CARDOZO LAW REVIEW
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USING VALUATION-BASED DECISION MAKING TO INCREASE THE EFFICIENCY OF CHINA'S PATENT SUBSIDY STRATEGIES

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> *"Science and technology hold the key to China's economic prosperity and sustainable development."*
>
> Former Chinese Premier Wen Jiabao[1]

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[1] *Chinese Premier Shares Vision for China's Future*, XINHUA (June 27, 2011, 11:48 PM), http://news.xinhuanet.com/english2010/china/2011-06/27/c_13952814.htm.

INTRODUCTION

China is working to increase its creation of indigenous technological inventions and become a more technology-based economy.[2] New technologies create new products, new markets, new processes for doing business, and even new industries, while improving an economy's overall efficiency and competitiveness. While China's economy has grown at an average annual rate of close to 10% over the last three decades[3]—one of the highest periods of sustained economic growth in history—that growth has not been fueled by indigenous inventions. China's ability to accumulate the technology needed to support its economic growth has primarily come through technology importation.[4] Instead of relying on indigenous technology creation,

2 *See e.g.*, NAT'L DEV. & REFORM COMM'N OF THE PEOPLE'S REPUBLIC OF CHINA (NDRC), THE OUTLINE OF THE ELEVENTH FIVE-YEAR PLAN FOR NATIONAL ECONOMIC AND SOCIAL DEVELOPMENT OF THE PEOPLE'S REPUBLIC OF CHINA, at Chaps. 1 and 7 (2006), *available in English at* http://en.ndrc.gov.cn/hot/t20060529_71334.htm [hereinafter *Outline of Eleventh Five-Year Plan*]; THE STATE COUNCIL OF THE PEOPLE'S REPUBLIC OF CHINA, THE NATIONAL MEDIUM- AND LONG-TERM PROGRAM FOR SCIENCE AND TECHNOLOGY DEVELOPMENT (2006–2020) (2006), *available in English at* http://www.cstec.org/uploads/files/National%20Outline%20for%20Medium%20and%20Long%20Term%20S&T%20Development.doc [hereinafter *Science and Technology Development Plan*]; THE STATE COUNCIL OF THE PEOPLE'S REPUBLIC OF CHINA, OUTLINE OF THE NATIONAL INTELLECTUAL PROPERTY STRATEGY (June 5, 2008), *available in English at* http://english.gov.cn/2008-06/21/content_1023471.htm [hereinafter *The National IP Strategy*]; STATE INTELLECTUAL PROPERTY OFFICE (SIPO), NATIONAL PATENT DEVELOPMENT STRATEGY (2011–2020) (Nov. 11, 2010), *available in English at* http://graphics8.nytimes.com/packages/pdf/business/SIPONatPatentDevStrategy.pdf [hereinafter *The Patent Strategy*].

3 Arthur R. Kroeber, *Why Financial Reform is Critical for China's Growth*, BROOKINGS (2012), *available at* http://www.brookings.edu/research/papers/2012/03/19-china-financial-reform-kroeber.

4 JOHN L. ORCUTT & HONG SHEN, SHAPING CHINA'S INNOVATION FUTURE: UNIVERSITY

various government policies have sought to entice foreign businesses to transfer their technology to China.[5] China's leadership has concluded that its technology importation strategy has "run its course"[6] and that Chinese inventors need to play a greater role in the country's economic future.[7]

Encouraging Chinese inventors to obtain more patents plays a major role in China's policies to increase indigenous inventions.[8] China's National Patent Development Strategy (2011–2020)[9] (the Patent Strategy), for example, establishes specific, quantitative targets for Chinese inventors to achieve by 2015. By that time, the Patent Strategy calls for China to rank in the top two patenting countries as measured by the number of invention-type patents[10] granted to domestic inventors.[11] The Patent Strategy also calls for Chinese inventors to double overseas patent applications from 2010 to 2015.[12] It should come as little surprise that China's indigenous innovation policy encourages Chinese inventors to obtain more patents as patents offer a powerful market-based tool to incentivize the creation, development, and use of technological inventions.[13] By providing enforceable and transferable property rights in an invention, patents help to motivate each step in the inventive process—from the earliest stages of research and development to the commercialization of the invention.

What is somewhat unique about China's indigenous innovation

TECHNOLOGY TRANSFER IN TRANSITION 174–75 (2010).

5 *Id.*; *see also* Cong Cao, Richard P. Suttmeier & Denis Fred Simon, *China's 15-Year Science and Technology Plan*, PHYSICS TODAY, Dec. 2006, at 38, 39, *available at* www.levin.suny.edu/pdf/Physics%20Today-2006.pdf.

6 Cao, Suttmeier & Simon, *supra* note 5.

7 *See e.g.*, *Outline of Eleventh Five-Year Plan*, *supra* note 2; *Science and Technology Development Plan*, *supra* note 2; *The National IP Strategy*, *supra* note 2; *The Patent Strategy*, *supra* note 2.

8 *See infra* Part I, Table 1.

9 *The Patent Strategy*, *supra* note 2.

10 China's patent system provides for three types of patents: invention patents; utility patents; and design patents. China's Patent Law, Art. 2). China's Patent Law is available in English at http://www.lexisnexis.com/documents/pdf/20100211022732_large.pdf. Invention patents tend to be the most valuable and technologically sophisticated of the three categories of patents; they are roughly the equivalent to the United States' utility patents, receive twenty years of protection from the date of filing, and receive a thorough substantive examination. *See* China's Patent Law, Art. 39, 42. Utility model and design patents in contrast only receive ten years of protection from the date of filing and are only subject to a preliminary examination. *See* China's Patent Law, Art. 40, 42. Invention patents are typically more valuable than utility model and design patents, which are sometimes derisively referred to as "petty" patents or "junk" patents. RICHARD P. SUTTMEIER & XIANGKUI YAO, CHINA'S IP TRANSITION: RETHINKING INTELLECTUAL PROPERTY RIGHTS IN A RISING CHINA, NAT'L BUREAU OF ASIAN RESEARCH, NBR SPECIAL REPORT NO. 29, at 14 (July 2011).

11 *The Patent Strategy*, *supra* note 2, at 4 (Part III).

12 *Id.*

13 *See* WILLIAM J. MURPHY, JOHN L. ORCUTT & PAUL C. REMUS, PATENT VALUATION: IMPROVING DECISION MAKING THROUGH ANALYSIS 23 (2012).

policy, however, is its use of subsidies to encourage patent applications and its recognition that such subsidy programs need to be carefully designed in order to generate higher-quality patents.[14] China has used a number of crude tools, including patent fee subsidy programs, to encourage patent applications for quite some time.[15] The results of these efforts have been mixed. On the one hand, patent applications by, and patent issuances to, Chinese inventors have soared.[16] As of 2010, there were more than 1.8 million domestic patents in force in China.[17] On the other hand, the quality of a significant portion of these patents is questionable.[18] China's patent policies, including its patent fee subsidy programs, have encouraged inventors to obtain many patents, but not necessarily many valuable patents.

The Chinese government has grown concerned that its patent fee subsidy programs have not funded the most deserving patents, and thus they no longer wish to spend public resources to promote low-value patents. Instead, the government would prefer subsidy programs that encourage the most deserving patents. The Patent Strategy reflects this desire, as the fourth strategic focus of the Patent Strategy recognizes the need to "[o]ptimize [China's] patent subsidy policy and further define the orientation to enhance patent quality."[19] This Article explains how a disciplined and transparent valuation-based decision making process

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[14] *The Patent Strategy*, *supra* note 2, at 8 (Part IV.4).

[15] *See e.g.*, Willy Shih et al., *Office of Technology Transfer—Shanghai Institutes for Biological Sciences*, Harvard Business School Case Study No. 9-611-057, 3–4 (2011):

> Many . . . factors also drove up the number of patents in China, most notably, improper uses of patent applications as required by the policies or rules of various governmental agencies or academic institutions. For example, governmental funding agencies usually required one or more patents to be filed at the end of a research grant period, which caused many grant recipients to have to find something to file without even considering the commercial value. In some universities or institutions, graduate students can graduate only if they either publish a scientific paper or file a patent, which caused some students to file junk patents in order to graduate. Other improper uses included giving advantages to people who had patent applications when evaluating for job promotions.

[16] In 2010, Chinese inventors filed 293,066 invention-type patent applications and received 79,767 invention-type patent grants. 2011 CHINA STATISTICAL YEARBOOK ON SCIENCE AND TECHNOLOGY, NAT'L BUREAU OF STATISTICS, MINISTRY OF SCI. & TECH. 180–81 (2011). In 1995, by comparison, Chinese inventors filed only 10,018 invention-type patent applications and received only 1,530 invention-type patent grants. *Id.*

[17] *Id.* at 182.

[18] *See e.g.*, Mark Liang, *Chinese Patent Quality: Running the Numbers and Possible Remedies*, 11 J. MARSHALL REV. INTELL. PROP. L. 478, 482, 491–514 (2012); Henry Koda, *The Global Patent Race*, 24 NO. 1 INTELL. PROP. & TECH. L.J. 21, 22 (2012) (referencing quality concerns expressed by others); Mark Cohen (speaking on a moderated panel), *China's Current Intellectual Property Plan, Policies & Practices*, 15 SMU SCI. & TECH. L. REV. 17, 28 (2011); Joff Wild, *Telling It How It Is*, 48 INTELL. ASSET MGMT. 67, 72–73 (2011); *Innovation in China: Patents, Yes; Ideas, Maybe*, ECONOMIST, Oct. 16, 2010, at 78, 78–79.

[19] *The Patent Strategy*, *supra* note 2, at 8 (Part IV.4).

can help the Chinese government design patent fee subsidy programs that allocate funds more consistently to deserving patents. In addition, this Article offers the outline of a practical valuation model the Chinese government could use to filter patent fee subsidy requests.

I. CHINA'S INDIGENOUS INNOVATION POLICY AND ITS CALL TO IMPROVE THE GOVERNMENT'S PATENT SUBSIDY POLICY

China's current indigenous innovation policy can be traced back to its 2006 National Science and Technology Plan (the 2006 Science and Technology Plan). The Science and Technology Plan is embodied in China's Eleventh Five-Year Plan (2006–2010)[20] and the accompanying National Medium- and Long-Term Science and Technology Development Plan (2006–2020).[21] The 2006 Science and Technology Plan makes clear that technological progress is to be the driving force behind China's future economic growth and calls for China to become an "innovative nation" by 2020.[22] To advance the intellectual property initiatives from the 2006 Science and Technology Plan, China's State Council[23] issued the National Intellectual Property Strategy (the National IP Strategy) in 2008.[24] And to implement the patent elements of the National IP Strategy, China's State Intellectual Property Office[25] (SIPO) issued the Patent Strategy in 2010.[26]

Collectively, these three documents guide indigenous innovation policy in China, which calls for China to reduce its dependence on

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20 For an English-language summary of China's Eleventh Five-Year Plan, see *Outline of Eleventh Five-Year Plan*, *supra* note 2. Five-year economic plans were long the driving force for China's economy. When China became a planned economy in the early 1950s, it took to using five-year plans to allocate China's economic resources and efforts. GREGORY C. CHOW, CHINA'S ECONOMIC TRANSFORMATION 44 (2d ed. 2007). As China began to embrace a market-oriented economic approach, five-year plans changed from being a strict resource allocation tool to providing a method for announcing national priorities and key national projects. *See What is the Five-Year Plan?*, CHINESE GOVERNMENT'S OFFICIAL WEB PORTAL (Apr. 5, 2006), http://www.gov.cn/english/2006-04/05/content_245556.htm.

21 *Science and Technology Development Plan*, *supra* note 2.

22 *Outline of Eleventh Five-Year Plan*, *supra* note 2, Chap. 7.

23 The State Council is China's chief executive and administrative body.

> The State Council of the People's Republic of China, namely the Central People's Government, is the highest executive organ of State power, as well as the highest organ of State administration. The State Council is composed of a premier, vice-premiers, State councillors, ministers in charge of ministries and commissions, the auditor-general and the secretary-general.

The State Council, PEOPLE'S DAILY ONLINE (ENGLISH), http://english.peopledaily.com.cn/data/organs/statecouncil.shtm (last visited Feb. 4, 2013).

24 *The National IP Strategy*, *supra* note 2.

25 SIPO is China's version of the U.S. Patent and Trademark Office.

26 *The Patent Strategy*, *supra* note 2.

foreign technology and increase domestic production of the technological inventions that are needed to drive China's economic growth.[27] One of the major goals in each of the 2006 Science and Technology Plan, the National IP Strategy, and the Patent Strategy is for Chinese inventors to obtain more patents.

Table 1
Patent Targets for Chinese Inventors in China's 2006 Science and Technology Plan, National IP Strategy, and Patent Strategy

2006 Science and Technology Plan	National IP Strategy (2008)	Patent Strategy (2010)
Chinese inventors will rank in the top five countries in receipt of invention-type patents by 2020.[28]	China will rank among the advanced countries in terms of annual number of patents granted to Chinese inventors.[29] Overseas patent applications by Chinese inventors will greatly increase.[30]	China will rank in the top two patenting countries as measured by the number of invention-type patents granted to domestic inventors by 2015.[31] Overseas patent applications by Chinese inventors will double by 2015.[32]

China's government has implemented a number of policies and initiatives to help achieve these targets. Many of these actions have focused on improving China's patent infrastructure, which should indirectly increase the number of domestic patents by lowering the administrative costs for obtaining patents. The Patent Strategy calls for the government to make a number of patent infrastructure improvements, including: enhancing SIPO's capacity to examine patents, which includes increasing the number of patent examiners and developing more efficient examination procedures;[33] making patent information more accessible by establishing "a multi-level and multi-

[27] *See Outline of Eleventh Five-Year Plan*, *supra* note 2, Chap. 7; *Science and Technology Development Plan*, *supra* note 2, at 12 (Part II.2), 46–53 (Part VII), 54 (Part VIII.3); *The National IP Strategy*, *supra* note 2, at 1 (Parts I(4), II.2(6)), 2 (Parts II.2(7)), III.2(11)–(12)), 4 (Part V.1(40)); *The Patent Strategy*, *supra* note 2, at 8 (Part IV.4).

[28] *Science and Technology Development Plan*, *supra* note 2, at 12 (Part II.2).

[29] *The National IP Strategy*, *supra* note 2, at 2 (Part II.2(7)).

[30] *Id.*

[31] *The Patent Strategy*, *supra* note 2, at 4 (Part III).

[32] *Id.*

[33] *Id.* at 9 (Part IV.5).

aspect information public service system for patents;"[34] improving administrative and judicial patent protection, with the goal of lowering the cost of enforcing patent rights;[35] accelerating development of a patent service industry that involves "information retrieval, analysis, early warning, data processing, database building, patent consultation, transaction, trust, assets appraisal and pledge loans;"[36] strengthening patent management functions in government-controlled entities;[37] and making patents an integral part of China's economic development policy.[38]

In addition to these indirect efforts to boost domestic patenting activities, the Patent Strategy also calls for a number of direct efforts. The Patent Strategy, for example, calls for the Chinese government to conduct a study to determine appropriate inventor rewards in government-funded research projects[39] and to provide preferential policies, including tax incentives, to encourage businesses to produce patents.[40]

One of the Patent Strategy's most direct efforts to increase domestic patent activity is the use of patent fee subsidies to encourage patent filings. For more than ten years now, various levels of the Chinese government have implemented patent fee subsidy programs to cover costs associated with obtaining patents. In 1999, the Shanghai municipal government implemented "Subsidization Measures of Patent Fees in Shanghai."[41] Shanghai is not alone in this approach; numerous local governments have employed similar programs.[42] The early patent subsidy programs appear to have focused primarily on subsidizing the costs for filing patents in China.[43] More recent patent fee subsidy programs focus on subsidizing foreign patent application fees. For example, SIPO operates a special fund[44] to subsidize foreign patent applications filed under the Patent Cooperation Treaty (the SIPO Patent

34 *Id.* at 11 (Part IV.8).

35 *Id.* at 9–10 (Part IV.6).

36 *Id.* at 11–12 (Part IV.9). The industry development may involve privatizing government patent information service agencies. *Id.*

37 *Id.* at 7 (Part IV.3).

38 *Id.* at 6–7 (Part IV.2).

39 *Id.* at 8 (Part IV.4).

40 *Id.* at 7 (Part IV.2).

41 Wen Jiachun, Zhou Yongtao & Zhu Xuezhong, *Research on Patent Fees Subsided by Local Government in China*, 2008 INT'L CONF. ON INFO. MGMT, INNOVATION MGMT & INDUS. ENG'G 270 (2008).

42 *See id.*

43 *See id.*

44 Chinese Ministry of Finance Memo, Notice of the Ministry of Finance on Issuing the Interim Measures for the Administration of Special Funds for Subsidizing Foreign Patent Applications (Aug. 28, 2009), *English version available at* http://www.lawinfochina.com/display.aspx?lib=law&id=7806 [hereinafter *The Memo*].

Subsidy Program).[45] The SIPO Patent Subsidy Program is restricted to Chinese small- and medium-sized companies, public institutions (including universities), and government research institutions.[46] Successful applicants may receive funding to cover application fees, examination, maintenance, and issuance fees, as well as patent agent or attorney fees, search fees, and other related expenses incurred by the patent agent or attorney.[47] The SIPO Patent Subsidy Program subsidizes these fees for up to five countries (or regions) at a level of up to Rmb 100,000 (roughly US$ 15,000) per country (or region).[48]

Evidently, the Chinese government has developed concerns that its various subsidy programs are not subsidizing the right patents.[49] While not retreating from the use of patent fee subsidies, the fourth strategic focus of the Patent Strategy states the need to "[o]ptimize [China's] patent subsidy policy and further define the orientation to enhance patent quality."[50] The Chinese government is looking to deploy its subsidy resources more efficiently to promote patent quality, rather than just patent quantity.

II. SUBSIDY PROGRAMS BENEFIT FROM VALUATION-BASED DECISION MAKING

Market failure is the typical justification for governments to intervene in private market transactions.[51] A market failure occurs when some barrier or inefficiency in the market causes significant allocation efficiencies.[52] In the case of developing technological inventions and obtaining patents, there are a number of well-documented market failures. Two of the more commonly cited causes for market failures in the inventive process (invention to market) are the free-rider problem and the uncertainty problem.

The free-rider problem arises because the inventive process does

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45 "The Patent Cooperation Treaty makes it possible to seek patent protection for an invention simultaneously in each of a large number of countries by filing an 'international' patent application. Such an application may be filed by anyone who is a national or resident of a PCT contracting State. It may generally be filed with the national patent office of the contracting State of which the applicant is a national or resident or, at the applicant's option, with the International Bureau of WIPO in Geneva." *Summary of the Patent Cooperation Treaty (PCT) (1970)*, WORLD INTELL. PROP. ORG., http://www.wipo.int/treaties/en/registration/pct/summary_pct.html (last visited Feb. 7, 2013).

46 *The Memo*, *supra* note 44, Article 3.

47 *Id.* at Article 6.

48 *Id.* at Article 5.

49 *The Patent Strategy*, *supra* note 2, at 8 (Part IV.4).

50 *Id.*

51 THOMAS J. WEBSTER, MANAGERIAL ECONOMICS: THEORY AND PRACTICE 687 (2003).

52 *See* CHRISTINE GREENHALGH & MARK ROGERS, INNOVATION, INTELLECTUAL PROPERTY, AND ECONOMIC GROWTH 17 (2010).

not generate an easily protectable good or service. Instead, it generates knowledge, which suffers from a problem that economists refer to as "free-riding."[53] It is inherently difficult to prevent others from copying knowledge without paying the knowledge producer.[54] "Knowledge spillover" is another way to describe this problem. Private sector research and development generates both "private returns"—returns for which the knowledge producer is compensated—and "social returns"—returns for which the knowledge producer is not capable of being compensated. Numerous studies have shown that the social returns from private-firm research and development investment can be substantial.[55] Because firms cannot capture the full value of their inventive efforts, the private sector is likely to underinvest in research and development.[56] And patents appear to provide only a partial solution to this free-rider/knowledge spillover problem.

The uncertainty problem is inherent to the inventive process.[57] Inventions involve new technologies that may not work as planned or may not scale to useful levels. They also lack a historical track record of proven economic returns. This uncertainty makes judging new technologies' future performance particularly difficult. The increased difficulty in projecting the future performance of inventions prevents informed decisions as to whether (and how much) to invest in such projects.

Such problems can create a considerable gap in the innovation system that, if unaddressed, prevents the creation and commercialization of an optimal level of technological inventions. Economic theory suggests that well-designed and implemented government subsidies can reduce the impact of these market failures by counterbalancing the private sector's underinvestment in research and development.[58] But government subsidies present their own set of problems. If the government is not capable of identifying which

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53 MURPHY, ORCUTT & REMUS, *supra* note 13, at 104–05.

54 Knowledge can be described as being "nonrival" (i.e., it can be used by an infinite number of people at the same time without depriving any person of its use) and only "partially excludable" (i.e., it is difficult to exclude unintended parties from benefiting from ideas). Paul Romer, *Endogenous Technological Change*, 98 J. OF POL. ECON. S71, S74 (1990).

55 Kenan Patrick Jarboe & Robert D. Atkinson, *The Case for Technology in the Knowledge Economy—R&D, Economic Growth, and the Role of Government*, PROGRESSIVE POLICY INSTITUTE POLICY BRIEFING 5 (June 1998); *see also* JOSEPH CORTRIGHT, U.S. ECONOMIC DEVELOPMENT ADMINISTRATION, NEW GROWTH THEORY, TECHNOLOGY AND LEARNING: A PRACTITIONER'S GUIDE, REVIEWS OF ECONOMIC DEVELOPMENT LITERATURE AND PRACTICE, NO. 4, at 7 (2001), *available at* www.rosecommunitydevelopment.org/New_Growth_Theory.pdf. Because the original knowledge producer is not compensated for these social returns, they are unlikely to serve as incentives for private research and development decisions.

56 *See* GREENHALGH & ROGERS, *supra* note 52, at 17–18.

57 *Id.* at 21.

58 *See generally id.* at 24–25.

research and development projects should be subsidized and which should not, valuable public resources will be wasted and the competitive market for conducting research and development could be damaged.[59]

For purposes of this Article, we are not taking a position on whether China's patent subsidy programs will provide a net benefit to China and its overall innovation system or whether they will cause a net detriment. Instead, we are taking as a given that the Chinese government will operate one or more patent subsidy programs. The focus of this Article and its proposed solution is how to improve the efficiency of such patent subsidy programs so that even if they turn out to cause a net detriment to China's overall innovation system, that detriment is minimized. If the patent subsidy programs turn out to be beneficial, such benefits can be maximized under the solution proposed in this Article.

When the government decides to subsidize a private market transaction, concerns justifiably arise that the government's actions will lead to wasteful resource deployment. This concern stems from skepticism about the government's competence (is the government decision maker capable of consistently making good decisions?) and motivations (will the government decision maker be corrupt?). In the context of Chinese patent fee subsidy programs, the main question is: will the Chinese government consistently be able to subsidize applications for the most deserving patents, or will it regularly ignore the most deserving patents and instead subsidize weak patents that do not warrant patent application funding? Fortunately, there are a number of relatively simple valuation techniques that can be employed that would greatly facilitate the Chinese government's allocation decisions regarding patent fee subsidies. Employing these relatively simple valuation techniques can improve the likelihood such subsidy programs improve China's indigenous production of valuable commercial technology.

III. VALUATION-BASED DECISION MAKING

Every decision involves a value determination. When one alternative is chosen over another, the decision maker has, either consciously or subconsciously, valued the chosen decision higher than the competing choices.[60] If a company decides to acquire Asset A rather than Asset B, the firm has determined the net benefits that will come from owning Asset A are greater than if the company acquired Asset B.

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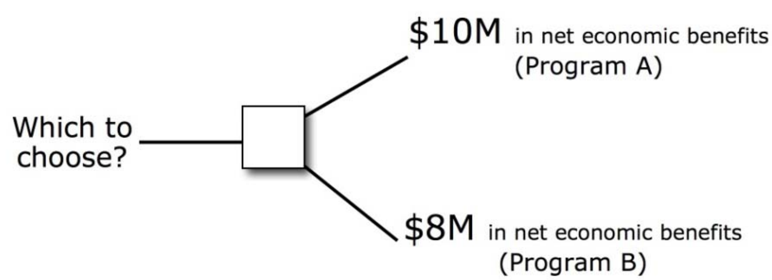
59 Some of the risks to the competitive market for conducting research and development include crony capitalism or collusive capitalism.

60 MURPHY, ORCUTT & REMUS, *supra* note 13, at 43.

If the government decides to fund Program A and not Program B, the government has decided the net benefits from Program A are greater than for Program B.

Figure 1
Choosing Between Government Programs Based on Net Economic Benefit



Decisions can be significantly improved by recognizing they can be quantified, compared, and evaluated.[61] The decision maker can determine the value of the decision in terms of a quantifiable, common measurement—usually money—and then make an apples-to-apples comparison to alternatives based on the common measurement.[62] Take the example of the above government funding decision between Programs A and B. Assume the primary purpose of the programs is to create jobs for purposes of general economic development. If the decision maker can project (a) the economic benefit that will come from each program's job creation and (b) the cost of funding and running each program, then she can then choose the program that will generate the greatest net economic benefit (see Figure 1). For those decision makers who purposefully or inadvertently try to avoid valuation analyses, their avoidance efforts will not be successful.[63] Every decision involves choosing one option over another, which, by definition, means the decision maker valued the option chosen as better than the other option along some dimension (e.g., creates more jobs or generates more profits). Whether or not the values used or implied in making the decision are logically derived, consistent or sufficiently encompassing is another matter and one that can be addressed by proactively approaching the decision making process with a disciplined valuation methodology.

Up to this point, few would disagree with the basic premise that

[61] *Id.* at ix.
[62] *Id.* at 43.
[63] *Id.* at 4.

valuation analysis improves decision making. We seldom meet resistance with the theoretical benefits that valuation can generate. Where we meet resistance, however, is from those who are skeptical about valuation's practical application. That line of critique questions how valuation can practically be implemented into basic decision making. In fact, there are two primary reasons valuation analysis may appear too onerous for general use in broader decision making: (1) belief that valuation analysis (in particular for patents) is too complicated and expensive to perform and requires valuation experts to do it properly; and (2) concern that valuation analyses are likely to be inexact and flawed.[64]

The first concern is simply wrong. While expert guidance and assistance can be beneficial, most valuation techniques (even those for patents) are within the understanding of anyone with a willingness to learn and an open mind.[65] The second concern is a bit more subtle. Valuation is not a one-size-fits-all endeavor.[66] There is no single approach to valuing decision alternatives. Moreover, there is no single approach for how much to invest in a particular valuation effort or what level of accuracy is required for the effort to be worthwhile. For some decisions, the valuation effort needs to be quite extensive and extremely accurate to be useful. For other decisions, a less extensive and less accurate effort could still be beneficial to the decision maker. Sometimes just the benefits generated by the disciplined thought process that valuation requires can justify a valuation effort.

A. *Using a Relative Value Technique to Guide Chinese Patent Fee Subsidy Programs*[67]

In the case of a patent fee subsidy program, each funding decision tries to determine whether to invest public funds to bring about a given patent. In 2010, 293,066 domestic applications for invention-type patents were filed with SIPO.[68] Even if only 0.1% of those patents were eligible for a subsidy program, 3,000 patents would still need to be evaluated. For that size decision, a less extensive and less accurate, but still logical and disciplined, valuation approach is all that is realistic.

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64 *Id.* at 53.

65 *Id.*

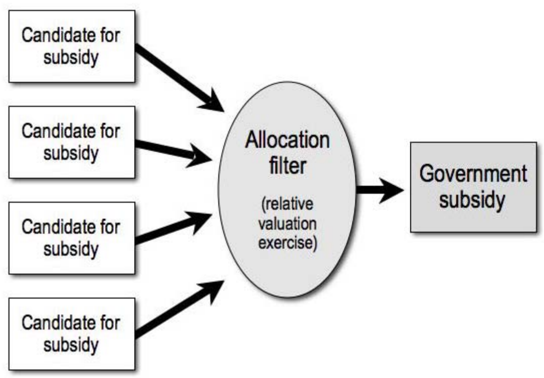
66 *Id.* at 54.

67 The relative value technique proposed in this paper is an example of an *analytic hierarchy valuation process* and is based on a valuation technique proposed in MURPHY, ORCUTT & REMUS, *supra* note 13, at 58–65. The relative value technique proposed in this article is a specific application of the more general technique described in that book.

68 2011 CHINA STATISTICAL YEARBOOK ON SCIENCE AND TECHNOLOGY, *supra* note 16, at 180.

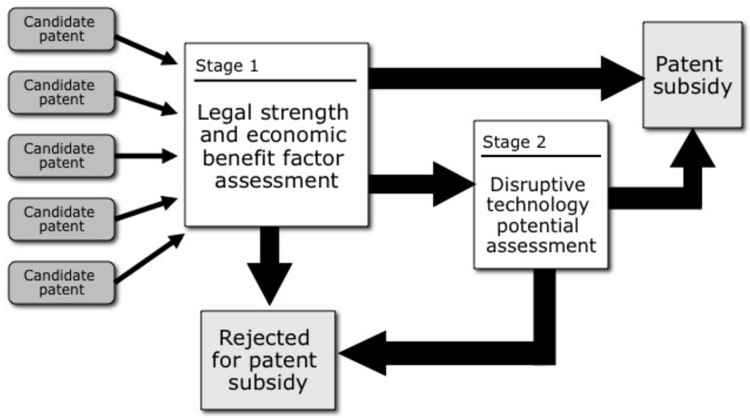
Fortunately, there are facile and inexpensive valuation techniques that could be used to provide the Chinese government with better information for determining which patents to subsidize (see Figure 2). While we do not have enough information about China's various patent fee subsidy programs to craft a truly detailed valuation model for the specific programs, we do have enough information to outline a general technique that provides an idea of how disciplined valuation analysis could be employed to improve subsidy decisions.

Figure 2
Using Valuation as an Allocation Filter



The recommended technique is a two-stage, three-dimensional valuation exercise that we refer to as a "relative value" technique (see Figure 3). This technique is not meant to establish definitive values for the various patents seeking a subsidy, which would be very expensive and cumbersome. Instead, the technique seeks to do two things. First, it identifies and organizes the available information that will affect the future value of the patents along three separate dimensions: (1) the economic importance to China of the patent; (2) the legal strength of the patent; and (3) the disruptive technology potential the patent offers. Second, the technique combines the information in a manner that allows government decision makers to make informed projections about each patent's ability to generate social returns that justify the subsidy.

Figure 3
Diagram of the Relative Value Technique



At the most basic level, the value of a patent depends on an analysis of both its legal and economic elements. Legal factors that affect the value of a patent may include the breadth of the claims,[69] the presence (or absence) of blocking patents,[70] whether the patent covers the critical competitive elements of the invention, whether there is any close prior art,[71] how courts are currently interpreting patents of this type,[72] and the receptivity of foreign jurisdictions to the patent. On the

[69] The legal definition of the invention is set forth in the claims. The claims are, in effect, similar to a deed for real estate in that they set the legal boundaries of the invention. Claims drafting has a major effect on the value of patent rights. If the claims are too narrow, substantial value will be left on the table as other parties may be able to easily invent around the patent. If too broad, however, the claim may be invalidated in a subsequent proceeding.

[70] A blocking patent is a patent that blocks a rights holder on a different patent from exploiting the different patented invention without a license to the blocking patent.

[71] In order to be eligible for a patent, an invention must be "new" or "novel." In the United States, for example, this novelty requirement is contained Section 101 of the U.S. Patent Act. 35 U.S.C. § 101. The term "prior art" refers to the materials (or references) that define the universe of available knowledge that is "pertinent to the novelty inquiry." ROGER E. SCHECHTER & JOHN R. THOMAS, PRINCIPLES OF PATENT LAW 74 (2004).

[72] For example, the value of a "software" patent may depend on how courts are interpreting the rules surrounding the patentability of software. China's Patent Law, for example, excludes rules and methods for mental activities from patent protection. China's Patent Law, Art. 25(2). China's Guidelines for Patent Examination 2010 (the Guidelines) explain that rules and methods for mental activities are not patentable because they do not involve any technical characteristics. The Guidelines, Chap. 1, § 4.2, *available in English at* http://www.sipo.gov.cn/zlsqzn/sczn2010eng.pdf. The Guidelines go on to provide a long list of activities that are considered to be rules and methods for mental activities, including "computer programs *per se*." *Id*. The term "computer programs *per se*" is generally considered to capture software, but the ability to obtain "software patents" can be a bit more subtle due to the definition of "computer programs *per se*" in the Guidelines and how it is differentiated from "computer program-related inventions." ORCUTT & SHEN, *supra* note 4, at 118.

economic side, the subsidy's justification should derive from the social returns the given patent is expected to provide China and its taxpayers. Factors that are likely to generate such social returns may include the size of the future potential market, the strategic importance of the technology sector to China and its economy, job-creation potential, whether the technology compliments other Chinese technology sectors, whether the technology reduces environmental degradation, and the proven track record of the inventor.

A third dimension that we recommend for the relative valuation analysis is what we refer to as "disruptive technology potential." Clayton Christenson used the term "disruptive technology" in a seminal 1997 book[73] to describe unanticipated technologies that displace established technologies and competitors.[74] Classic examples of disruptive technologies include the semiconductor replacing vacuum tubes in the computer industry, digital image and storage chips replacing film and tape in the photography and recording industries, and desktop computers replacing mainframe computers as the primary source of computing power for most businesses. Christenson's thesis for the success of disruptive technologies can be reduced to five basic points:[75] (1) At first, disruptive technologies tend to underperform established technologies along the performance dimensions historically valued by mainstream customers.[76] (2) Disruptive technologies, however, offer other features that a few fringe (and generally new) customers desire.[77] Disruptive technology offerings tend to be "cheaper, simpler, smaller, and, frequently, more convenient to use."[78] (3) The leading firms' most profitable customers are not interested, and

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[73] Christenson's "disruptive technology" work began with an article he co-wrote with Joseph Bower. *See* Joseph L. Bower and Clayton M. Christensen, *Disruptive Technologies: Catching the Wave*, HARV. BUS. REV., Jan.–Feb. 1995, at 43. Christenson built on that work with a best-selling book, which remains the seminal piece on disruptive technology. *See* CLAYTON M. CHRISTENSON, THE INNOVATOR'S DILEMMA: WHEN NEW TECHNOLOGIES CAUSE GREAT FIRMS TO FAIL (1997).

[74] CHRISTENSON, *supra* note 73, at xiv–xviii. Christensen's thesis of disruptive technology is very Schumpeterian in nature. Economist Joseph Schumpeter developed a related concept more than a half century ago the he referred to as "creative destruction." JOSEPH A. SCHUMPETER, CAPITALISM, SOCIALISM, AND DEMOCRACY 83 (3d ed. 1950). A healthy economy is a dynamic organism that is constantly in a state of change and renewal. *Id.* Innovation (the creative part) and competition constantly revolutionize the company from within—"incessantly destroying the old one, incessantly creating a new one." *Id.* By seeking innovations to render their competitors obsolete, innovators create new products, markets, processes for doing business, and even new industries, while inefficient companies, products, and business methods are destroyed. Established competitors, as well as entire industries, are forced out of business if they cannot meet the increased competition, which causes a constant renewal of the economy.

[75] This breakdown of Christensen's thesis was motivated by Gerald J. Tellis, *Disruptive Technology or Visionary Leadership?*, 23 J. PROD. INNOV. MANAG. 34, 34 (2006).

[76] CHRISTENSEN, *supra* note 73, at xv.

[77] *Id.*

[78] *Id.*

probably cannot even use, the disruptive technology when first introduced.[79] As a result, disruptive technology offerings are first commercialized in emerging or insignificant markets and embraced by a market's least desirable customers.[80] (4) While disruptive technologies initially offer worse product performance, the technology improves until it becomes performance-competitive in the mainstream market.[81] (5) Once the disruptive technology becomes performance-competitive, it displaces the dominant technology because it more accurately targets customers needs, including offering a better price.[82]

While disruptive technology potential is related to the economic benefit factor, it is sufficiently different that we recommend treating it as a separate factor. The economic benefit factor measures a technology's ability to succeed in the current market setting based on its ability to interact with established technologies and business practices. The disruptive technology potential seeks to measure the ability of a technology eventually to displace established technologies and business practices and create entirely new markets and practices. Because disruptive technologies tend to underperform established technologies in satisfying customers' current demands, they risk generating a low economic importance score and are easy to overlook when deciding which patents to subsidize. As we will explain below, however, disruptive technologies may be the patents that are most suitable for government subsidies.[83]

B. *Mechanics of the Relative Value Technique*

Complex decisions with multiple dimensions of analysis are difficult to assess without a structure to guard against oversimplification.[84] Determining which patent subsidy candidates will be most valuable to China depends on a considerable number of diverse but interrelated factors. Without a proper valuation structure, collecting, analyzing, and interpreting the relevant information is beyond the capabilities of most humans. To compound matters, few, if any, government decision makers have the combined legal, economic, and technical expertise that is required to truly understand a patent subsidy candidate's potential to benefit China. Finally, the scope of the task limits the amount of resources the government can spend on valuing any

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79 *Id.* at xvii.
80 *Id.*
81 *Id.* at xvi.
82 *Id.* at xvi, xxii.
83 *See infra* Part III.B.2.
84 *See generally* MURPHY, ORCUTT & REMUS, *supra* note 13, at 67–87.

one patent subsidy candidate.

One method to improve decision making in this type of challenging environment is to disassemble the problem into its individual parts, apply focused logic and analytical rigor to each part, and then reassemble the individual parts back into a coherent solution that can be evaluated at the aggregate level.[85] This disassembly process helps the decision maker to identify the individual factors that collectively generate the overall value of the item being valued, generate a better understanding of those individual factors and how they interact to generate value, organize the information so that it can be dealt with in a manageable way, and identify and eliminate extraneous information that is not important to the valuation process.[86] Disassembly also allows multiple evaluators with different areas of expertise to all contribute to the decision-making process.[87] Legal experts can provide information about the legal qualities of the patent without having to worry about a lack of economic or technology expertise. Economists (or business experts) can provide focused information about the patent's economic qualities and technology experts can provide focused information about the quality of the technology. The reassembly process brings these disparate judgments back together so that an informed decision can be made based on the collective knowledge and expertise of the various evaluators.

The relative value technique that we propose provides an inexpensive but powerful disassembly method that: (a) collects the combined legal, economic, and technical information needed to make an informed patent subsidy decision; (b) analyzes that information in a clear, consistent, and transparent manner; and (c) logically assembles that information into a final result that can be readily understood using the visual power of a cluster map.[88] We propose conducting the relative value technique in two stages:

> **Stage one** consists of a preliminary analysis of patent subsidy candidates based on their legal and economic factors. Stage one provides an initial filtering of the candidates to identify which candidates clearly merit a subsidy, which candidates clearly do not merit a subsidy, and which candidates require further analysis.
>
> **Stage two** applies a second filter to those patent subsidy

[85] *Id.* at 69.

[86] *Id.*

[87] *See id.* at 85–86.

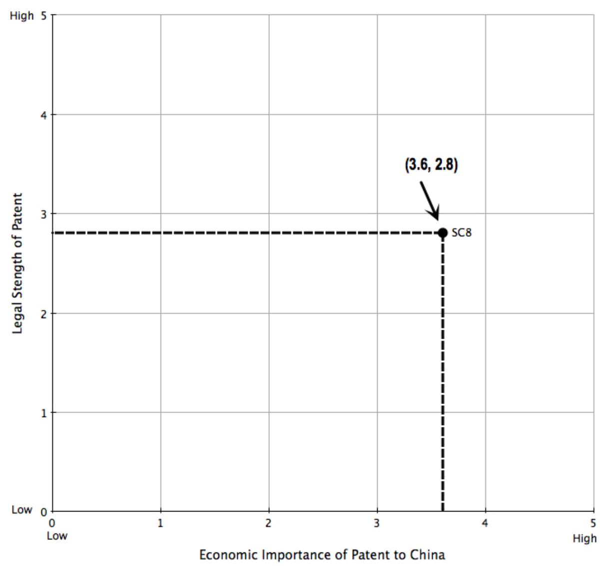
[88] Reduced to its core, valuation analysis has three elements: (1) collecting information inputs; (2) employing valuation techniques that translate the information input into value results; and (3) interpreting the value results. *Id.* at 67. The relative value technique that we are proposing performs each of these three functions.

candidates that require further analysis. Stage two, which is when the disruptive technology potential analysis is introduced, seeks to identify highly speculative candidates that have so much upside potential they warrant a subsidy.

1. Stage One—Analyzing Economic Importance and Legal Strength

Stage one of the relative value technique reduces a patent subsidy candidate's various economic and legal dimensions to *x* and *y* coordinates that can be plotted on a two-axis chart (see Figure 4) that we refer to as a "patent cluster map." The relative value technique allows the valuator (or valuators)[89] to place each patent subsidy candidate on the chart and then use the visual power of the patent cluster map to easily compare the various candidates across their economic and legal dimensions.

Figure 4
Stage One—Plotted Relative Value of a Single Patent Subsidy Candidate on a Patent Cluster Map



89 We recommend having different groups evaluate the different dimensions. Legal experts should evaluate the patent subsidy candidates' legal qualities, economic experts should evaluate their economic quality, and technology experts should evaluate their technology quality. Since the various assessments are later combined for a holistic analysis, using lawyers, economists, and technology experts in the initial valuation provides an excellent method for obtaining their differing areas of expertise.

a. Determine the Economic Importance of the Patent to China

In order to determine the economic importance of the patent subsidy candidate to China, we suggest preparing a uniform "economic importance score sheet" (see Table 2). This uniform score sheet seeks to identify and quantify the various economic factors that are likely to provide social returns to China. The factors listed in Table 2 are simply illustrative. A much more detailed analysis would be required to determine the ideal factors. To obtain more information from the exercise, we recommend weighting the importance of the factors rather than treating all factors as equal. The combined weights of all factors must add up to 1 (or 100 percent). Each factor is scored from 0-to-5 and then multiplied by that factor's weight to yield a factor value. All the factor values are added up to yield a single economic importance value for the patent subsidy candidate, which will be the *x* value on the relative value chart. The uniform score sheet will be used for each patent subsidy candidate uniformly (hence the name "uniform" score sheet) so that apples-to-apples comparisons can be made among the candidates.

Table 2
Example of a Completed Economic Importance Score Sheet

Economic Factor that Generate Social Returns for China	**Weight (0-1)**	**x**	**Score (0-5)**	**=**	**Calculated Factor Value**
Size of the future potential market	0.1	x	4	=	0.4
Strategic importance of the technology sector	0.2	x	3	=	0.6
Job creation	0.3	x	4	=	1.2
Compliments other Chinese technology sectors	0.1	x	4	=	0.4
Reduces environmental degradation	0.1	x	2	=	0.2
Proven track record of the inventor	0.2	x	4	=	0.8
Total of weights must add up to 1.0	1.0				
Add all calculated factor values and plot an *x*-axis →					↓ **3.6**

b. Determine the Legal Strength of the Patent

The legal strength of each patent subsidy candidate must also be evaluated. The process is similar to that used to assess economic importance. We suggest preparing a uniform "legal strength score sheet" (see Table 3). The legal strength score sheet should include the legal factors that affect the ability of a patent holder to profit from the patent, with the factors listed in Table 3 being simply illustrative. As with the economic factor score sheet, the legal strength factors should be weighted, with the combined weights adding up to 1 (or 100 percent). Each factor is scored from 0-to-5 and then multiplied by that factor's weight to yield a factor value. All the factor values are added up to yield a single legal strength value for the patent subsidy candidate, which will be the *y* value on the relative value chart.

Table 3
Example of a Completed Legal Strength Score Sheet

Legal Factors that Impact Patent's Strength	**Weight (0-1)**	**x**	**Score (0-5)**	**=**	**Calculated Factor Value**
Broad claims	0.2		3		0.6
No blocking patents	0.2		2		0.4
Patent covers critical competitive elements	0.3		3		0.9
No close prior art	0.1		1		0.1
Impact of relevant court decisions	0.1		4		0.4
Foreign jurisdictions' receptivity to the patent	0.1		4		0.4
Total of weights must add up to 1.0	1.0				
Add all calculated factor values and plot a *y*-axis →					**2.8**

c. Making the Various Determinations

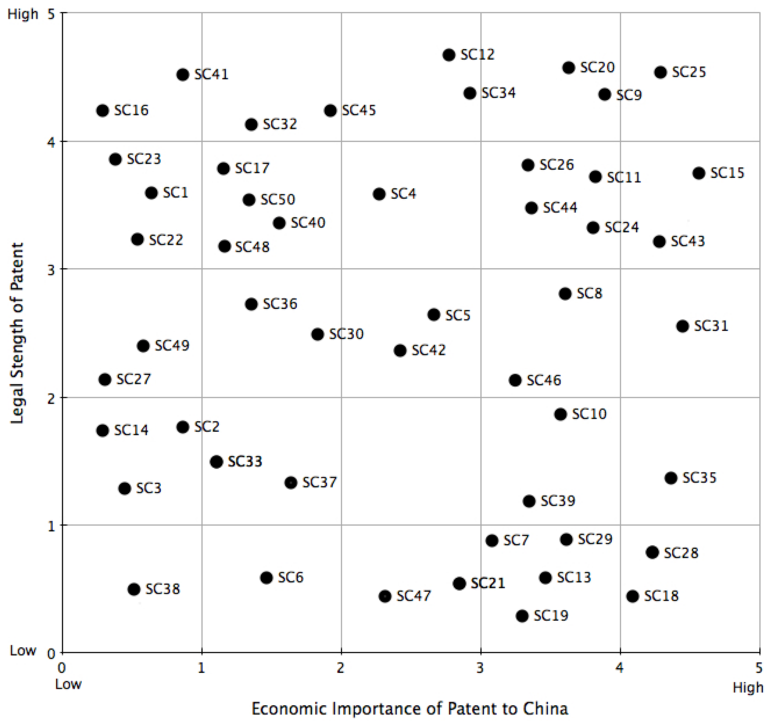
The question is frequently asked: what is the best way to choose the various factors and weights when creating the uniform score sheets? There is no single approach for making those choices. In fact, the process of discussing and determining the factors and weights is, in and of itself, a highly useful endeavor for the decision maker. We recommend against simply delegating this task to outside experts, although their assistance may be helpful. These discussions lead to a deeper understanding and appreciation of the relevant factors and how they interact to generate the social returns that drive the purpose for the subsidies in the first place.

A related, and equally relevant, question is: who should evaluate and score the patent subsidy candidates? We do not know enough about the strengths and capabilities of the various Chinese government agencies that provide patent fee subsidies to make a concrete suggestion. But we caution against assigning the task to evaluators with a singular perspective. Unfortunately, many patent evaluators approach patent valuation from either a legal perspective or an economic perspective. If the evaluator is a patent attorney, there is a significant risk any patent valuation will overemphasize the legal aspects of the patent valuation and underemphasize the economic aspects. If the valuator has an economic background, the valuation is likely to suffer from the opposite bias. One benefit of the relative value technique is the ease with which it can collect and combine the wisdom from legal, economic, and technology experts and thereby allow each to contribute to the valuation exercise. Ideally, the economic importance score sheets will be scored by economic and technology experts and the legal strength score sheet will be scored by patent lawyers.

d. Using a Patent Cluster Map to Provide an Initial Subsidy Determination

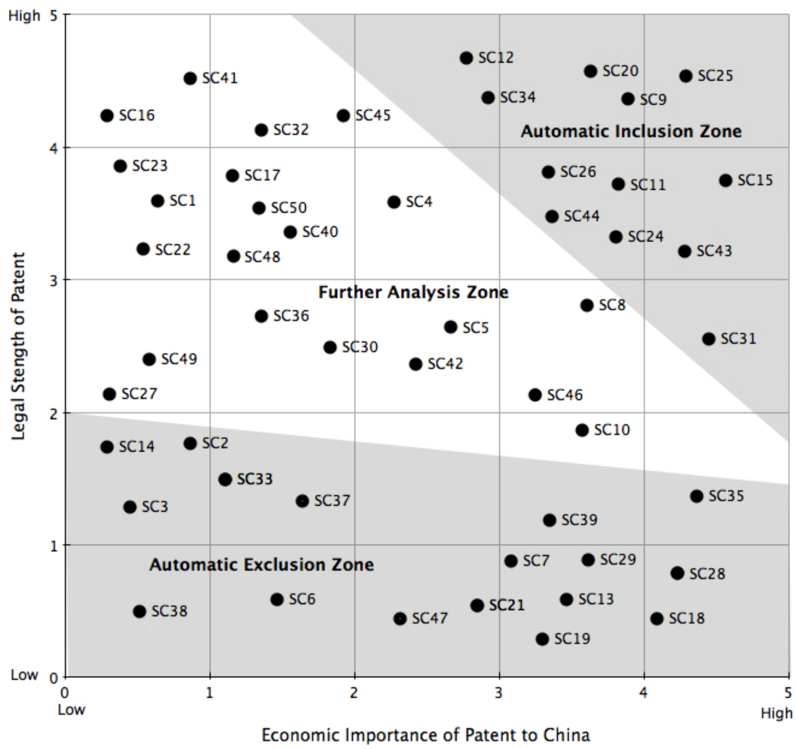
Once a collection of patent subsidy candidates is plotted on the patent cluster map, the results can be analyzed. Figure 5 provides an example of a plotted stage one patent cluster map. The government decision maker could employ the results in a number of ways. Our recommendation is to use the patent cluster map as an initial filter that identifies which candidates clearly merit a subsidy, which candidates clearly do not merit a subsidy, and which candidates require further analysis. This approach allows the government decision makers to strike a balance in how much to invest in the subsidy determination process. Obvious “yes” and “no” determinations can be made without the need to commit any further resources. For those candidates that do not fall within an obvious “yes” or “no” category, additional resources can be expended to determine if a subsidy is justified.

Figure 5
Example of a Plotted Stage One Patent Cluster Map



We suggest dividing the patent cluster map into three areas to cover the automatic inclusion zone, the automatic exclusion zone, and the further analysis zone (see Figure 6).

Figure 6
Example of a Plotted Stage One Patent Cluster Map that Is Divided into Automatic Inclusion, Automatic Exclusion, and Further Analysis Zones



1. **Automatic Inclusion Zone.** Figure 6 shows a congregation of patent subsidy candidates in the upper right-hand section of the map that are both economically and legally strong. If the goal of the patent subsidy program is to fund high-quality patents, these candidates should be funded so long as there are sufficient funds in the patent subsidy program. These candidates represent high-quality inventions that are economically important to China and can be protected with strong patents. The "Automatic Inclusion Zone" set forth in Figure 6 is simply illustrative. Where to draw the line for automatic inclusion will depend on a number of factors, not least of which is the amount of money that is dedicated to the subsidy program.

2. **Automatic Exclusion Zone.** Figure 6 also shows a congregation of patent subsidy candidates in the bottom sections of the map that are legally weak. Valuable inventions do not always translate into valuable patents. If, for example,

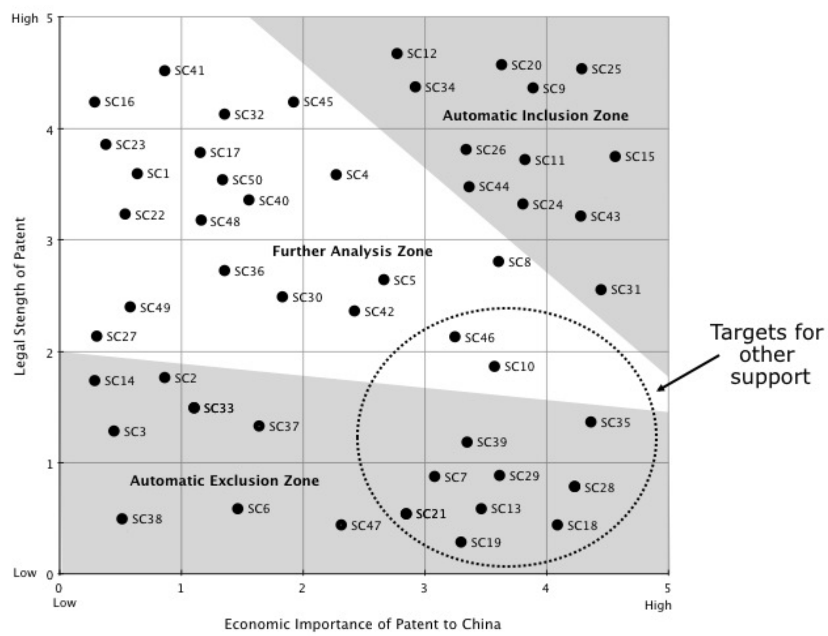
there is close prior art that may result in a future invalidation proceeding, or if the patent's claims are so narrow that competitors can easily invent around the patent, then a valuable invention may not generate a valuable patent. Because the goal of the patent subsidy program is presumably to encourage valuable "patented" technology, these candidates that are legally weak should be automatically excluded without further analysis. As was the case for the Automatic Inclusion Zone, the "Automatic Exclusion Zone" set forth in Figure 6 is simply illustrative.

3. **Further Analysis Zone.** A number of patent subsidy candidates do not fall within either the Automatic Inclusion Zone or the Automatic Exclusion Zone. For these candidates that fall within the "Further Analysis Zone," a second stage filter is required. It is in stage two that we recommend considering the candidate's disruptive technology potential.

The patent cluster map's graphical representation of the multifactor analysis allows the ultimate government decision makers to analyze hundreds, if not thousands, of patent subsidy candidates simultaneously. On a single sheet of paper (or a single computer screen), government decision makers can pull together the expert opinions of multiple evaluators and see how a huge number of patents compare to each other on a relative basis. This simultaneous analysis should make it easier for the decision makers to delineate the borders of the Automatic Inclusion Zone and the Automatic Exclusion Zone.

The graphical representation also makes it easy to spot trends that may be correctable if recognized. For example, Figure 7 shows a patent cluster map with a substantial clustering of patent subsidy candidates in the lower right quadrant. That means a lot of economically valuable technology is being protected by very weak patents. That kind of problem can be corrected if appreciated and clearly communicated to the relevant inventor and legal communities. In the alternative, these economically strong, but legally weak, patent subsidy candidates may be good targets for other support policies because of their economic importance to China. Being able to inexpensively identify this potential should itself be very valuable to Chinese policymakers.

Figure 7
Patent Cluster Map Allows Government Decisions Makers to Spot Trends



2. Stage Two—Incorporating Disruptive Technology Potential into the Analysis

For patent subsidy candidates that fall in the Further Analysis Zone, we recommend conducting a second filtering stage that identifies and measures one or more characteristics the Chinese government wishes to promote. For example, the stage two filtering process could focus more specifically on the potential job impact or environmental impact of the candidate's technology. While there is any number of potential stage two filters, we believe that measuring the disruptive technology potential of the patent subsidy candidates is an ideal characteristic on which to focus the stage two filtering process. Patents for disruptive technologies may be those that are most suitable for government subsidies.

To begin with, the private markets are likely to underfund research and development for disruptive technologies. Because the leading firms' most profitable customers are generally not interested, and probably cannot even use, most disruptive technologies when first introduced,[90]

90 *Id.* at xvii.

established firms are unlikely to fund disruptive technology research and development efforts. As Christensen notes, "[t]he highest-performing companies . . . have well-developed systems for killing ideas that their customers don't want. As a result, these companies find it very difficult to invest adequate resources in disruptive technologies."[91] Moreover, disruptive technologies also pose funding problems for professional private investors (e.g., venture capital firms) because disruptive technologies suffer from extreme uncertainty problems.[92] It is "impossible to predict with any useful degree of precision how disruptive products will be used or how large their markets will be."[93] Not surprisingly, this heightened uncertainty negatively impacts the willingness of investors to invest.[94]

Market failure is the typical justification for governments to intervene in private market transactions,[95] and there certainly appears to be a market failure in the case of research and development funding for disruptive technologies. When coupled with the high upside potential that disruptive technologies offer to a country, the case for trying to reduce this underfunding problem is particularly strong. By creating entirely new markets and new ways of doing business that render the economy more competitive and more efficient, disruptive technologies can be among the most attractive technologies to a country. Therefore, a method to include the most promising of this group for patent subsidy could allow China to sow the seeds, however speculative, for future considerable rewards.

In effect, we are suggesting that China take a "portfolio theory"[96] type of approach to its patent subsidy program and diversify its portfolio of subsidized patents with a group of high-risk, but potentially high-return patents. Modern portfolio theory has instructed generations of financial asset managers that they can maximize returns by diversifying investments.[97] China could use a similar lens for constructing its portfolio of patent subsidies. The country is making investments on

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91 *Id.* at xix.

92 *Id.* at 158.

93 *Id.*

94 PAUL A. GOMPERS & JOSH LERNER, THE VENTURE CAPITAL CYCLE 157–58 (2d ed. 2004).

95 WEBSTER, *supra* note 51, at 687.

96 Modern portfolio theory is generally traced back to Harry Markowitz's 1952 paper. *See* Harry M. Markowitz, *Portfolio Selection*, 7 J. FIN. 77 (1952).

97 In 1990, the Nobel Prize for Economics was awarded to Markowitz, Merton Miller (also famous for his contribution to the Black-Scholes option pricing model), and William Sharpe (who is most noted for his work on the Capital Asset Pricing Model, or CAPM). The major insight of modern portfolio theory is that measurement of the risk of an entire portfolio, and not just the risk of individual investments, is key to managing the return of the investments in the portfolio. Markowitz and those who followed have shown that by informed balancing of the various classes of investments, one can construct a diversified portfolio with a certain risk that can achieve a higher average return than the associated risks and returns of individual investments it contains.

various assets with an expectation of generating social returns that exceed the investment. As with financial assets, diversifying the patent subsidy portfolio to include some higher-risk/higher-reward patents and some lower-risk patents (e.g., they have more predictable benefit expectations) should generate superior results. Those candidates that fall within the Automatic Inclusion Zone after stage one (see Figure 6) should tend to be lower-risk patents, while those candidates that qualify after the stage two disruptive technology analysis should tend to be higher-risk/higher-reward patents.

To assess the disruptive technology potential of the patent subsidy candidates that fall in the Further Analysis Zone, we suggest using a second patent cluster map. For this second patent cluster map, the *x* value on the relative value chart will represent a patent subsidy candidate's disruptive technology potential while the *y* value will represent the candidate's legal strength score.

To calculate a patent subsidy candidate's disruptive technology potential, we suggest preparing a uniform "disruptive technology score sheet" (see Table 4). The disruptive technology score sheet should include the factors that are significant to measuring disruptive technology potential, with the factors listed in Table 4 being simply illustrative. As with the economic factor and legal strength score sheets, the disruptive technology factors should be weighted, with the combined weights adding up to 1 (or 100 percent). Each factor is scored from 0-to-5 and then multiplied by that factor's weight to yield a factor value. All the factor values are added up to yield a single disruptive technology value for the patent, which will be the *x* value on the relative value chart.

Table 4
Example of a Completed Disruptive Technology Score Sheet

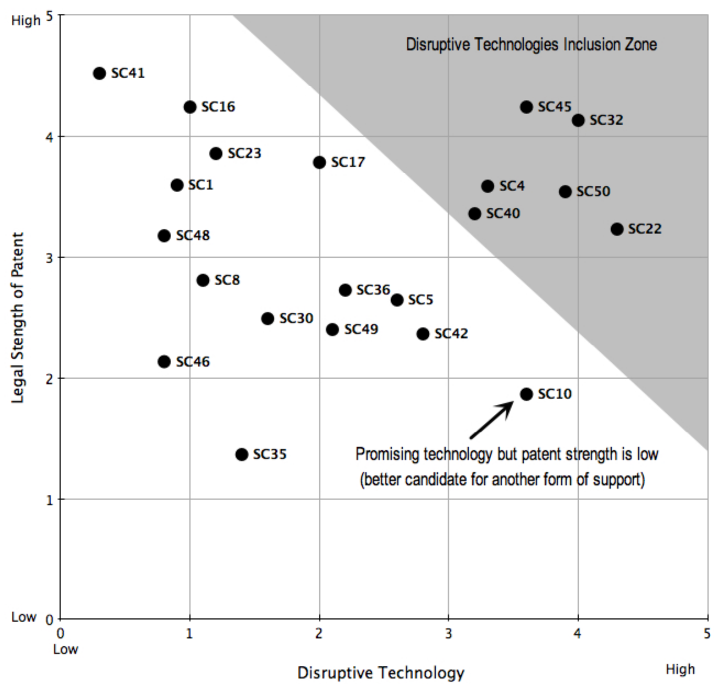
Factors Indicative of Disruptive Technology Potential	**Weight (0-1)**	**x**	**Score (0-5)**	**=**	**Calculated Factor Value**
Transformative product or service	0.3		3		0.9
Ability to create a new market	0.2		4		0.8
Technology is cheaper, simpler, smaller, and/or more convenient to use	0.2		3		0.6
Potential to address initially a smaller niche market that is currently ignored by leading firms	0.2		4		0.8
Potential to motivate the creation of a significant number of startups	0.1		2		0.2
Total of weights must add up to 1.0	1.0				
Add all calculated factor values and then determine if value exceeds cut-off value →					**3.3**

A candidate's disruptive technology score should be interpreted in connection with its legal strength. Because this is a "patent" subsidy program, the legal strength of the potential patent remains highly relevant for the stage-two analysis. China is not just investing in technology, China is investing in "patented" technology that will provide its people with the additional benefits that are associated with patents.[98] Since the legal strength of the candidate was already measured during stage one, the information can easily be incorporated into this second stage analysis. The candidate's legal strength score from stage one is brought forward to become its *y* value for the stage two patent cluster map.

The stage two candidates can then be plotted on the patent cluster map and the results analyzed. Figure 8 provides an example of a stage two plotted patent cluster map. Once again, the government decision maker could employ the results in a number of ways. One possibility is to use the stage two patent cluster map as a final filter to identify which candidates merit a subsidy. Figure 8 shows a possible cutoff for determining which candidates would be subsidized based on a stage two analysis.

[98] For a thorough discussion of the various direct and indirect economic benefits that come patent rights, see MURPHY, ORCUTT & REMUS, *supra* note 13, at 103–17.

Figure 8
Example of a Plotted Stage Two Patent Cluster Map



C. *Additional Benefits of the Suggested Valuation Process*

One of the benefits of our proposed valuation process is the ease with which it can be updated or modified. Because each of the evaluated factors and final scores is represented as a numerical projection, the government decision makers can go back later and measure the accuracy of past scoring and weighting decisions and the importance of the various factors. China could then improve its subsidy performance over time by reevaluating the accuracy of its past decisions on a regular basis.

Another benefit of our proposed valuation process is the verifiable decision-making record that it leaves behind. If the decision making results are regularly published, the transparent results can provide useful knowledge to inventors and their lawyers who will have an incentive to develop patented technology that is more likely to be subsidized. Since these should be precisely those patents that the Chinese government has strategically decided are more promising, the program should evolve into less of a filter to eliminate less desirable patents and more of an information system to provide clear incentives to inventors to submit more promising patent subsidy candidates, thus eliminating the waste of producing worthless patents.

Finally, government subsidy programs invariably raise concerns that the government agency will make funding decisions based on politics, favoritism, or corruption, rather than merit. A transparent verifiable decision-making record should also help to reduce those concerns. Moreover, dispersing the evaluation process among various experts makes it more difficult for candidates or government officials to use strategic behavior to skew funding decisions towards undeserving patent subsidy candidates.

CONCLUSION

The Chinese government has stated the need to "[o]ptimize [China's] patent subsidy policy and further define the orientation to enhance patent quality."[99] This Article offers the outline of a practical valuation model the Chinese government could use to do just that. The two-stage, three-dimensional relative value technique proposed in this Article would allow the Chinese government, without the need for a significant resource commitment, to filter patent fee subsidy requests and allocate public funds to the most deserving patents.

Whether operating a patent fee subsidy program is an effective use of public funds for promoting innovation remains an open question,[100] and is not something this Article tries to address. We are not taking a position on whether China should operate a patent subsidy program. But if China is going to operate such a program, our proposed valuation model will allow China to do so more efficiently and effectively. When the government decides to subsidize a private market transaction, concerns justifiably arise that the government's actions will lead to wasteful resource deployment. In the context of Chinese patent fee subsidy programs, the question is: will the Chinese government consistently be able to subsidize applications for the most deserving patents, or will it regularly ignore such patents and instead subsidize patents that do not warrant patent application funding? The valuation model we propose in this Article should reduce such concerns. More specifically, the model should significantly improve the Chinese

99 *The Patent Strategy*, *supra* note 2, at 8 (Part IV.4).

100 David Kappos, while Under Secretary of Commerce for Intellectual Property and Director of the United States Patent and Trademark Office, called on the academic community to explore that specific question. David J. Kappos, A Public Discussion on Strategies for Engaging China, Fordham IP Conference—Understanding China's New Environment for Intellectual Property (Apr. 11, 2011), *available at* http://www.uspto.gov/news/speeches/2012/kappos_fordham.jsp.

government's allocation decisions regarding patent fee subsidies and thereby improve the likelihood that such subsidy programs improve China's indigenous production of valuable commercial technology. The relative value technique that we propose provides an inexpensive but powerful method that: (a) collects the combined legal, economic, and technical information needed to make an informed patent subsidy decision; (b) analyzes that information in a clear, consistent, and transparent manner; and (c) logically assembles that information into a final result that can be readily understood using the visual power of a cluster map. Moreover, the technique does not require expert valuators to implement. Instead, the technique seeks to improve the Chinese government's decision making by offering a very practical solution for taking advantage of the disparate legal, economic, and technological expertise the government already possesses.

Finally, while this Article's proposed valuation model was motivated by China's patent fee subsidy program, it is not limited to that program. Numerous countries, including Australia, Belgium, Canada, India, Ireland, Italy, Japan, the Philippines, Spain, and the United Kingdom have launched similar patent fee subsidy programs.[101] This Article's proposed valuation model would be applicable to any of these other patent fee subsidy programs. In addition, it could be used for filtering and awarding research and development funding grants and other types of government technology funding decisions.

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[101] Federico Munari & Liang Xu, *Are Patent Subsidies for SMEs Effective? Empirical Evidence from Italy* (Sept. 8, 2011), *available at* http://www.epip.eu/conferences/epip06/papers/Parallel%20Session%20Papers/MUNARI%20Federico.pdf; *Managing Patents Costs: An Overview*, WORLD INTELLECTUAL PROP. ORG., http://www.wipo.int/sme/en/documents/managing_patent_costs.htm (last visited Feb. 7, 2013).