

# CARNEGIE PAPERS

## Innovation and the Visible Hand

China, Indigenous  
Innovation, and the  
Role of Government  
Procurement

Nathaniel Ahrens

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***Government  
procurement should  
play an important  
role in stimulating  
innovation, but  
maintaining open  
markets and  
international linkages  
is critical.***

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## Summary

Indigenous innovation<sup>1</sup> has become the greatest immediate source of economic friction between the United States and China. This trend is not unique to these two countries; policy makers globally are actively trying to stimulate domestic innovation. The burgeoning markets for biotech and environment-related products and services and, potentially even more important, countries' efforts to emerge from the global economic slowdown all reinforce this trend. Mindful of this global scene, China has made indigenous innovation one of the core elements of its attempt to make a structural shift up the industrial value chain.

Recently, however, indigenous innovation has been tarred with a protectionist brush. In both China and the United States, there have been increasing calls for buy-local stipulations and the erection of tariffs and non-tariff barriers to trade. In China, these measures primarily take the shape of government "local content" mandates and through the preferential treatment given to products officially classified as "national indigenous innovation products" (NIIP) in the government procurement process. In the United States, they have taken the form of buy-local provisions and efforts to shut out foreign companies. The conflict has been escalating dangerously. In the run-up to the recent Strategic and Economic Dialogue, the U.S. business community ranked indigenous innovation in China as its number one policy concern, above even the currency issue. As of this writing, the key points of contention remain unresolved.

Yet despite the loud cries of protest against it, the global trend toward "home-grown" innovation is a healthy, positive development. Without innovation, countries cannot continually raise wages and living standards.<sup>2</sup> Government procurement should play an important role in stimulating innovation, but maintaining open markets and international linkages is critical. But instead of following its current approach of short-term product substitution and picking winners by protecting them from competition, China should focus on proven, market-friendly ways of stimulating innovation. Government procurement's primary roles should be market signaling, de-risking R&D, bridging the finance gap, and stimulating demand. The United States would also benefit by refocusing its government procurement policies along the lines indicated in the key findings of this paper, especially concentrating on facilitating more open markets and elevating the importance of sustainable procurement.

The following set of specific recommendations for China will stimulate innovation through open markets and the effective use of government procurement:

- Become a signatory to the World Trade Organization's Agreement on Government Procurement (GPA) in order to build a solid system that can legally incorporate certain mechanisms that stimulate indigenous innovation while keeping markets open. China should follow through on commitments made during the most recent Strategic and Economic Dialogue by submitting a revised application that is robust and in line with international best practices.
- Clarify the scope of the government procurement law
- Strengthen China's intellectual property rights (IPR) regime so as to encourage innovative solutions being brought to the government
- De-couple NIIP and government procurement, both nationally and locally.
- Include in government procurement teams experts who know how to make the government an "intelligent customer"
- Improve the governance and transparency of national and local procurement entities
- Create national-level sustainable procurement guidelines (but not product lists) for key product areas (energy, transportation, construction, IT, chemicals) in order to mandate quality and performance levels connected with national goals in the areas of climate and sustainable development

Finally the United States and China could lead by example by working to form a joint sustainable procurement agreement. This will not only increase innovation in both countries; it will also increase overall technological progress worldwide.

This paper addresses the following questions: Are there ways to encourage indigenous innovation while still keeping markets open? Are open markets good for innovation? What is the role of government procurement in stimulating indigenous innovation? It is into this last topic, government procurement, that this paper delves most deeply because of the important role it can play in promoting innovation, the large percentage of GDP it represents, and its increasing importance internationally.

## China's Government Procurement and Indigenous Innovation

Many have accused China of raising barriers to the purchase of foreign technologies. While there is strong evidence to support these accusations in the clean technology sector, China has been erecting barrier policies across a wide range of high technology products. International companies have been particularly worried about the coupling of indigenous innovation and government procurement.

In 2002, China issued its first set of government procurement laws. While the effort lacked substance and polish in many areas, it marked an important first step in regulating the massive Chinese government procurement market, which was racked with inefficiencies and corruption. The new laws also sought to set China on a path toward becoming a signatory of the World Trade Organization's Agreement on Government Procurement.

Ever since the laws were first announced, the Chinese government has focused both on improving them and on issuing a set of implementation regulations. The government made these draft implementation regulations public for comment in fall 2009. Non-Chinese entities (and some Chinese ones) immediately found problems with Articles 9 and 10 in particular. Article 9 states that certain products will receive preferential treatment: products that save energy or protect the environment; that are national indigenous innovation products; that are made by small- and medium-sized enterprises (SME); or that are made by enterprises in underdeveloped or ethnic-minority regions. Article 10 states that domestic goods must be purchased in all but a few special cases. The implementation regulations go on to define domestic goods as those goods produced in China whose domestic (that is, Chinese) production cost exceeds a certain percentage of the final good's price (the 2009 regulations do not define that percentage). For projects and services to be considered domestic, they must be provided by Chinese citizens, legal persons, or other organizations. While this definition appears to imply that any legal entity in China would qualify, it is questionable whether wholly foreign-owned entities would be considered "domestic." While Articles 9 and 10 trouble foreign entities the most, Article 11's

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requirement that imported products must get special approval has also given some cause for concern.<sup>3</sup>

It is helpful to separate the issues here. Giving preference to domestic entities generally goes against global standards and best practices, whether one is referring to the World Trade Organization's Agreement on Government Procurement or the commitment to non-discrimination between European states. The bigger problem, however, is the preference given to national indigenous innovation products (NIIP).

## Chinese National Indigenous Innovation Products

In recent years, China has paid more attention to furthering the development of domestic Chinese standards and technologies. It has done so largely to upgrade the country's industrial base, thus retaining more added value, but it has also done so to secure a seat at the table where global standards are set. In 2006, the Chinese government began to actively promote the concept of indigenous innovation by issuing Trial Measures for the Administration of Accreditation of National Indigenous Innovation Products. These measures define several criteria (listed below) that products must meet to receive NIIP status. After listening to feedback from the international community, China edited and reissued the measures for comment. (These edits are shown below either in gray additions or strikethrough deletions):<sup>4</sup>

1. The product must be in accord with national laws and regulations, and meet national industrial and technology policies. ~~and other related industrial policies~~
2. The product has indigenous intellectual property rights and the rights and interests are clear. ~~The product having indigenous intellectual property rights refers to~~ The applying unit, through its own leading technological innovation activities or transfer, ~~has obtained the exclusive legal~~ legally holds the intellectual property rights or intellectual property usage rights in China, ~~or a Chinese enterprise, public institution, or citizen who has legally obtained through transfer the exclusive ownership or usage rights in China~~ for the researched and developed product.
3. ~~The product has an indigenous brand, and~~ The applying entity has the legal exclusive rights or usage rights to the product's registered trademark.
4. The product's ~~level of innovation is high~~ technology is advanced. Product has obvious efficacy in the areas of resource conservation, raising energy efficiency, decreasing pollution, etc., ~~Masters the product's manufacturing core technology and key methods; or applies new technology theories or new design compositions in structure, material, methods and other aspects that are fundamental~~ substantial improvements over the original product,

clearly improving the product's performance; or first pioneers domestic and international technical standards.

5. ~~The product's technology is advanced; [author note: this first part moved to previous item] and in the company of similar products has the condition of leading international level.~~
6. 5. The product's quality is reliable ~~and has passed inspection by the National Certification and Accreditation Administration or the province's, autonomous region's, or autonomous municipality's Bureau of Technical and Quality Supervision's qualified designated testing laboratory or inspection organization.~~ Products falling under national special industry management requirements (for example: pharmaceutical, medical equipment, pesticides, measurement instruments, pressure vessels, post and telecommunications, etc.) must have approved and issued product manufacturing license from related industry departments of the State Council;. Products belonging to the State Compulsory Product Certification regime must pass compulsory certification.-
7. 6. The product has already entered the market for sale or has potential for economic benefits and fairly large market prospects ~~or can replace imports.~~

The main benefits of accreditation (and subsequent inclusion in the NIIP catalogues) derive from the preferences such products receive in the government procurement process. These preferences range from a simple requirement to choose an NIIP over a similarly priced but non-accredited product, to a 5–10 percent margin cushion when comparing prices and an additional 4–8 percent boost in technical and price evaluations. Given the size of the market and the degrees of preference, these requirements give a very significant advantage to NIIPs over their foreign or domestic non-accredited counterparts.

There are two criteria we should consider to assess this policy: effectiveness and legality. Legality will be addressed in greater detail in a later section, but to put it simply for the time being, as issued these rules clearly violate the WTO's Agreement on Government Procurement (GPA), which China claims it wants to join.<sup>5</sup> There are, however, significant loopholes in the GPA that would allow China to give preference to certain domestic suppliers. Each country's Annex IV to the GPA indicates certain areas to be excluded from the agreement (or lists of just those to be included), and the lists of excluded areas can be quite extensive. The key area for our purposes is one that is frequently approved for exclusion under Annex IV: research and development. This is the crux of the difference between the emerging global standards and China. In China, government policy gives preferences to *products*, whereas elsewhere

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preferences are reserved for *R&D*. It is the latter that has been shown to stimulate sustainable innovation, which naturally raises the question: How effective is China's NIIP program?

## Why Innovate?

It is our belief that innovation is best cultivated in the soil of open markets and healthy competition, watered by supportive government policies. But why grow the plant at all? In other words, why innovate? While innovation may seem self-evidently good to us, it is helpful to note the importance of innovation in the process of industrial upgrading, as this shift from low-end industrial development to high-end industrial development is one of the key structural reforms that Chinese planners are trying to consciously make to their development model.

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In a study published by the East-West Center, Dieter Ernst showed that shifting to higher value-added products and services through increasing specialization enables a country to grow and increase revenues. This growth happens primarily through what he refers to as “industrial deepening.”<sup>6</sup> Ernst found that innovation and specialization lead to improved productivity. He also

suggested that developing nations can no longer rely on foreign capital and technological inflows to move the process of industrial upgrading forward.<sup>7</sup> International linkages and the knowledge they bring are critical to the process. He concluded that “while the first priority needs to be a continuous upgrading of the domestic innovation systems, this needs to be complemented with a variety of international linkages.”<sup>8</sup> He further stressed that competition is also of “critical importance”<sup>9</sup>; we will take up this subject later.

The Australian government is even more direct, stating that multi-factor productivity is driven by innovation, and that “long-term growth and productivity increases are largely driven by endogenous technical change.”<sup>10</sup> There is a direct connection between indigenous technological change and increased productivity. These lessons apply not just to recently developing economies but to wealthy nations as well. In the 1820s James Francis (Lazonick 2004) developed a water turbine to power Massachusetts’ increasing number of textile mills—technology that later became critical to the development of the modern turbojet. Thus indigenous innovation at a particular time and place can have long-term implications for a country’s developmental, innovative, and productive capabilities.<sup>11</sup>

If we can agree that innovation is critical to growth and increasing productivity, then that leaves us with two further questions: What makes a place innovative? How is innovation stimulated?

## What Makes a Place Innovative?

There are many factors that make a place innovative, but we will here touch upon the majority of these only enough to connect them to the focal points of this brief: the roles of government and, especially, government procurement.

We can divide the factors that have been clearly shown to increase innovation in an organization into internal and external categories. Internal factors include issues such as staff competencies, R&D budgets, financial resources, the ability to deploy patient capital, and linkages to external developments and organizations. These are all covered in modern management practices and are of less interest to us here.

We can break external factors down into two further categories: those a country or region cannot influence and those it can. It is the latter category that governments should focus on when looking to encourage indigenous innovation. The main factors in this category are:

- Availability of scientists and engineers
- Investment in and incentives for R&D
- Quality of universities and research institutions
- Protection of intellectual property rights (IPR)
- University-industry collaboration
- Competition and openness, linkages
- Government procurement of advanced R&D products

While most experts accept the importance of the first five factors,<sup>12</sup> there has been a great deal of debate recently about the last two: the role of open markets and government procurement.

## Innovation and Open Markets

Many policy makers intuitively assume that protecting firms and markets from competition provides them space for development. Nothing could be further from the truth. In fact, it has been amply demonstrated that protecting a market destroys innovation. This is true whether one is restricting imports or giving preferences to domestic products or services; in both cases, the action has the result of destroying domestic companies' motivation to produce the best products. Ernst emphatically demonstrates that firms will only invest in productivity-enhancing innovation if competition forces them to.<sup>13</sup> The best government policies stimulate innovation without restricting competition. A UK government analysis of the need for collaboration on innovation with India argued that protectionism in previous economic crises increased economic pains. In particular, it showed that the import controls and tariffs adopted after October

1929 contributed to a 30 percent decline in world trade.<sup>14</sup> The UK's National Endowment for Science, Technology, and the Arts stresses the critical role of external knowledge to innovation. They argue that innovation does not come solely from the ability to create new knowledge but also from the ability to access and absorb external knowledge and develop this into new innovations. They suggest a model called AC/DC, which stands for "absorptive capacity" and "development capacity."<sup>15</sup> The Australian government also recognizes the importance of economic openness and competitive markets to innovation. It

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recently published a study arguing that "Australia produces 3 per cent of the world's formal research. Our capacity to innovate depends very much on how effectively we harness and apply the other 97 per cent."<sup>16</sup>

One of the most revealing quantitative studies on the role of public science in technology innovation, Narin et al. (1997), shows that during the time frame of the study almost three-quarters of U.S. industry patents cite public science (in other words, research conducted not only outside of their organization but outside of all private industry). The study also looks at the origin of scientific papers cited in IBM's patents. In 1993 IBM researchers published 860 papers and obtained 1,087 patents. Only 21 percent of the citations in those studies referred to in-house research; the remaining 79 percent referred to research conducted outside the organization. Of this 79 percent, the largest number of citations referred to U.S. public science, followed by foreign companies.<sup>17</sup> Thus, even an innovation powerhouse like IBM relies on openness and linkages to the outside world. In short, innovation rarely happens in a black box.

In an article about Polaroid, which had then recently filed for bankruptcy protection, the *Harvard Business Review* showed how lessons learned from the free market can be used to stimulate innovation: "The pioneer in instant photography lost everything because its longstanding bias for inventing at home caused managers to discount digital photography substitutes."<sup>18</sup> The article calls for firms (and I believe this lesson applies to nations too) to take a critical, unflinching look at their innovation initiatives with "market-hardened eyes"<sup>19</sup>—something that is impossible without the light of competition and openness. Moreover, the article states that "product complexity, specialization, and shorter product life cycles make it increasingly unlikely that one company can release world-class products by itself."<sup>20</sup> One of the global experts on innovation and its relation to economic development, William Lazonick of the University of Massachusetts Lowell, has also demonstrated that the innovation process often requires the interaction and integration of people within different firms.<sup>21</sup>

The same logic can be extrapolated from individual firms to nations. Nations need to continue the process of industrial upgrading by innovating, but this needs to be “complemented with a variety of international linkages... investment is only half the story; it needs to be complemented with knowledge, which requires international linkages.”<sup>22</sup>

Not only are open markets and linkages critical to the development of new innovations; they are the only way that those innovations can be adopted worldwide, and they also keep countries from being locked into a narrow technology standard. Basing an industry on homegrown technology essentially locks them into a single path that may turn out to be obsolescent or uncompetitive in the future.

Consider the findings (Grossman 1989) of one National Bureau of Economic Research study of Japan’s experience with trade policy and high-tech innovation in the 1980s. The study shows that a country that introduces high-tech production subsidies “will see its competitiveness in high-technology products grow, but its long-run rate of indigenous innovation decline.”<sup>23</sup> The same logic applies to export subsidies and import tariffs: they increase the competitiveness of a country’s high-tech products at the expense of indigenous innovation<sup>24</sup>:

A small tariff on imports of high-technology goods coupled with a small subsidy to exports of these goods at equal *ad valorem* rate expands the number of high-technology goods manufactured and exported by the policy active country. The rate of technological progress falls in the policy active country.<sup>25</sup>

**The study found that Japan’s “implicitly subsidizing” the production of high-tech products via government procurement practices “reduces the rate of innovation in the policy active country, increases the rate of innovation in the trade partner country, and slows the global rate of technological progress.”**<sup>26</sup> This is the opposite of what happens when a country subsidizes R&D. Subsidizing R&D increases both domestic innovation and the rate of global technological progress.<sup>27</sup>

The conclusion we should draw from these findings is that it is in the interests of trade partners to encourage open markets, not only for the long-term competitiveness of each country’s own indigenous innovation but also for global technological progress as a whole. Each country is naturally concerned primarily about what happens within its own borders, but as the pressing global issues of climate change, environmental degradation, resource shortages, disease, and poverty have shown us, short-changing the global in favor of the local is often self-defeating. We cannot afford to lose sight of the overarching need for global technological progress.

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## The Role of Government

The role of government procurement in innovation is the second issue for our present discussion. But before we take up smaller-bore issue of procurement, we need to explore the large-bore question of the role of government in encouraging innovation. Americans have a tendency to overstate the role of free markets and understate the role of government in industry. Government nevertheless has certain key levers with which it can (if skillfully managed) stimulate innovation without interfering in the efficient functioning of markets. These levers are related to the seven external factors listed above.

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In a recent study of the development of innovative German biotechnology firms, Simcha Jong attempted to explain why Germany's biotech industry grew from next-to-nothing into Europe's largest in the span of a decade. The government's first move, says Jong, was to target the biotech sector as one of strategic importance. It then deployed a particular set of policy initiatives to encourage the development of that sector. The first of these policy initiatives aimed at "streamlining the process of transferring valuable scientific 'founding ideas' from scientific institutions to entrepreneurial spin-off firms."<sup>28</sup> A main pillar of this reform was to model their intellectual property rights legislation on the American Bayh-Dole Act of 1981,

which gave the intellectual property resulting from publicly funded research to the universities that developed it. This gave the universities an incentive to commercialize their research. (Other policies encouraged the formation of start-ups that would facilitate that goal.)

Jong singled out three keys to the successful development of the German biotech industry: access to finance, professional management teams, and inter-company relations. But one of his most important findings was that the biotech sector grew successfully *despite* the constraints that existed in the rigid German system by essentially creating "a second institutional system, which worked according to a different logic than the old one and thereby provided the functional equivalent of an Anglo-American business environment."<sup>29</sup> This observation evokes instructive parallels with China, which has its own rigid political, institutional, and social constraints.

## The Role of Government Procurement and the Case of the SBIR

While we can all generally agree that governments should do whatever they can to increase education levels, increase funding for universities and research institutions, use tax incentives to encourage R&D spending and the deployment

of patient capital, administer high quality intellectual property rights regimes, encourage institution-industry collaboration, and keep markets as open as possible, the U.S. debate about the role of government procurement has been tilting in favor of a hands-off approach for government. This would be a bad idea, especially when it comes to the path we should encourage China to take. These “open procurement” advocates ignore both established research, the legal framework, and one of the most effective tools in the U.S. government’s kit for stimulating innovation: the Small Business Innovation Program (SBIR).

The United States itself offers perhaps the best example of the role that government procurement can play in encouraging indigenous innovation. University of Cambridge professor David Connell conducted a study of how the United States uses the SBIR and government procurement to support innovation. His study found that, as countries try to increase R&D spending as a proportion of GDP, “public sector procurement in the innovation economy assumes a position of pivotal importance.”<sup>30</sup> Most innovation comes from “soft” companies that focus on scientific expertise or proprietary technology, rather than companies that focus on standard products.<sup>31</sup> Connell points out that Intel owed its success primarily to external, customer-driven requirements, not black-box R&D. The U.S. government, acting as a customer, places its own R&D contracts (not grants) with small businesses through the SBIR, thus funding a project plus a small profit. The purpose is to give businesses an incentive to develop innovative technologies that directly address the procuring government agency’s needs, thereby leading to commercialization.

The SBIR legislation mandates that federal government agencies distribute 2.5 percent of their external R&D budgets through the program. Each year the SBIR awards more than \$2 billion in contracts, essentially converting billions of dollars of government funds into high-value, innovative goods.<sup>32</sup> Connell’s study points to success stories like Qualcomm, Amgen, Genzyme, Photobit (developers of CMOS image sensors), and Embrex (makers of chick vaccination equipment who used the SBIR award to attract venture capital and subsequently made an initial public offering)—all of which benefited from SBIR and have generated five times as many new jobs as non-SBIR-funded firms.<sup>33</sup>

Complementing the SBIR is the Small Business Technology Transfer (STTR) program. According to the Small Business Administration, the STTR is intended to “foster the innovation necessary to meet the nation’s scientific and technological challenges in the 21st century.”<sup>34</sup> This program gives small businesses funding to allow them to cooperate with large non-profit research institutions, helping the small business gain access to access R&D and helping the research institution gain access to the market in turn. To qualify for this program the small business must be American-owned *and* -operated.

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The SBIR and supporting programs are internationally recognized as a model for the government stimulation of innovation. The SBIR benefits small, domestic, innovative companies by:

- allowing for early involvement
- providing start-up funding
- facilitating technology transfer and spin-offs
- supporting R&D that meets real customer needs
- providing a critical reference customer
- reducing time to market
- improving risk management in R&D
- providing initial market scale
- supporting both platform technologies and niche markets
- getting companies venture ready<sup>35</sup>

All told, the SBIR and related programs are worth approximately \$4 billion a year.<sup>36</sup>

The SBIR program successfully fulfills the three core goals of public policy assistance: signaling opportunities, reducing risks, and engaging in R&D.<sup>37</sup> “Science and Innovation Strategy,” a 2008 paper by the United Kingdom’s Institute of Physics, echoed this conclusion, stating that the government can “provide a strong lead market for innovative solutions to government procurement through its ability to mitigate the financial risks associated with innovation.”<sup>38</sup> It goes on to warn, however, that large government purchases of technology can also hinder innovation by showing a continuing preference for established solutions. This warning highlights the need for government procurement to focus on R&D rather than mature products. This is not to say that the government should perform this function across the entire R&D spectrum; rather, *equal treatment should be given to foreign and domestic firms, with the key exception of small, innovative, and risk-taking firms.*<sup>39</sup>

## The Effectiveness of China’s NIIP Program

This brings us to the questions of the overall quality of China’s NIIP program. Let’s consider the issue of effectiveness first, and then that of legality. The purpose of the NIIP program is to create an environment that encourages indigenous innovation. This is a noble and rational goal for a country seeking to move its economy up the industrial value chain. China is falling short not in the goals it has set for itself but in its methods of achieving them. Instead of encouraging innovation, China’s policies are mostly stymieing it. Essentially,

they are making the mistake of viewing innovation through lenses colored by their past and largely successful experiences with low-end manufacturing.

Current Chinese policies embody an entrenched belief that protecting domestic companies from foreign competition gives them time to innovate and capture enough market share to scale up their production. While this core belief holds true for low-end manufacturing, it does not apply to higher-end production. Moreover, the NIIP policies more often than not result in product substitution rather than true innovation.

China has a less-than-illustrious history of this kind of product substitution. A few examples are the nationally directed development of China's own 3G standard (TD-SCDMA), its own Wi-Fi standard (WAPI), and its own DVD standard (EVD). WAPI and EVD have been publicly acknowledged as failures (despite some recent relative success in domestic Chinese revival of WAPI). To put all this in terms that an average consumer might be able to appreciate: Does China's banning of Apple iPhones with Wi-Fi functionality in order to promote a domestic standard serve to increase innovation? Clearly not. In fact, all it has accomplished is to delay the arrival of many new handsets on the market and to reduce Chinese developers' technical interaction with leading global technology. Somewhat ironically, there was one area that did see an increase in innovation following China's iPhone restriction: the development of "cracks"—software workarounds to connect foreign Wi-Fi-enabled phones to local telecom networks.<sup>40</sup>

The jury is still out on international adoption of the TD-SCDMA standard (and on its next technical iteration TD-LTE). Some developing countries may adopt it if it comes bundled with "aid" projects (telecomm provider Ericsson has assisted China in this regard). But even if it does gain some traction via this route, the constraints placed on the 3G telecom market in China have certainly slowed the growth of the overall market and stifled innovation. As this paper showed earlier, protecting the market from competition results in increased domestic manufacturing at the cost of decreased domestic innovation. In their study "Trade, Innovation, and Growth," Grossman and Helpman found that "trade protection shifts resources from research into manufacturing in the policy active country, and in the opposite direction in the policy inactive country."<sup>41</sup>

China's experience merely bears out what other countries' past experiences have shown: Establishing catalogues of preferred products is not an effective way for government procurement to stimulate innovation. Government procurement has been used most successfully to stimulate innovation when it directs funding towards those areas that are believed to be critical to future needs, but unmet by current offerings.

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## Suggestions for China's Government Procurement With Regard to Innovation

China should continue its efforts to use government procurement to encourage indigenous innovation, but it needs to retool these efforts in ways that have been proven to work elsewhere. The major lines along which it should reconsider retooling its policy are market signaling, de-risking R&D, bridging the finance gap, and stimulating demand.

At its core, innovation is about solving problems.<sup>42</sup> Government's first task in designing an innovation-friendly government procurement policy is defining the problems that lack solutions. The United Kingdom's Council for Industry and Higher Education states clearly that "the focus should be on stimulating innovation, not procuring deliverables."<sup>43</sup> In this way, government procurement sends out signals to the market, letting it know that there is a well-defined customer in mind. A program like the U.S. SBIR allows each department to focus on their future needs.

The Australian government succinctly states their role in encouraging innovation: "the Australian Government will drive innovation in the private sector by being a demanding and discerning customer."<sup>44</sup> Again, the emphasis is initially not on the procurement of goods, but on communicating to the market precisely what is needed.

How that signal is communicated can be just as important as the content of the signal itself. The team responsible for framing the requirements of a project should be careful not to specify one particular solution or identify precise features of the final product; rather it should restrict itself to describing the problem in need of solution. When it does not so restrict itself, especially in order to favor or exclude a specific company, it curtails innovation. This restriction naturally makes the framing team's job harder. They have to have specialized knowledge, an ability to understand technology trajectories and trends, and an understanding of where strategy and policy are going. Thus procurement needs to happen at a sub-ministry or program level, not the national level. Furthermore, the government needs to involve suppliers early enough in the process that they will not be constrained by predetermined requirements.<sup>45</sup> Innovators need room to innovate.

The signals that the government sends to the market must also be sufficiently long-term to give suppliers a chance to develop solutions. The more open this process is, the more effective it will be at stimulating innovation. This might mean involving suppliers in the actual requirement process in order to better understand the existing landscape and to ensure that there is enough competition. The U.S. government's efforts to procure a new tanker aircraft provide a strong contrary example that illustrates this point: There are only two companies on the planet today who can fulfill this requirement.

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Awarding a contract to a supplier enables the government to help that supplier clear the next hurdles in the innovation process: the risk inherent to R&D and the prohibitive costs of finance. A contract greatly reduces the risk to which the supplier is exposed by both creating a market and providing funding (or giving the supplier the leverage it needs to secure outside funding; contract in hand, the company appears much more attractive to external investors). The most difficult funding to acquire for a small business is typically the seed funding to get them “venture ready.” Government procurement can play an important role in bridging this gap.

Finally, government procurement can encourage innovation by stimulating demand. The United Kingdom’s National Endowment for Science, Technology, and the Arts claims that “if used intelligently, government procurement represents a huge potential reservoir of demand for innovation.”<sup>46</sup> Government is a major consumer and service provider in any economy. Non-defense-related government procurement typically represents somewhere between 10 and 15 percent of a country’s GDP, which is a sizeable enough chunk to encourage the mass market adoption of a product, service, or standard. In the European Union, government procurement is about 16 percent of GDP.<sup>47</sup> In the United States that number rises to about 18 percent. The UK government spends £125 billion per year on goods and services from third parties, which is over half of total discretionary spending.<sup>48</sup> Certain industries are especially large beneficiaries of these expenditures; the public sector in the United Kingdom purchases 55 percent of all IT products and services.<sup>49</sup> While China’s government procurement is officially only about 2 percent, this figure does not include public infrastructure projects conducted by the National Development and Reform Commission, which would push the percentage much higher.<sup>50</sup> China is seeking to put this figure somewhere in the range of 10–15 percent.

Utilizing the government’s role as an early adopter or a lead market is especially important, both for scaling up manufacturing in order to reduce production prices and also for overcoming initial market inertia. New products are typically attempting to usurp the place of an entrenched product, a task that can be difficult if manufacturing hasn’t been scaled up enough yet. For small companies, having an initial reference customer can also be invaluable; many innovations perish due to the inability to get a market foothold. This role is especially important when procuring innovative products beyond the R&D stage (pre-commercial).

Government procurement needs to be part of a larger innovation strategy that extends beyond government; tax incentives, grants, and government regulations can also have a big influence on innovation. Especially with regard to the role of the government as a lead market, one must coordinate between these different functions. To take an example that ought to be familiar to

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anyone with a car, high prices at the gas pump create market incentives for alternative means of transportation that don't rely on fossil fuels. The same goes for fuel efficiency standards. Much of Denmark's success in the wind power industry can be attributed to early adoption of renewable energy feed tariffs.<sup>51</sup> We are more concerned in this paper with the role of government procurement in innovation, but these comments merely demonstrate that the government has other roles to play as well, and that demand-side policy, regulation, and standard-setting can be especially effective.

The Chinese government might also focus on the process by which contracts are awarded. There is a term of art the industry uses in this regard: "MEAT," or the most economically advantageous tender. Too often the government awards

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contracts solely on price. For innovative products and services, this fails to take into consideration key criteria such as quality, cost of usage, energy efficiency, maintenance cost, potential downtime, and other factors that affect the cost over the entire life of the product. Delays in delivery time (or even outright failure to deliver) are typical problems when one awards contracts to the cheapest bidder. For example, in 2008 and 2009, the Chinese government awarded wind turbine contracts based upon the

lowest initial cost per kilowatt, thus favoring lower quality, cheaper products. Moreover, this was based on turbine capacity, not on the power produced. If they had evaluated these turbines for their likely cost over their entire operating life, they might have discovered that the purportedly "cheapest" option was actually more expensive than a higher-quality alternative.

For government to stimulate innovation through government procurement, IPR protection is also obviously critical. While many countries have argued that China should strengthen its intellectual property rights regime to protect their own interests, the strongest argument for doing so should be the healthy development of indigenous innovation in China.

## The Legal Framework

Much of the friction between the United States and China surrounding the issue of indigenous innovation relates to the legal framework. In a WTO-governed global economy that encourages free and open markets, how can countries legally continue to encourage domestic over foreign innovation?

The WTO, the European Union, and the increasing prevalence of bilateral and multilateral trade agreements make this question a thorny one. As a component of their economic strategies, countries should do everything possible to encourage indigenous innovation. The Australian government explains its strategy as follows:

The commonwealth's aim is to stimulate home-grown innovation. The government is a firm believer in free trade, and takes Australia's World Trade Organisation and bilateral trade treaty obligations very seriously. The government is also mindful, however, that these international agreements give Australia considerable scope to support its own innovators. For example, the WTO rules allow members to aid the development of small and medium-size firms, including through government procurement. They permit local preference in the supply of certain goods and services, including research and development. The same is true of our free-trade agreements. For instance, our treaty with the United States permits both countries to give preference to their own small businesses. It also exempts the Australian Industry Capability Program operated by the Department of Defense.<sup>52</sup>

This is a sensible way for Australia to view its agreements. Research has stressed the benefits of protecting "risk taking and innovative smaller companies"<sup>53</sup> from competing with foreign firms on purely equal terms.

In the European Union, indigenous innovation has also been a topic of intense focus, as member countries try to find space for domestic innovation within the bounds of the EU public procurement directives and each member's national procurement policies. Part of the essence of the European Union is commitment to opening markets and removing trade barriers. This commitment translates into two key principles: non-discrimination and transparency. These principles serve not only to open markets but also to reduce corruption, favoritism, and nepotism.<sup>54</sup> They also make foreign markets accessible to contractors. However, the above commitment, coupled with the single market, makes it difficult to use procurement to stimulate purely domestic innovation. One way EU countries can get around this difficulty is through the increased inclusion and encouragement of small businesses. The European Union announced the Small Business Act in June 2008, a key part of which facilitates the involvement of small- and medium-sized enterprises in government procurement. While the act does not explicitly give preference to local companies, due to resource constraints and physical proximity, a small, local company would have an easier time accessing a local procurement opportunity than would a small company located elsewhere.

The core agreement against which mature government procurement regulations should be measured, however, is that of the WTO's Agreement on Government Procurement (GPA). This agreement also sets the principles of non-discrimination and transparency as its cornerstones, ensuring that foreign products and services are treated no less favorably than domestic ones. This is extended to include non-discrimination with regard to domestic entities that are partly owned by foreign entities as well as the location of production for the good or service in question.

That said, there is still considerable room to encourage indigenous innovation through the GPA process. For the moment, we will set aside the fact that awarding a contract to a foreign supplier may stimulate domestic competitors

to be more innovative in the future. There is wiggle room both for developing and developed countries. Article V specifies several options for special treatment of developing countries. At the time of accession, they may negotiate conditions for the use of offsets (including domestic content, licensing of technology, investment requirements, counter-trade, or other requirements) in order to [emphasis added]:

- a) safeguard their balance-of-payments position and ensure a level of reserves adequate for the implementation of programmes of economic development;
- b) promote the establishment or development of domestic industries including the development of small-scale and cottage industries in rural or backward areas; and economic development of other sectors of the economy;**
- c) support industrial units so long as they are wholly or substantially dependent on government procurement;** and
- d) encourage their economic development through regional or global arrangements among developing countries presented to the Ministerial Conference of the World Trade Organization . . . and not disapproved by it.

Furthermore, under the GPA there are limits to all signatories' obligations (not just developing countries). Each signatory's appendix has five annexes specifying coverage:

- Annex 1 containing a list of national entities covered by the GPA and their value thresholds
- Annex 2 containing sub-central government entities and their value thresholds; also including specific exclusions of products and services
- Annex 3 containing all other entities that procure in accordance with the provisions of the Agreement and their value thresholds
- Annex 4 specifying services, whether listed positively or negatively, covered by the Agreement
- Annex 5 specifying covered construction services.

In addition to the five annexes, each signatory may include certain exceptions in their General Notes. Each country's Annexes and General Notes are available online.<sup>55</sup> The United States, for example, uses the Annexes and General Notes as follows:

Thresholds (the value of a contract at or above which the GPA applies) are generally set at 130,000 SDRs, or Special Drawing Rights (approximately \$196,000 at the time of writing), for national supplies and services, and 5 million SDRs for construction. Thresholds on a local level are significantly higher for supplies and services, at 355,000 SDRs. For "other entities," such as the New York and New Jersey port authorities, the threshold is 400,000 SDRs (with other exceptions).

In Annex 1, the United States excludes a broad range of purchases by the Department of Defense. It then outlines all the Federal Supply Classification (FSC) categories that are covered. There are exceptions that are covered by Article XXIII:

1. Nothing in this Agreement shall be construed to prevent any Party from taking any action or not disclosing any information which it considers necessary for the protection of its essential security interests relating to the procurement of arms, ammunition or war materials, or to procurement indispensable for national security or for national defence purposes.
2. Subject to the requirement that such measures are not applied in a manner which would constitute a means of arbitrary or unjustifiable discrimination between countries where the same conditions prevail or a disguised restriction on international trade, nothing in this Agreement shall be construed to prevent any Party from imposing or enforcing measures: necessary to protect public morals, order or safety, human, animal or plant life or health or intellectual property; or relating to the products or services of handicapped persons, of philanthropic institutions or of prison labour.

There are clear categories that this would cover, such as weapons, space vehicles, and nuclear ordnances. Some of these are less obvious, however, such as the category for aircraft components and accessories, which includes:

- [1610] Aircraft propellers & components
- [1615] Helicopter rotor blades, drive mechanisms and components
- [1620] Aircraft landing gear components
- [1630] Aircraft wheel & brake systems
- [1650] Aircraft hydraulic, vacuum and de-icing system components
- [1660] Aircraft air conditioning, heating and pressurizing equipment
- [1670] Parachutes; aerial pick-up, delivery, recovery systems & cargo tie down equipment
- [1680] Miscellaneous aircraft accessories & components
- [1610] Aircraft propellers & components

Other examples of excluded items include floating dry docks, small craft boats, fishing vessels, dredges, buoys, rigging, commercial fishing equipment, engines, bearings, gas and water turbines, electrical components, facsimile equipment, radio and television components, and metal bars, rods, sheets, and shapes.

As can be seen from these examples, the national security designation is quite broad and its exclusions extensive.

On the U.S. state level, the lists of covered institutions vary by state, with some just including executive branch agencies, and others including institutions such as public authorities and state universities. All states are also allowed

to give special preference to distressed areas and businesses owned by minorities, disabled veterans, and women. States may also apply additional environmental restrictions. Twelve states also have exclusions for construction-grade steel, motor vehicles, and coal.

In Annex 3, the United States also refers to the domestic purchase section (1605a) of the *American Recovery and Reinvestment Act of 2009*, stating that it shall not apply to Canadian iron, steel, and manufactured goods above the threshold. That note continues to say “the United States undertakes no other commitments with respect to these programs.”<sup>56</sup>

Annex 4 contains some notable service exclusions, including transportation services, dredging, management and operation contracts for certain government or privately-owned facilities used for government purposes, including federally funded research and development centers, research and development, and printing services (state entities).

**The attempt to shut out goods manufactured abroad from stimulus funding is just as misguided as some of China’s recent and ongoing missteps.**

In the General Notes, the United States makes certain specific exclusions. For example, Japanese goods and services are excluded from NASA procurement, and the threshold for state-level construction services from Korea is raised from 5 million SDRs to 15 million. Most important, however, is the note that states, “notwithstanding the above, this Agreement *will not apply to set asides on behalf of small and minority businesses.*”<sup>57</sup> [emphasis mine]

The U.S. government also has policies that require a statutory minimum of 23 percent of procurement from small businesses.<sup>58</sup> On a state level, many states provide funding and administrative assistance to local companies that want to take part in the SBIR, and they also have significant “set-asides” for local state procurement from small and minority-owned businesses. To be eligible for such set-asides, businesses must register and apply for a license to do business in that particular state, and the majority of its business activities must occur in that state.

Furthermore, there are also set-asides for direct procurement expenditures that require prime contractors to maximize the amount subcontracted to small businesses. Given that direct set-aside rules require 23 percent of procurement to go to small businesses and 20 percent of prime contractors subcontracting to go to small firms, 43 percent of the U.S. procurement market is essentially protected from international competition.<sup>59</sup>

Our purpose in reviewing the U.S. example in detail is primarily to show that even for a developed country signatory to the GPA there is significant latitude for policies that spur local innovation. In the U.S. case, there are two key areas that contribute to *indigenous* innovation:

- Excluding small businesses from the agreement and using thresholds enable smaller contracts to be directed to innovative small businesses. Breaking up

large procurement contracts into small pieces also encourages small, local enterprise involvement. One can also limit applicants to small, local, innovative firms by making subsequent stages of an award contingent upon participation in an initial (smaller) phase.

- A research and development exclusion allows the most innovative awards to be directed to local enterprises. This exclusion allows the U.S. SBIR program and similar state-funded programs to focus on U.S. businesses.

However, the United States should be wary of overprotecting government procurement markets. It is very important to remember that open markets and increased linkages are critical for innovation. In the United States, a number of American lawmakers and corporations have been attempting to prevent foreign technology from being used in government-funded projects. For instance, some raised objections to a stimulus-funded wind power project in Texas because the turbines to be used in the wind farms were manufactured in China. While this project did not technically qualify as government procurement, it certainly raises the issue of the temptation to direct government funds to domestic technologies.

## Conclusion and Recommendations

The Chinese government has already taken important steps in addressing some of the key shortcomings in their NIIP program. Furthermore, the mere fact that they issue draft regulations for international comment is commendable. There are, however, other key steps that the government can take to encourage indigenous innovation through public procurement:

- Become a signatory to the World Trade Organization's GPA. This will create a solid foundation for the construction of a legal set of mechanisms to stimulate indigenous innovation and keep markets open. During the most recent Strategic and Economic Dialogue, China made a commitment to submit a revised application to join the GPA; China should ensure that the quality of the application is robust and in line with international best practices.
- Further clarify the scope of government procurement law; specify that it applies, at least initially, to administrative government departments and not to state-owned enterprises and other government-related organizations; specify local versus national coverage.<sup>60</sup>
- Strengthen China's intellectual property rights regime so as to encourage innovation within the context of government procurement.
- De-couple NIIP and government procurement; keep government procurement focused on the best practices outlined in this paper; allow innovation to answer a need, not a specification.

- Recruit to government procurement teams experts who can make the government an “intelligent customer.”
- Improve governance and transparency of national and local procurement entities (including auditing and dispute-resolution mechanisms). Open and transparent processes will foster the highest levels of innovation.
- Create national-level sustainable procurement guidelines for certain key product areas (energy, transportation, construction, IT, chemicals) so as to mandate quality and performance levels that are connected to national climate and sustainable development goals, and that can also stimulate innovation and stimulate markets (but don’t fall into the trap of creating a catalogue of specific products).<sup>61</sup>

The same theories and best practices discussed in this brief apply equally to the United States. While programs like the SBIR have effectively used government procurement to foster indigenous innovation, other recent developments have threatened to hinder innovation. The attempt to shut out goods manufactured abroad from stimulus funding is just as misguided as some of China’s recent and ongoing missteps. The U.S. history of open procurement markets, it should be kept in mind, is a short one. It was not until the Trade Agreements Act of 1979 that the president could waive decades-old procurement restrictions when they conflicted with international treaties.<sup>62</sup> Even today, the United States is still legally permitted to favor domestic suppliers when the supplying country is not a signatory to the GPA, is not a member of NAFTA, or does not otherwise offer reciprocal benefits. The United States should also ensure that government procurement is aligned with the key findings of this paper, especially with regards to open markets and sustainable procurement.

Unilateral measures along the lines described above are not the only options for China and the United States. One immediate way they can move forward cooperatively on these issues is to form a joint sustainable procurement agreement that aligns certain key requirements and standards. Given the sizes of the U.S. and Chinese markets, other nations would likely follow their lead. The resulting benefit to global innovation in some of the most critical future need areas would be astounding.

## Notes

- 1 Also referred to as endogenous or domestic innovation.
- 2 Klaus Schwab and Michael Porter, *The Global Competiveness Report 2008–2009*, World Economic Forum, 2008, p. 6.
- 3 On May 26, 2010, the government issued further draft measures on the procurement of domestic products. There were a couple of key developments contained in this document. First, it defines domestic products as those whose proportional domestic production cost exceeds 50 percent. Second, it states that procurement of products manufactured in countries that have bilateral or multilateral agreements with China shall be carried out in accordance with those agreements, a development that would have a large impact in the context of the World Trade Organization's Agreement on Government Procurement.
- 4 Translation from Chinese by the author.
- 5 As previously noted, in the recent Chinese government-issued "Notice Requesting Public Comment on the 'Administrative Measures for the Government to Purchase Domestic Products (Draft for Public Comment)'" (May 26, 2010), Article 22 states that bilateral or multilateral agreements on the opening of government procurement markets would be carried out in accordance with said agreements. This would address much of the legal issue.
- 6 Dieter Ernst, "Global Production Networks and the Changing Geography of Innovation Systems: Implications for Developing Countries," East-West Center Working Papers, Economic Series, no. 9, November 2000, p. 23.
- 7 Ernst, p. 22.
- 8 *Ibid.*, p. 24.
- 9 *Ibid.*, p. 26.
- 10 "The Importance of Innovation to Productivity," Department of Innovation, Industry, Science and Research, Australian Government. Available at <http://www.innovation.gov.au/Section/Innovation/Pages/2Theimportanceofinnovationtoproductivity.aspx>.
- 11 William Lazonick, "Indigenous Innovation and Economic Development: Lessons from China's Leap Into the Information Age," *Industry and Innovation*, December 2004, vol. 11, no. 4, pp. 292–93.
- 12 See Jong, Lazonick, Sternberg, and Arndt, and UK, AU government studies sources in bibliography, among others.
- 13 Ernst, p. 26.

- 14 Brune Poirson, "Linking Innovators," NESTA Discussion Paper, February 2009, p. 13.
- 15 Sami Mahroum et al., "Innovation by Absorption," NESTA Research Report, October 2008, p. 14.
- 16 Australian Government, "Powering Ideas: An Innovation Agenda for the 21st Century" (Canberra, 2009), p. 26.
- 17 Francis Narin, Kimberly Hamilton, and Dominic Olivastro, "The Increasing Linkage between U.S. Technology and Public Science," *Research Policy*, no. 26, 1997, p. 330.
- 18 Darrell Rigby and Chris Zook, "Open-market Innovation," *Harvard Business Review*, October 2002, p. 89.
- 19 Ibid. p. 84.
- 20 Ibid. p. 83.
- 21 Lazonick, p. 277.
- 22 Ernst, p. 24.
- 23 Gene Grossman, "Explaining Japan's Innovation and Trade: A Model of Quality Competition and Dynamic Comparative Advantage," *National Bureau of Economic Research*, Working Paper no. 3194, Cambridge, Mass., December 1989, p. 34.
- 24 Ibid., p. 34.
- 25 Ibid., p. 32.
- 26 Ibid., p. 30.
- 27 Ibid., p. 30.
- 28 Simcha Jong, "The Development of Munich and Cambridge Therapeutic Biotech Firms: A Case Study of Institutional Adaptation," in Crouch, Colin and Voelzkow, *Innovation in Local Economies: Germany in Comparative Context* (Oxford: Oxford University Press, 2009), p. 124.
- 29 Ibid., p. 125.
- 30 David Connell, "'Secrets' of the World's Largest Seed Capital Fund: How the United States Government Uses its Small Business Innovation Research (SBIR) Programme and Procurement Budgets to Support Small Technology Firms," Centre for Business Research, University of Cambridge, July 2006, p. 2.
- 31 Ibid., p. 1.
- 32 Ibid., p. 2.
- 33 Ibid., p. 4. This study recounts numerous success stories.
- 34 Available at [http://www.sba.gov/aboutsba/sbaprograms/sbir/sbirstir/SBIR\\_STTR\\_DESCRIPTION.html](http://www.sba.gov/aboutsba/sbaprograms/sbir/sbirstir/SBIR_STTR_DESCRIPTION.html).
- 35 Connell, pp. 34–39.
- 36 David Connell et al., "Proceedings of the Forum on Innovation and Procurement Policy," October 2007, p. 7.
- 37 Ernst, p. 25.
- 38 "Science and Innovation Strategy," Institute of Physics, February 14, 2008.

- 39 Ernst, p. 25.
- 40 Yining Peng, "Imitation innovation irritation," *China Daily*, February 23, 2010, p. 7.
- 41 Gene Grossman and Elhanan Helpman, "Trade, Innovation, and Growth," *The American Economic Review*, May 1990, 80, 2, p. 90.
- 42 Connell, p. 34.
- 43 Philip Termouth, "Using Public Procurement to Stimulate Innovation," Council for Industry and Higher Education, London, November 2007, p. 6.
- 44 "Powering Ideas: An Innovation Agenda for the 21<sup>st</sup> Century," Commonwealth of Australia, 2009, p. 54.
- 45 "Competing in the Global Economy," UK Department of Trade and Industry, December 2003, p. 87.
- 46 "Towards an Innovation Nation," *NESTA Policy Briefing*, March 2008, p. 2.
- 47 Available at <http://www.publicprocurementnetwork.org/b3.htm>.
- 48 "Transforming Government Procurement," Her Majesty's Treasury, Crown Copyright, 2007, p. 4.
- 49 Connell, p. 2.
- 50 This figure also does not include state-owned enterprises, as they are not targeted to be within the scope of government procurement.
- 51 Luke Georghiou, "Demanding Innovation," *NESTA Provocation*, 02, February 2007, p. 12.
- 52 "Powering Ideas: An Innovation Agenda for the 21<sup>st</sup> Century," Commonwealth of Australia, p. 54.
- 53 Ernst, p. 25.
- 54 European Commission Expert Group Report, "Public Procurement for Research and Innovation," European Communities, September 2005, p. 13.
- 55 Available at [http://www.wto.org/english/tratop\\_E/gproc\\_e/appendices\\_e.htm](http://www.wto.org/english/tratop_E/gproc_e/appendices_e.htm).
- 56 United States GPA, Appendix I, Annex 3, Note 3, March 19, 2010.
- 57 United States GPA, General Notes, Note 1, March 19, 2010.
- 58 US Small Business Act, Section 15(g)(1).
- 59 Connell et al., p. 8.
- 60 Furthermore, it is important that the Chinese government not exclude state-owned enterprises from China's WTO GPA offer, yet move to classify purchases from these entities domestically as government procurement.
- 61 The China Association of Environmental Protection Industry has recently promoted the construction of a Green Procurement Catalogue, which still takes a product list approach. Available at <http://www.zycg.gov.cn/article/show/11128>.
- 62 The 1933 Buy America Act required procurement to come from domestic sources when possible.



## Bibliography

- Barbalas, Michael et al. Letter to Wan Gang, Xie Xuren, and Zhang Ping, December 10, 2009.
- Chao, Loretta. "China's Curbs on Tech Purchases Draw Ire," *Wall Street Journal*, December 11, 2009.
- China Association of Environmental Protection Industry, "Notice Regarding the Collection of 'Green Procurement Guide Catalogue' Typical Case," May 28, 2010. Available at <http://www.zycg.gov.cn/article/show/11128>.
- "Competing in the Global Economy: the Innovation Challenge," UK Department of Trade and Industry, Crown Copyright, December 2003.
- Connell, David. "'Secrets' of the World's Largest Seed Capital Fund: How the United States Government Uses its Small Business Innovation Research (SBIR) Programme and Procurement Budgets to Support Small Technology Firms," Centre for Business Research, University of Cambridge, July 2006.
- Connell, David et al. "Proceedings of the Forum on Innovation and Procurement Policy, October 2007.
- "Driving Innovation Through Public Procurement," *NESTA Policy Briefing*, February 2007.
- Ernst, Dieter. "Global Production Networks and the Changing Geography of Innovation Systems: Implications for Developing Countries," East-West Center Working Papers (Economic Series), no. 9, November 2000.
- European Commission Expert Group Report, "Public Procurement for Research and Innovation," European Communities, September 2005.
- Fu, Xiaolan and Yundan Gong. "Indigenous and Foreign Innovation Efforts and Drivers of Technological Upgrading: Evidence from China," SLPTMD Working Paper Series no. 016, University of Oxford, 2008.
- Georghiou, Luke. "Demanding Innovation," *NESTA Provocation*, 02, February 2007.
- Grabher, Gernot, ed. *The Embedded Firm: On the Socioeconomics of Industrial Networks* (London: Routledge, 1993).
- Grossman, Gene. "Explaining Japan's Innovation and Trade: A Model of Quality Competition and Dynamic Comparative Advantage," *National Bureau of Economic Research*, Working Paper no. 3194, Cambridge, Mass., December 1989.
- Grossman, Gene and Elhanan Helpman. "Trade, Innovation, and Growth," *American Economic Review*, May 1990, 80, 2, pp. 86–91.

- “Guide on Dealing with Innovative Solutions in Public Procurement: 10 Elements of Good Practice,” Pro Inno Europe Paper, no. 1, European Communities, 2007.
- Hu, Shaowei. “Blazing New Technology Trails; Promoting self-innovation is key to sustainable development,” *China Daily USA*, April 20, 2010, p. 8.
- “The Importance of Innovation to Productivity,” Department of Innovation, Industry, Science and Research, Australian Government. Available at <http://www.innovation.gov.au/Section/Innovation/Pages/2Theimportanceofinnovationtoproductivity.aspx>.
- Jong, Simcha. “The Development of Munich and Cambridge Therapeutic Biotech Firms: A Case Study of Institutional Adaptation,” in Crouch, Colin and Voelzkow, *Innovation in Local Economies: Germany in Comparative Context* (Oxford: Oxford University Press, 2009), pp. 121–138.
- King, Christopher. “With Output and Impact Rising, China’s Science Surge Rolls On,” *Sciencewatch.com*, July/August 2008.
- Lazonick, William. “Indigenous Innovation and Economic Development: Lessons from China’s Leap Into the Information Age,” *Industry and Innovation*, December 2004, vol. 11, no. 4, pp. 292–93.
- Mahroum, Sami et al. “Innovation by Absorption,” *NESTA Research Report*, October 2008.
- Narin, Francis, Kimberly Hamilton, and Dominic Olivastro. “The Increasing Linkage between U.S. Technology and Public Science,” *Research Policy*, no. 26, 1997, pp. 317–330.
- Peng, Yining. “Imitation Innovation Irritation,” *China Daily*, February 23, 2010, p. 7.
- People’s Republic of China. “PRC Government Procurement Law,” June 29, 2002. Available at <http://www.people.com.cn/GB/jinji/20020629/764316.html>.
- People’s Republic of China. “China’s National Medium- and Long-term Plan for Science and Technology Development (2006–2020),” February 9, 2006. Available at [http://www.gov.cn/jrzq/2006-02/09/content\\_183787.htm](http://www.gov.cn/jrzq/2006-02/09/content_183787.htm).
- People’s Republic of China. “State Council Notice of Selected Supporting Policies for the ‘National Medium- and Long-term Plan for Science and Technology Development (2006–2020),’” February 7, 2006. Available at [http://www.gov.cn/xxgk/pub/gov-public/mrlm/200803/t20080328\\_32743.html](http://www.gov.cn/xxgk/pub/gov-public/mrlm/200803/t20080328_32743.html).
- People’s Republic of China. “Ministry of Science, National Development and Reform Commission, and Ministry of Finance Notice Regarding the Launch of the National Indigenous Innovation Product Accreditation Work for 2009,” November 15, 2009. Available at [http://most.gov.cn/tztg/200911/t20091115\\_74197.htm](http://most.gov.cn/tztg/200911/t20091115_74197.htm).
- People’s Republic of China. “Trial Measures for the Administration of the Accreditation of National Indigenous Innovation Products (2006),” November 6, 2008. Available at <http://www.csoet.cn/n16/n1100/n38116/n38723/205126.html>.
- People’s Republic of China. “Evaluation Measures on Indigenous Innovation Products for Government Procurement,” February 25, 2008. Available at [http://most.gov.cn/ztl/gjzctx/ptzcfcg/200802/t20080225\\_59306.htm](http://most.gov.cn/ztl/gjzctx/ptzcfcg/200802/t20080225_59306.htm).
- People’s Republic of China. “Administrative Measures for the Government to First Purchase and Purchase Management of Indigenous Innovation Products,” February 5, 2008. Available at [http://www.gov.cn/ztl/kjzfzgh/content\\_883647.htm](http://www.gov.cn/ztl/kjzfzgh/content_883647.htm).

- People's Republic of China. "Ministry of Science, National Development and Reform Commission, and Ministry of Finance Notice Requesting Public Comment On 'Notice Regarding the Launch of the 2010 National Indigenous Innovation Product Accreditation Work' (Draft for Public Comment)," April 9, 2010. Available at [http://www.most.gov.cn/tztg/201004/t20100409\\_76710.htm](http://www.most.gov.cn/tztg/201004/t20100409_76710.htm).
- People's Republic of China. "Ministry of Science and Technology Q&A Regarding the 2010 Accreditation Work of National Indigenous Innovation Products," April 12, 2010. Available at [http://news.china.com.cn/txt/2010-04/12/content\\_19797422.htm](http://news.china.com.cn/txt/2010-04/12/content_19797422.htm).
- People's Republic of China. "Notice Requesting Public Comment on the 'Administrative Measures for the Government to Purchase Domestic Products (Draft for Public Comment),' " May 26, 2010. Available at <http://www.chinalaw.gov.cn/article/cazjgg/201005/20100500254720.shtml>.
- Poirson, Brune. "Linking Innovators," *NESTA Discussion Paper*, February 2009.
- "Powering Ideas: An Innovation Agenda for the 21<sup>st</sup> Century," Commonwealth of Australia, 2009.
- "Public Procurement for Research and Innovation," European Commission Expert Group Report, European Communities, September 2005.
- Rigby, Darrell and Chris Zook. "Open-market Innovation," *Harvard Business Review*, October 2002, pp. 80–89.
- Schwab, Klaus and Michael Porter. *The Global Competitiveness Report 2008–2009*, World Economic Forum, 2008.
- Roberts, Dexter. "China: Closing for Business?" *Business Week*, March 9, 2010, Cover Story.
- Sainsbury of Turville, Lord. "The Race to the Top: A Review of Government's Science and Innovation Policies," Her Majesty's Treasury, Crown Copyright, 2007.
- "Science and Innovation Strategy," Institute of Physics, February 14, 2008.
- Song, Ying. "Zhongmei zhanlv yu jingji duihua luomu Xue Lan: Zizhu chuangxin zhengce xu jiaqiang goutong," *China Energy News*, June 2, 2010.
- Sternberg, Rolf and Olaf Arndt. "The Firm or the Region: What Determines the Innovation Behavior of European Firms," *Economic Geography*, vol. 77, no. 4, October, 2001, pp. 364–382.
- Tatelman, Todd. "International Government-Procurement Obligations of the United States: An Overview," *Congressional Research Service Report*, Library of Congress, May 17, 2005.
- Termouth, Philip. "Using Public Procurement to Stimulate Innovation," Council for Industry and Higher Education, London, November 2007.
- "Towards an Innovation Nation," *NESTA Policy Briefing*, March 2008.
- "Transforming Government Procurement," Her Majesty's Treasury, Crown Copyright, January 2007.
- The US-China Business Council. "The US-China Business Council Comments on the April 2010 Draft Notice on the Launch of the National Indigenous Innovation Product Accreditation Work," The US-China Business Council, Washington D.C., 2010.

- The US-China Business Council. "US-China Business Council Comments on Draft Implementing Regulations on the PRC Government Procurement Law," The US-China Business Council, Washington D.C., 2010.
- The US-China Business Council. "International Innovation Best Practices: Recommendations for China's Innovation Incentive Policies," The US-China Business Council, Washington D.C., 2010.
- The US-China Business Council. "Issue Brief: New Developments in China's Domestic Innovation and Procurement Policies," The US-China Business Council, Washington D.C., 2010.
- Wei, Yan. "Wo guo SCI lunwen shu shouci tupo shiwan bian," *Science Times*, November 30, 2009.
- Wessner, Charles. "Small Business Innovation – A Role for Government," *EJournalUSA*, November 6, 2009. Available at <http://www.america.gov/st/scitech-english/2009/November/20091106123750ebysedo0.6841547.html>.
- Wessner, Charles, ed. *An Assessment of the SBIR Program at the National Science Foundation* (Washington D.C., National Academies Press, 2008).
- World Trade Organization, The Plurilateral Agreement on Government Procurement (GPA). Available at [http://www.wto.org/english/tratop\\_E/gproc\\_e/gp\\_gpa\\_e.htm](http://www.wto.org/english/tratop_E/gproc_e/gp_gpa_e.htm).
- Xue, Lan. "The Prizes and Pitfalls of Progress," *Nature*, vol. 454, July 24, 2008, pp. 398–401.
- Xue, Lan. "Wo guo keji fazhan de zhengce jianyi," January 14, 2006. Available at <http://news.tsinghua.edu.cn/new/readnews.php?id=12220>.

**Additional Sources** on the more general topic of national innovation systems:

- Freeman, Christopher. "The 'National System of Innovation' in Historical Perspective," *Cambridge Journal of Economics*, 1995.
- Freeman, Christopher. 'Japan: A New National Innovation System?', in G. Dosi, C. Freeman, R. R. Nelson, G. Silverberg and L. Soete, eds. *Technology and Economy Theory* (London: Pinter, 1988).
- Lundvall, Bengt-Åke, ed. *National Innovation Systems: Towards a Theory of Innovation and Interactive Learning* (London: Pinter, 1992).
- "National Innovation Systems," OECD, Paris, France, 1997.
- Nelson, Richard, ed. *National Innovation Systems. A Comparative Analysis* (Oxford: Oxford University Press, 1993).
- Patel, Pari and Keith Pavitt. "The Nature and Economic Importance of National Innovation Systems," *STI Review*, no. 14, OECD, Paris, 1994.
- Porter, Michael. *The Competitive Advantage of Nations* (Basingstoke: Macmillan, 1990).
- Rowen, Henry, Marguerite Gong Hancock, and William F. Miller, eds. *Greater China's Quest for Innovation* (Stanford: Walter H. Shorenstein Asia-Pacific Research Center Books, 2008).

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