S. software patents rising from less than 5,000 for most of the 1980's to nearly 40,000 in 2009). The sheer number of patents in circulation increases the risk that patent thickets will coalesce, potentially choking innovation, especially where standards are involved. Carl Shapiro, *Navigating the Patent Thicket: Cross Licenses, Patent Pools, and Standard Setting*, 1 INNOVATION POL'Y AND THE ECON. 119, 121-22 (2001).
82. See Breznitz & Murphree, *Innovation in China*, *supra* note 79, at 206.
83. *Id.*
84. *Id.* at 207.
85. Prior to EVD, Chinese manufacturers were paying around \$21 per unit to license DVD technology. EVD rates were set at \$2/unit, eventually causing DVD patent owners to lower rates to \$12-\$13.50/unit. *Id.* at 209-10.
86. *Id.* at 210-11.

down price by increasing supply—arguably explains much of the Chinese push for alternative technology standards.⁸⁷ But it's merely one aspect of a larger tension. As a consequence of Chinese firms' position in the global supply chain and possibly also of more intangible cultural attitudes towards proprietary technology,⁸⁸ Chinese standardization policy mitigates the perceived commercial drag created when manufacturers are compelled to lease intellectual property rights simply for purposes of international compatibility.

E. SAC goes FRAND

The problems created by the interplay of standards and patents are well-known. Because the adoption of a standard, particularly a *de jure* mandatory standard, shelters technology choice from pure market forces, standard-essential patents (SEPs) are potential windfalls for the owners and inefficient taxes for the users.⁸⁹ In particular, SEP owners can “hold up” manufacturers and consumers, demanding license terms that the value of their technology on its own would never warrant, a problem compounded where a multitude of rights-holders creates “patent stacking” issues.⁹⁰

As a result, many SSOs have guidelines incorporating—to varying degrees—FRAND or RAND commitments: rules that usually require members to disclose any SEP and to commit to licensing on (Fair), Reasonable, and Non-Discriminatory terms.⁹¹

As previously noted, Chinese commentators often regard technology standards as themselves potential “technical barriers” to trade.⁹² The Chinese delegation to the WTO has repeatedly raised the argument that mandatory imposition of proprietary technology standards hampers international trade and that patents in international standards should be subject to some form of FRAND licensing if adherence to those

87. BREZNITZ & MURPHREE, *THE RISE OF CHINA*, *supra* note 38, at 34.

88. Fewer Chinese companies than Western ones operate on a business model relying on sale or licensing of intellectual property, and the Chinese standards-setting process in general involves less participation by commercial enterprises (as opposed to academic or research institutions) than in the West. *Id.* at 29-31.

89. See Shapiro, *supra* note 81, at 136-38; COMM. ON INTELLECTUAL PROPERTY MGMT. IN STANDARD-SETTING PROCESS ET AL., NATIONAL RESEARCH COUNCIL, *PATENT CHALLENGES FOR STANDARD-SETTING IN THE GLOBAL ECONOMY* 54 (Keith Maskus & Stephen A. Merrill eds. 2013) [hereinafter *PATENT CHALLENGES*]; Tim Pohlmann & Knut Blind, *The Interplay of Patents and Standards for Information and Communication Technologies*, 37 *PRAXIS DER INFORMATIONSVERRARBEITUNG UND KOMMUNIKATION* 189, 191 (2014).

90. Pohlmann & Blind, *supra* note 89, at 193-94.

91. See *PATENT CHALLENGES*, *supra* note 89, at 1.

92. See *SIMMTESTER.COM*, *supra* note 53.

standards is to be mandatory under the TBT Agreement,⁹³ a seemingly straightforward position that the U.S. insists it cannot even comprehend.⁹⁴

On the national level, much to the consternation of the U.S. Trade Representative, China has emphasized developing standards that rely either on public-domain technology or technology that can be made available at reduced rates.⁹⁵ SAC circulated several draft regulations on patents and standardization, each taking an incrementally more placatory tone in relation to international IP concerns, in 2004, 2009 and 2012.⁹⁶ All three drafts are clear in principle: patents don't belong in mandatory national standards.⁹⁷ Under the 2004 and 2009 drafts, moreover, where a mandatory standard simply must include patented technology, the patent-holder would have been required to negotiate a resolution with SAC, presumably involving a reduced-fee license, and, alarmingly, when such a resolution could not be reached, SAC had authority to impose a compulsory royalty-free license.⁹⁸ In voluntary standards, the earlier proposed regulations would have permitted patented technology only if essential and only if owners of standard-essential patents signed a written declaration agreeing to license their technology on a royalty-free or "substantially lower[ed]" reduced-fee, FRAND basis.⁹⁹

The 2012 draft dropped SAC's compulsory-license remedy in cases of mandatory standards (requiring only negotiation with relevant departments, failing which the standard will be put on hold) and removed the "substantially lower" royalty requirement for SEP-licensing declarations (requiring only that licenses be "fair, reasonable and non-discriminatory" (公平合理无歧视)).¹⁰⁰ These regulations were finally enacted, substantially unaltered, as the Interim Regulatory Measures on National Standards Involving Patents ("Measures on National Standards"), issued

93. Gibson, *supra* note 49, at 1429-1435.

94. After thoroughly reviewing the concerns raised by the Chinese delegation, the U.S.'s representative "could not see any such relationship" between SEP hold ups and the TBT Agreement's focus on removing technical barriers to trade. *Id.* at 1431.

95. 2014 USTR REPORT, *supra* note 45, at 69. The USTR frames such reduced rates as below market, though, of course, the point of RAND licensing terms is to correct the market disruption caused by standardization.

96. D. Daniel Sokol & Wentong Zheng, *FRAND in China*, 22 TEX. INTELL. PROP. L.J. 1, 19-23 (2014), available at <http://ssrn.com/abstract=2335664>.

97. *Id.* at 20, 21, 23.

98. *Id.*

99. *Id.*

100. 国家标准委 国家知识产权局关于发布《国家标准涉及专利的管理规定(暂行)》的公告, [State Provisional Rules on National Standards Involving Patents] (promulgated by the Nat'l Standardization Comm. of the State Intellectual Prop. Office, Dec. 19, 2013, effective Jan. 1, 2014), available at http://www.wipo.int/wipolex/en/text.jsp?file_id=337261.

jointly by SAC and SIPO and effective January 1, 2014.¹⁰¹

While greeted with wary positivity internationally—at least in comparison to previous proposals¹⁰²—the Measures on National Standards are striking in their commitment to defanging patents. Under the regulations, mandatory GBs will never incorporate patented technology unless SAC cuts a deal with the patent holder, effectively ensuring that proprietary technical standards will always, one way or another, be subject to competition (and teeing China up for another WTO/TBT dispute if it decides to mandate a standard in a field where an international standard *does* incorporate patent rights). Furthermore, while FRAND commitments are a common tool among SSOs, “reasonable” is a notoriously slippery legal standard, and it remains to be seen how SAC—given its declared hostility towards SEPs generally—will interpret this requirement.

Chinese courts have already addressed FRAND commitments in the context of the 2008 Anti-Monopoly Law (AML), China’s recently-enacted national antitrust law.¹⁰³ Standardization and patent licensing raise antitrust concerns in many jurisdictions.¹⁰⁴ However, the AML is unique among comparable laws in specifically addressing intellectual property rights, the “abuse” (滥用) of which can constitute a violation,¹⁰⁵ and AML guidelines recently issued by the State Administration of Industry and Commerce (SAIC) emphasize that abusive licensing practices—including charging “unfairly high prices”—can constitute an abuse of market dominance in violation of the AML.¹⁰⁶

In a suit by Chinese telecom giant Huawei¹⁰⁷ against InterDigital, a U.S. company

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101. SIPO, 国家标准涉及专利的管理规定 (暂行) [Interim Regulatory Measures on National Standards Involving Patents], available at http://www.sipo.gov.cn/yw/2013/201401/t20140124_900699.html Non-official English translation available at http://sunsteinlaw.com/wp/wp-content/uploads/2013/01/2013_01_IP_Update_PRC.pdf.
102. See e.g. Letter from Richard Phillips, President, Intellectual Prop. Owners Assoc., to Zhang Chengyu, Standardization Admin. of the People’s Republic of China (Jan. 18, 2013), available at http://www.ipo.org/wp-content/uploads/2013/03/2013.01.18_IPO_Comments_on_SAC_Regulatory_Measures_on_National_Standards_Involving_Patents.pdf
103. Sokol & Zheng, *supra* note 96, at 27-34.
104. Mark A. Lemley, *Intellectual Property Rights and Standard-Setting Organizations*, 90 CALIF. L. REV. 1889, 1901-03 (2002).
105. Sokol & Zheng, *supra* note 96, at 10-11. Article 55 of the AML states that the law does not apply to companies exercising their intellectual property rights unless it is to restrict competition through abuse of those rights. Thus, the AML provisions with respect to monopolistic agreements (Articles 13-16) and abuse of market dominance (Articles 17-19) could apply to patent licensing. Zhonghua Renmin Gongheguo Fan Longduan Fa (中华人民共和国反垄断法) [Antimonopoly Law of the People’s Republic of China] (promulgated by the Standing Comm. Nat’l People’s Cong., Aug. 30, 2007, effective Aug. 1, 2008), 2007 STANDING COMM. NAT’L PEOPLE’S CONG. GAZ. 517, http://www.gov.cn/flfg/2007-08/30/content_732591.htm.
106. Sokol & Zheng, *supra* note 96, at 11-13.
107. As of 2012, Huawei is the largest telecommunications equipment maker in the world. *Who’s afraid of Huawei?*, THE ECONOMIST, Aug. 4, 2012, available at <http://www.economist.com/node/21559922>.

that develops and monetizes wireless technology, the Guangdong High People's Court found that InterDigital's proposed license terms for its SEPs violated Articles 17 and 55 of the AML.¹⁰⁸ It also found that, under Chinese law, the license terms failed to comply with InterDigital's FRAND commitments arising from its participation in the European Telecommunications Standards Institute (ETSI) standard-setting process.¹⁰⁹ Notably, the court imposed a royalty rate calculated by some commentators as "orders of magnitudes lower" than the rate commanded by other telecom SEPs.¹¹⁰

More recently, Nokia was pressured to commit to licensing its patents on FRAND terms in order to gain the approval for their acquisition of Alcatel-Lucent from Chinese regulators (the last holdouts among major national antitrust regulators), who feared the deal would concentrate too many SEPs in the hands of a single company.¹¹¹

Such aggressive interpretations of FRAND represent a stark departure from current global norms. Like the efforts to develop alternative standards discussed in III.B and III.C *supra*, new Chinese regulations like the Measures on National Standards and Article 55 of the AML appear calculated to drive a new patent-licensing paradigm, one where the power of SEPs is greatly diminished, the leverage of patentees neutralized and royalty rates drastically reduced. Given China's robust participation in international standard setting and its undeniable centrality to the global economy, companies at all levels of the innovation supply chain would do well to heed the Chinese vision.

IV. A Patent Portfolio with Chinese Characteristics

Given the increasing number of Chinese patent holders, perhaps Chinese SSOs will begin to receive domestic pushback if they impose overly austere FRAND terms. Conventional wisdom, after all, has suggested that China's reverence for intellectual property rights will blossom in proportion to its own intellectual property holdings.¹¹²

The profile of Chinese applicants, however, may make them less inclined to drive

108. Sokol & Zheng, *supra* note 96, at 30.

109. *Id.*

110. *Id.*

111. Liam Tung, *China gives nod to Nokia-Alcatel deal after extracting patent promise*, ZDNET (Oct. 19, 2015, 12:16 PM), <http://www.zdnet.com/article/china-gives-nod-to-nokia-alcatel-deal-after-extracting-patent-promise>.

112. Jonathan Landreth, *What Chinese companies want: intellectual property protection*, CHRISTIAN SCIENCE MONITOR (Apr. 13, 2012), <http://www.csmonitor.com/World/Asia-Pacific/2012/0413/What-Chinese-companies-want-intellectual-property-protection>.

hard bargains in licensing their patents. In contrast to the U.S., many are universities and research centers who are motivated to pursue and patent their research and to participate in standards development by factors other than the ability to aggressively monetize their IP rights, for example, by acquiring prestige, tenure, state benefits, or the all-important Chinese intangible *guanxi*.¹¹³

Even profit-driven Chinese tech companies tend to be less focused on pursuing a technology-licensing-based business model than are their European or U.S. counterparts.¹¹⁴ The Chinese companies with large R&D capacities tend to derive most of their revenue from selling tangible goods and are therefore more ambivalent about policies that might lower the cost of patent licenses, which they often view more as production inputs rather than products unto themselves.¹¹⁵

Nevertheless, Chinese firms are not indifferent to their patent portfolios. One solution to the problems associated with patent thickets—the risks and transaction costs associated with fields like IT involving large numbers of potentially blocking patents—is cross-licensing and the creation of “patent pools,” agreements whereby multiple patent holders agree to grant the licenses to multiple patents to one another or to third parties as a package.¹¹⁶ Patent pools are crucial in IT due to the particularly dense collection of complementary patents necessary to implement a single technology.¹¹⁷

However, patent pools can also have anti-competitive effects, and Chinese firms have long complained of being shut out of Western patent pools and charged exorbitant royalty rates by collusive patent cabals.¹¹⁸ Since IT patent pools often bundle together potentially substitutive technologies, the companies involved are accused of, effectively, price-fixing.¹¹⁹ Stockpiling a patent arsenal of their own may advantage Chinese IT companies in a variety of ways: gaining entrance to patent-pool negotiations, setting up competing pools, putting downward pressure on prices, and generally providing a counter-deterrent to aggressive strategic IP behavior by foreign firms.

For these purposes, the supposed lack of quality of Chinese patent applications¹²⁰ may matter less than their sheer quantity. Individual patents within a pool often have little or no value by themselves.¹²¹ Furthermore, software patents—a core

113. BREZNITZ & MURPHREE, *THE RISE OF CHINA*, *supra* note 38, at 29-32.

114. *Id.*

115. *Id.*

116. Shapiro, *supra* note 81, at 134-37.

117. *See Id.*

118. Zhan & Zhu, *supra* note 5, at 194-95.

119. *Id.*

120. *See Patents, yes; ideas, maybe*, THE ECONOMIST, *supra* note 30; *Valuing Patents*, THE ECONOMIST, *supra* note 31.

121. Shapiro, *supra* note 81, at 134.

component of the intellectual property rights involved in IT—have classically unpredictable boundaries, making their inclusion in patent pools less a matter of technical necessity than of addressing the risk of inadvertent infringement.¹²² All that's needed is to find a sufficient number of patents with the theoretical potential to hold up a standard or provide substitutes for some of the claims that the standard incorporates.

Between increased Chinese participation in international patent pools, competing patent pools dominated by Chinese technology and increased pressure to impose strict FRAND commitments on standards, it may become more difficult in the near future for IT patent holders to obtain the same rents they have sought in the past. For companies built around developing and exporting the fruits of R&D, this could be destabilizing.

For others, though, it could be a boon. Hardware factories in the Pearl River Delta aren't the only companies that rely on patented technologies as a production input and who may be inclined to view high stacked royalties as a burden and patent thickets as a source of risk and inefficient transaction costs. Moreover, research, like production before it, is becoming a geographically fragmented global activity. Multinational corporations increasingly make use of the cheap engineering talent available in China's research hubs.¹²³ Thus, while the bounties of innovation may fall, the costs could drop in tandem.

V. Conclusion

China's patent and standards activity has the potential to dramatically affect the global tech economy. However, the impact is likely to be more complex than that suggested either by the dream of indigenous innovation promoted in China or by the threat of techno-nationalism decried in the west.

Though perhaps motivated in part by a desire to raise retaliatory trade barriers in response to perceived trade barriers created by Western companies, China's development of alternative technical standards is just as important in pressuring SEP rights holders—both foreign and domestic—into concessions on licensing terms. It is a strategy that dovetails with the apparent policy priorities of Chinese representatives at international SSOs and with the aggressive Anti-Monopoly Law and Standardization regulations recently enacted at the national level.

Meanwhile, absorbing a massive influx of Chinese brainpower into the globalized

122. Bessen, *supra* note 81, at 10-11.

123. BREZNITZ & MURPHREE, *RUN OF THE RED QUEEN*, *supra* note 3, at 106-08. *See also* Branstetter, Li & Veloso, *supra* note 32.

research supply chain and into international patent pools seems likely to both increase the scale of these pools and to promote greater involvement by the producers of actual technology products, parties with an interest in lowering rather than maximizing royalty rates.

Just as there were winners and losers when the world economy was disrupted by cheap Chinese manufactured goods, the sudden surge in Chinese intellectual property will hurt some foreign firms and help others. Companies whose businesses are built around extracting large bounties from their blocking patents may find their profit margins harder to maintain. On the other hand, companies on the consumption end of tech licenses may benefit from cheaper inputs and reduced transaction costs, and large multinationals may wring productivity dividends from another shift towards geographic fragmentation, this time in research rather than production.