SECTION 4: CHINA'S 12TH FIVE-YEAR PLAN AND TECHNOLOGY DEVELOPMENT AND TRANSFERS TO CHINA

Introduction

While China seeks to be considered a market-oriented economy, its government continues to engage in comprehensive economic planning, direction, support, and control. During the 2011 report cycle, the Commission examined various aspects of China's industrial policy and the implications it may have for U.S. companies competing for a share of the Chinese market. This section continues the discussion started in sections 2 and 3 of this Report, with a particular focus on China's newly adopted 12th Five-Year Plan (2011–2015). This section also addresses the policies aimed at helping China move up the manufacturing value-added chain, fostering strategic emerging industries (SEIs), which include new-generation information technology, high-end manufacturing, alternative energy, and biotechnology, and completing its transformation to a global technological powerhouse.

China's rapid industrialization and economic growth during the past 30 years has often been attributed to liberalization policies undertaken as part of its "reform and opening up" era. But that only tells half the story. Chinese economic development during the same period has relied extensively on a government-directed industrial policy to promote certain segments of the economy and support export-led growth. Many such policies are outlined in five-year plans that identify broad development goals. The process then develops regulations, guidelines, and tools to accomplish those objectives. Examples include providing subsidies to companies in select industries and encouraging foreign investment of money and technology in target sectors. Aaron L. Friedberg, professor at Princeton University, noted that "vital though imports have undoubtedly been, it is foreign direct investment that has served as the 'decisive catalyst' propelling China up the high-tech ladder." [310]

China's 12th Five-Year Plan

China began implementing five-year plans in 1953 in order to align the economy with top policy goals and to communicate this directive throughout the government bureaucracy.[311] Five-year plans are designed to be roadmaps for regulators and provincial officials, who are responsible for their implementation and act as "key indicators of the directions and changes in development philosophy" at the highest levels of Chinese leadership, according to Cindy Fan, a professor at the University of California, Los Angeles.[312]

Like previous plans, the 12th Five-Year Plan ratified by the National People's Congress in March 2011 sets out a broad range of goals, policy prescriptions, and reform priorities.* Unlike earlier plans, however, the 12th Five-Year Plan shifts its emphasis from enumerating hard production targets to describing broader principles, consistent with China's goal of economic rebalancing, and technological and scientific upgrading, especially in industrial production.[313]

The 12th Five-Year Plan attempts to restructure the Chinese economy by encouraging domestic consumption, developing the service sector, shifting to higher value-added manufacturing, conserving energy, and cleaning up the environment. Premier Wen Jiabao's annual address to the National People's Congress on March 5, 2011, the "Report on the Work of the Government," listed the expansion of domestic demand as a key aspect of the government's work in 2011.[314] This section will focus on economic restructuring and industrial upgrading.

Economic Goals and Rebalancing

Although China has maintained gross domestic product (GDP) growth averaging 10 percent for the past decade, this success was achieved largely due to massive fixed-asset investment† and policies aimed at boosting the export sector. During the past decade, exports and investment that supported export industries were the biggest contributors to China's gross domestic product (GDP) (see Addendum II: Figure 1). Household consumption, by contrast, stagnated (see Addendum II: Figure 1). Moreover, such reliance on investment-led growth resulted in personal disposable income falling as a share of GDP (see Addendum II: Figure 2), causing consumption to lag behind GDP growth.[315]

The Chinese government has long been aware that maintaining growth in an economy so substantially dependent on exports and fixed investment is unsustainable, as articulated by Premier Wen in 2007, when he called the Chinese economy "unstable, unbalanced, uncoordinated and unsustainable."[316] As Chinese economic growth slowed sharply in late 2008 when U.S. and European demand collapsed (together they account for over 40 percent of China's exports), the imperatives of rebalancing became clear.[317]

Fearful of economic instability, however, in the wake of the 2008 crisis, the Chinese government embarked on a massive fiscal and monetary stimulus program, which relied significantly on state-owned bank lending to boost growth. Banks lent out nearly $1.5 trillion in 2009, leading to a massive investment boom that amounted to nearly 90 percent of GDP growth in the same year.[318] In short, China's dependence on investment and exports grew at a time when global demand for Chinese exports floundered.[319]

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*See Addendum I for a list of 11th and 12th Five-Year Plan key economic indicators.

†Fixed-asset investment includes land improvements (fences, ditches, drains, and so on); plant, machinery, and equipment purchases; and the construction of roads, railways, and the like, including schools, offices, hospitals, private residential dwellings, and commercial and industrial buildings.

Key Economic Targets of the 12th Five-Year Plan

In the "Report on the Work of the Government," Premier Wen has outlined the key economic targets of the 12th Five-Year Plan:[320]

- Annual GDP growth: 7 percent
- Increase service sector contribution to GDP by 4 percentage points, from 43 percent to 47 percent
- Increase per capita disposable income of urban and per capita net income of rural residents by 7 percent per annum
- Increase spending on research and development (R&D) to 2.2 percent of GDP [from 1.75 percent as of 2010]

GDP Growth: The 7 percent GDP growth target is aimed primarily at reining in the Chinese economy, which has been overheating. It is also a signal to provincial and local governments to focus on generating economically and environmentally sustainable growth rather than growth at any cost. China has been trying to accomplish this transition for many years, though with limited success. For example, the 11th Five-Year Plan similarly had a lower GDP growth target (7.5 percent) but achieved rates of nearly 11 percent.[321]

Service Sector: The 12th Five-Year Plan places an emphasis on moving away from labor-intensive and low-skilled manufacturing toward more sophisticated and capital-intensive production. As a result, China will need a new source of employment. China's service sector is underdeveloped: in 2009 it accounted for just 42 percent of total GDP (compared to 54 percent for India and 57 percent for Taiwan).[322] It has the potential, however, to generate new urban jobs and absorb surplus rural labor.[323] According to Trevor Houser, an economist with the Rhodium Group, achieving such structural changes is the best way to meet long-term employment goals: "[I]f I invest a million RMB [renminbi] on services, I create three times more jobs than in the iron and steel sector . . . if you're resource-constrained and desperate for new jobs [like China is], [being the] world steel mill is a losing strategy in a wide variety of ways."[324] However, Premier Wen's work report fails to address the implementation of his goals, that is, how China will actually encourage growth in service industries. (For more on the Chinese government's concerns over unemployment and social stability, see chap. 1, sec. 5, of this Report.)

Income: The government views income inequality and the urban/rural divide as sources of potential social instability (see chap.1, sec. 5, of this Report for more). According to the Chinese government, the 12th Five-Year Plan is intended to help increase income through raises in minimum wages, with a particular focus at the low end of the pay scale.[325] However, boosting income does not guarantee that consumers will reduce precautionary savings. The 12th Five-Year Plan also contains a set of reform priorities, including improving the social safety net and providing low-cost housing, in the hope that this will lead Chinese households to reduce savings rates and increase consumption.[326]

In practice, five-year plans are constantly reviewed and revised over the course of five years.[327] Reversing years of economic policies aimed at growth at all costs will not be easy. Critics doubt the Chinese government's ability to overcome entrenched domestic interests to push through a reform agenda. The 12th Five-Year Plan does not indicate how the economy will become less reliant on capital spending, have more liberalized financial markets, or fundamentally shift China's global trade balance. According to Stephen Green, regional head of research at the Standard Chartered Bank in Shanghai, so far "[t]here's absolutely no sign that the percentage of investment in GDP is slowing. And there are no signs of liberalization of the service sector to allow the private sector to take a bigger share of the economy."[328]

Cornell University economist Eswar Prasad testified before the Commission that one reason that the 12th Five-Year Plan offers few details related to major structural changes, especially a shift to a consumption-driven economy, is the inherent tension between China's short- and long-term objectives. For example, while significantly raising wages would certainly boost domestic consumption, it would also drive up inflation.[329] Moreover, structural change would not be to everyone's benefit. As Dr. Prasad stated, "For the politically well-connected state-owned enterprise bosses, for many of the bank chairmen, this is actually a very good system because it keeps profits flowing into the state enterprises, into the banks."[330] With the leadership change next year, the Communist Party may be reluctant to upset the status quo.

In meetings with the Commissioners, Hong Kong-based journalists have noted that there is a contradiction at the heart of China's 12th Five-Year Plan: It aims to create domestic consumption but an active consumer class will mark a shift in power away from the government and state-owned enterprises (SOEs). Michael Pettis, professor of finance with Peking University's Guanghua School of Management, has pointed out that a key characteristic of China's development model is financial repression. The vast majority of household savings takes the form of bank deposits, while the vast majority of corporate financing takes the form of bank loans. With the lending and deposit rates set very low, household savings are used by the state to heavily subsidize the cost of capital. This amounts to a transfer from the household sector to favored borrowers.[331] Efforts to boost consumption will necessarily cut into household savings thus limiting the amount of the capital available for loans to SOEs and other state-supported entities.

Industrial Upgrading and Strategic Emerging Industries

For the first time, the 12th Five-Year Plan also makes explicit mention of SEIs. According to Dr. Roach, "the new plan targets a major move up the manufacturing value chain."[332] It focuses on the development and expansion of seven SEIs: New-generation information technology, high-end equipment manufacturing, advanced materials, alternative-fuel cars, energy conservation and environmental protection, alternative energy, and biotechnology. Within these industries, 37 projects have been identified, which are listed in Addendum III of this section. The goal is to take the SEIs

from a current combined share of 3 percent of Chinese GDP to 8 percent by 2015 and 15 percent by 2020.[333]

Willy Shih of the Harvard Business School told the Commission that the 12th Five-Year Plan is a "continuation of a long-term strategy of capability building that has been in place for decades" and is strongly aligned with other guiding policies from the central government, in particular, the National Medium- and Long-Term Plan for the Development of Science and Technology (MLP), issued in 2006. This plan articulated the goal of making China an innovation-oriented society.[334]

The 12th Five-Year Plan calls for funding SEI development and increasing the scale of government and capital-market investment in SEIs and proposes using various subsidization policies to support the SEIs. As with other five-year plan policies, the national five-year plan only provides general guidance, and regional governments are responsible for devising precise subsidies and policies. For example, in May 2011, the Taiyuan City government passed an "opinion" on speeding up the development of SEIs, which calls for various local government measures to enable SEIs to account for 20 percent or more of Taiyuan City GDP and develop locally branded SEIs worth 1 billion RMB (about $157 million) or more by 2015.[335]

To achieve its SEI goals, the central and local government and private sectors would have to spend between $600 billion and $2.1 trillion over the next five years, according to industry experts' estimates.[336] The central and local governments will likely combine this investment with preferential tax and procurement policies to ensure that Chinese firms emerge as global leaders, or "national champions," in these industries within the next five years. Similar policies previously have been successful in establishing "national champions" in industries such as telecommunications, steel, and railway, although it is unclear how much of this success can be attributed to China's domestic innovation and how much to technology transferred or illegally copied from foreign producers. For example, in the railway industry, China went from producing steam engines just over ten years ago to competing internationally, including a joint proposal with General Electric for constructing bullet trains in California.[337]

According to Ministry of Finance Chief of Staff Hu Jinglin, the ministry will actively use finance and taxation policy to support the development of the SEIs, including providing multiple channels for financing. The ministry will encourage its regional offices to develop relevant policies based upon local conditions and will encourage local governments to take a share in SEIs and actively develop investment funds.[338] According to the National Development and Research Commission's draft, "Major Tasks and Measures for Economic and Social Development in 2011," released during the Eleventh National People's Congress on March 5, 2011:

> *We will quickly formulate and implement a development plan and supporting policies for strategic emerging industries, set up a special fund for promoting their development, expand the scale of venture capital investment in them, formulate a guiding list for developing them, and work out industry standards for major emerging industries. We will*

organize the implementation of industrial innovation and development projects, including those on National Broadband Internet Agenda, cloud computing, the Internet of Things, integrated circuits, flat-panel displays, space infrastructure, regional aircraft and industrialization of general aviation aircraft, as well as major application and demonstration, projects on the health of the people and on using information technology to benefit the people. We will advance national pilot programs and demonstrations for IT [information technology] promotion.[339]

The 12th Five-Year Plan also includes the following, more precise goals for each of the seven SEIs:

Innovation and development of new strategic industries[340]
01 Energy conservation and environmental protection industries—Implement major exemplary projects in energy conservation and environmental protection and promote the industrialization of efficient energy conservation, advanced environmental protection and resource recycling.
02 New-generation IT [information technology] industry—Construct new-generation mobile communication networks, the new-generation Internet, and digital broadcast and television networks. Implement exemplary application projects of the Internet of things and special industrialization projects of network products. Construct industrial bases of IC [integrated circuit], panel display, software, and information services.
03 Biological industry—Build databases of gene resources for pharmaceuticals, important plants and animals, and industrial microbial bacteria. Construct R&D [research and development] and industrialization bases for biopharmaceuticals and biomedical engineering products, biological breeding, testing, detection and fine breeding bases, and exemplary biomanufacturing application platforms.
04 High-end equipment manufacturing industry—Construct industrialization platforms for homemade trunk and feeder airplanes, general-purpose airplanes and helicopters, and a spatial infrastructure framework composed of navigation, remote sensing and communication satellites, and develop intelligent control systems, high-class numerically controlled machines, high-speed trains and urban rail traffic equipment, etc.
05 New energy industry—Construct industrial bases for new-generation nuclear power equipment, large wind power generating sets and parts, new assemblies of efficient solar power generation and heat utilization, biomass energy conversion and utilization technologies, and intelligent power grid equipment, and implement exemplary large-scale application projects of marine wind power, solar power, and biomass energy.
06 New material industry—Promote the R&D and industrialization of carbon fibers, semiconductor materials, high-temperature alloy materials, superconductive materials, high-performance rare earth materials and nanometer materials for aviation and spaceflight, energy and resources, traffic and transport, and major equipment.
07 New-energy automobile industry—Conduct R&D and large-scale commercialization demonstration projects for plug-in hybrid electric vehicles and pure electric vehicles, and promote industrialized application.

Four of these industries (biopharmaceuticals, high-end equipment manufacturing, new materials, and next-generation information technology) were previously identified as target industries in the 11th Five-Year Plan. Three of these industries align with sustainable growth (alternative energy, clean energy vehicles, and clean energy technology), and four industries align with moving up the value chain (biotechnology, new materials, next-generation information technology, and high-end manufacturing).[341] There is also overlap between the SEIs and industries the Chinese government previously identified as strategic or heavyweight, including information technology and automobiles. (For more information, see chap. 1, sec. 2, of this Report.)

Technology Development and Transfers to China

Upgrading Manufacturing and Industrial Policy

Over the past several decades, Chinese exports to the United States have primarily been low-value, labor-intensive products such as toys and games, footwear, textiles, and apparel. However, since China entered the World Trade Organization (WTO) in 2001, an increasing proportion of U.S. imports from China have been more technologically advanced.[342] By far the largest growth sector in Chinese exports to the U.S. market since 2000 has been computer and electronic products, exploding from $24.7 billion in 2000 to nearly $132.8 billion in 2010.[343] (See chap.1, sec. 1, of this Report for more on China's exports of advanced technology products.)

But China's evident success in increasing exports of advanced technology does not tell the whole story. To some degree, China has become the assembler of parts produced throughout much of Asia. Assembly operations typically do not pay high wages nor do they represent the majority of the value added to a product along the line from research, design, parts supply, assembly, marketing, advertising, shipping, distribution, financing, retail sales, and servicing. There is a perception in China that opening the country to foreign investment has not led to improvement of domestic capabilities and that foreign technologies continue to dominate, with China "relegated to low value-added labor intensive roles."[344]

The Chinese government desires to become competitive in technology-intensive areas and has adopted a set of policies to achieve this. In October 2005, the Chinese Communist Party Central Committee met and elevated the importance of China's "indigenous innovation to a strategic level equal to Deng Xiaoping's 'reform and opening' policy," according to a comprehensive study of the evolution of the program.[345] The National Medium- and Long-Term Plan for the Development of Science and Technology followed in 2006 with the goal to "increase investments in research and development to 2.5 percent of GDP and reduce reliance on foreign technology by 9 percent by 2020."[346] At the time, China's reliance on foreign technology was estimated at 60 percent.[347]

The term "indigenous innovation" appears in both the 11th and 12th Five-Year Plans. In the 11th Five-Year Plan, strengthening "indigenous innovation" is listed as a "national strategy," and in the 12th Five-Year Plan it is included as a primary objective. According to Jia Qinglin, chairman of the Chinese People's Political

Consultative Conference National Committee, "The success of the 12th FYP [Five-Year Plan] (2011–2015) rests on science and technology and indigenous innovation capacity."[348] To help promote "indigenous innovation," the 12th Five-Year Plan has added a new target not present in the 11th Five-Year Plan: patents per 10,000 people. In 2010, there were 1.7 patents per 10,000 people in China; by 2015, the 12th Five-Year Plan anticipates nearly doubling that number to 3.3 patents per 10,000 people. (For more information on patents and indigenous innovation, see chap. 1, sec. 3, of this Report.)

In addition to patents, the 12th Five-Year Plan seeks to improve the international competitiveness of Chinese firms by upgrading and consolidating certain industries (especially high-polluting industries) and promoting mergers and investments in advanced manufacturing equipment and technology.[349] While not mentioned explicitly in the five-year plan, favored companies in China may receive various subsidies, such as inexpensive loans, tax benefits, utility services, and free land.[350] Moreover, even if China's innovation strategy fails to achieve a broad range of innovation, by heavily investing in certain critical technologies, China could make innovative breakthroughs in those favored technologies.[351] For example, according to Christopher McNally of the East-West Center, state support has enabled hardware and software manufacturers like Huawei and ZTE to innovate.[352] And, according to the consulting firm McKinsey, Chinese innovation has contributed to such fields as pharmaceuticals, genetics, and structural biology.[353]

Global Supply Chains, Innovation, and the Case of Apple Corporation

A great majority of U.S. technology companies manufacture advanced technology products in China via networks of global (largely Asian) supply chains and then sell them in the United States. Such production often results in lower manufacturing costs, which benefits both U.S. companies and consumers. According to Wayne Morrison of the Congressional Research Service, "U.S. firms that use China as the final point of assembly for their products, or use Chinese-made inputs for production in the United States, are able to lower costs and become more globally competitive."[354] Becoming more globally competitive allows U.S. companies to increase profits and market share and theoretically should facilitate the hiring of more employees, both in the United States and abroad. Such benefits are not always distributed equally. According to the U.S. Bureau of Economic Analysis, U.S. multilateral corporations cut their work forces in the United States by 2.9 million during the 1999–2009 decade while increasing employment overseas by 2.4 million.[355]

Global Supply Chains, Innovation, and the Case of Apple Corporation—*Continued*

Apple has become a go-to example of such a company. Apple neither manufactures nor assembles any of the components of its famous range of products, including iPods. Instead, components from a variety of suppliers are assembled by Foxconn, a Taiwanese contract manufacturer, at its plant in China. A 2009 study by researchers at the University of California-Irvine, has estimated that the iPod and its components accounted for about 41,000 jobs worldwide in 2006, of which about 27,000 were outside the United States (of which 19,160 were in manufacturing) and 14,000 within the United States (6,101 in engineering and other professional jobs and 7,789 in retail and other nonprofessional jobs).[356]

In the same study, however, the authors concluded that the professional jobs, such as those maintained by Apple in the United States, were "at risk on multiple fronts":

> *Many U.S. high-tech companies are investing in white-collar job creation offshore to tap pools of low-cost talent and gain access to growing markets. The offshore jobs often support high-value jobs in the U.S., but this may not always be the case. Also, when U.S. companies lose their innovation leadership, foreign competitors do not typically employ many engineers or other professionals in the U.S.* [357]

Apple's success is due in great measure to the company's emphasis on designing and marketing unique products to a loyal and technologically sophisticated clientele. Business experts typically rank the Apple brand as among the top brands in the world, along with Coca-Cola and IBM. The company has focused its efforts on innovation and in-house research and design far more than most technology companies. For example, according to Gary Pisano and Willy Shih of Harvard Business School, "nearly every U.S. brand of notebook computer, except Apple, is now designed in Asia, and the same is true for most cell phones and many other handheld electronic devices."[358] Commission witness Ralph Gomory said that an economy based on the Apple model is "both unattainable and undesirable," because (1) the huge profits generated by Apple are specific to the company and, in any event, "unlikely to last," and (2) there would be only few high-paying jobs, with the rest in retail.[359]

Technology Transfers

The alternative to research-driven innovation is technology transfer. During their 2011 trip to China, the Commissioners heard from representatives of the American Chamber of Commerce in China that the Chinese government mandated technology transfer for some ventures. In the case of joint ventures, in particular, any concession made to the Chinese partner increases the likelihood of the venture being approved.

When joining the WTO, China agreed to the "elimination and cessation of enforcement of trade and foreign exchange balancing requirements, local content and export performance offsets and technology transfer requirements made effective through laws, regulations or other measures."[360] China has circumvented these WTO obligations through a combination of local-content requirements, mandatory joint ventures, and forced technology transfers. Chinese policies since 2006 "limit investment by foreign companies as well as their access to China's markets, stipulate a high degree of local content in equipment produced in the country, and force the transfer of proprietary technologies from foreign companies to their joint ventures with China's state-owned enterprises."[361]

Thomas Hout and Pankaj Ghemawat wrote in "China vs. the World: Whose Technology Is It?" of the ease with which China has circumvented the WTO rules:

> *The WTO's broad prohibitions on technology transfers and local-content requirements are more complex and easier to subvert than its rules pertaining to international trade in products. Furthermore, China hasn't yet signed the level playing-field provisions covering government procurement; it claims that its policies don't violate them, because the WTO allows domestic policy concerns to be accommodated in government purchases. Although the WTO prohibits mandatory technology transfers, the Chinese government maintains that incentivized transfers, whereby companies trade technology for market access, are purely business decisions.*[362]

China's strategy has been successful because "U.S. industry has feared being locked out of the vast Chinese central, provincial and local government procurement markets."[363] Dieter Ernst of the East-West Center has argued that foreign firms often must still compromise intellectual property in order to establish a presence in China.[364] Describing Chinese strategy for technological upgrading, Drs. Hout and Ghemawat noted that "Chinese officials have learned to tackle multinational companies, often forcing them to form joint ventures with its national champions and transfer the latest technology in exchange for current and future business opportunities."[365]

Chinese industrial strategy appears to have become more aggressive since 2006. Drs. Hout and Ghemawat note in their research that:

> *[S]ince 2006 the Chinese government has been implementing new policies that seek to appropriate technology from foreign multinationals in several technology-based industries, such as air transportation, power generation, highspeed rail, information technology, and now possibly electric automobiles. These rules limit investment by foreign companies as well as their access to China's markets, stipulate a high degree of local content in equipment produced in the country, and force the transfer of proprietary technologies from foreign companies to their joint ventures with China's state-owned enterprises. The new regulations are complex and ever changing. They reverse decades of grant-*

ing foreign companies increasing access to Chinese markets and put CEOs [chief executive officers] in a terrible bind: They can either comply with the rules and share their technologies with Chinese competitors—or refuse and miss out on the world's fastest-growing market.[366]

In a recent example, the Chinese government is refusing to let the Chevy Volt qualify for subsidies totaling up to $19,300 a car unless General Motors (GM) agrees to transfer the engineering secrets for one of the Volt's three main technologies to a joint venture with a Chinese automaker.[367] Thus far, GM has refused to transfer the Volt technologies (in a separate case, GM has agreed to develop electric cars in China through a joint venture with a Chinese automaker).[368] The proposed Chinese subsidy rules in question cover new energy vehicles (one of the seven SEIs highlighted in the 12th Five-Year Plan), which China defines as including electric cars, plug-in hybrids, and fuel-cell cars. The three core technologies that China is most interested in acquiring through the subsidy provision are electric motors, complex electronic controls, and power storage devices, whether batteries or a fuel cell. At least one of those systems would need to be included in the technology transfer for a vehicle to qualify for the consumer subsidies. Several trade experts said such a Chinese requirement violates WTO rules.[369] (For more on GM's negotiations with China on hybrid car technology see chap. 1, sec. 3, of this Report.)

The Chinese government also has sought to encourage multinational companies to invest in R&D in China. According to APCO's James McGregor, "The government provides incentives for foreign-invested R&D centers, including exemptions of customs duties on imported equipment, as well as business and income tax deductions."[370] Intellectual property lawyers Jason Cooper and Stephanie Chu of Alston & Bird argue that "innovation centers in China are finding robust funding available for their R&D-related expenses, [which] have already caused significant reverse brain drain from Silicon Valley and are also inducing many foreign corporations without previous ties to China into opening operations there."[371] Table 1, below, shows R&D expenditures by majority-owned foreign affiliates of U.S. companies in China through 2008 (latest available). There are certain limitations to the data, however, including that the data do not cover R&D expenditures of non-majority-owned affiliates.

Table 1: R&D Performed in China by Majority-owned Foreign Affiliates of U.S. Parent Companies (2000-2008)
(U.S. $ million)

2000	2001	2002	2003	2004	2005	2006	2007	2008
$506	*D	$645	$565	$575	$668	$759	$1,173	$1,517

** D indicates suppression to avoid disclosure of confidential information.*
Source: Bureau of Economic Analysis, *U.S. Direct Investment Abroad (USDIA): Operations of U.S. Parent Companies and Their Foreign Affiliates* (Washington, DC: U.S. Department of Commerce, various BEA issues). *http://www.bea.gov/international/di1usdbal.htm.*

Many incremental design tasks are already delegated to Chinese engineers by multinational corporations, for example, through large, original equipment manufacturers.[372] According to the consulting firm McKinsey, as of January 2011 "foreign-invested com-

panies account[ed] for fully 7 percent of [R&D] spending [by large- and medium-sized enterprises], spread among nearly 1,500 R&D centers established by multinational companies."[373] This includes major American firms like General Electric (GE) and Caterpillar.[374]

Witnesses at the Commission's June 15 hearing disagreed about the threat to U.S. technological leadership and competitiveness posed by China's efforts to move up the value-added chain. Commission witnesses Ralph Gomory and Leo Hindery viewed Chinese efforts with alarm. Philip Levy, another witness, contended that China's industrial policies are self-harming and will sabotage China's growth because "state-sponsored attempts to grab technological leadership" stifle the competitive environment, often generating sales but not real innovation.

According to Mr. Hindery, China's demands that the United States and other developed countries' advanced technology companies seeking to do business in China make massive transfers of their intellectual property "will, because of their perpetual ripple effects throughout our economy, ultimately . . . be an even bigger drain on our economy than the direct offshoring of millions of American jobs over the last 15 years."[375]

Dr. Levy, on the other hand, concluded that the government-dominated approach to technological development and innovation favored by the Chinese state was "stultifying" and "unlikely to achieve its objective of vaulting [China] to the forefront of global innovation."[376] He cautioned, however, that while China's policies do not threaten U.S. technological leadership in the long run, they do have the potential ability to impose substantial costs on U.S. businesses in the short run.

Outsourcing of Manufacturing

China's 12th Five-Year Plan is the latest example of China's efforts to upgrade its technological capabilities and encourage production in China. There is considerable debate about whether Chinese industrial policies and outsourcing of manufacturing and R&D to China harm the United States. At the Commission's June 15, 2011, hearing, the Commissioners heard testimony on China's efforts move up the value-added chain and their implications for the United States.

According to Dr. Gomory, it is a "dangerous delusion" to maintain that Americans do not need manufacturing jobs and will instead focus on "design and innovation and let other nations do the grunt work."[377] Dr. Gomory also cautioned that U.S. corporations are increasingly locating their R&D in China, which can have a further detrimental effect on U.S. economic growth. The "interests of our global corporations and the interests of our country have, in fact, diverged," Dr. Gomory said.

Echoing this argument, Willy Shih wrote in the *Harvard Business Review* with Gary Pisano that:

Outsourcing of Manufacturing—*Continued*

[O]utsourcing has not stopped with low value tasks like simple assembly or circuit-board stuffing. Sophisticated engineering and manufacturing capabilities that underpin innovation in a wide range of products have been rapidly leaving, too. As a result, the U.S. has lost or is in the process of losing the knowledge, skilled people, and supplier infrastructure needed to manufacture many of the cutting-edge products it invented. [378]

Mr. Hindery expressed a similar view, noting that a country as large and complex as the United States needed to maintain high rates of manufacturing employment.[379] He suggested that jobs such as administration and marketing, which are often proposed as alternatives to manufacturing jobs, would not be able to substitute for wealth creation generated by manufacturing.

Dr. Levy, however, urged caution in blaming China for the decline of U.S. manufacturing employment, noting that "we have seen in manufacturing . . . a steady decline as a share of employment, dating back to 1979. This long predates China's emergence . . . [and] has probably much more to do with technological change . . . [and] a dramatic increase in productivity [in the United States]." [380]

According to the U.S. Bureau of Labor Statistics, the number of U.S. manufacturing jobs fell by a third, from 12.2 million to 8.1 million, during the past decade.[381] The precise number of job losses that can be attributed to outsourcing to China is not known.

Implications for the United States

The policy of indigenous innovation in government procurement, in particular state and local procurement, as well as forced technology transfers, poses a significant challenge to the ability of U.S. companies to export goods and services to China (see chap.1, sec. 3, of this Report for further discussion).

The Chinese government's emphasis on technology development through technology transfer also poses multiple risks. At the Commission's June 2011 hearing, witnesses expressed concern over whether U.S. companies' transferring of technology to Chinese partners in exchange for market access or to be closer to the domestic market ultimately may lead to the growth of Chinese industries and the decline of U.S. equivalents.[382] Even if high-tech manufacturing activity in China has in the past largely been confined to low-value labor and basic engineering to the benefit of U.S. multinational companies, it is unlikely that this will always remain the case. According to Dr. Prasad, "The companies that hand over proprietary technology do so in the hope that they'll be the ones to get the better end of the bargain. But so far the Chinese have come out ahead in most cases. Hope springs eternal, but it's a very dangerous bargain to make." [383]

Transfer of manufacturing and R&D facilities from the United States to China has the potential to damage U.S. competitiveness.

Dr. Shih has testified before the Commission that as a consequence of the long-term implications of outsourcing, as well as the faltering investment in research, the United States "has lost or is on the verge of losing" its collective R&D, engineering, and manufacturing capabilities that sustain innovation. With the loss of these capabilities, according to Dr. Shih, the United States will lose its ability to develop and manufacture many high-tech products.[384] With the transfer of manufacturing to China, vital innovation ecosystems in the United States are lost to Chinese competition.

The handing over of proprietary technology also raises questions about the impact on U.S. national security. For example, a report prepared for the Commission by the RAND Corporation stated that there is "no question . . . that foreign involvement in China's aviation manufacturing industry is contributing to the development of China's military aerospace capabilities."[385] This contribution, the report states, is "increasing China's ability and possibly its propensity to use force in ways that negatively affect U.S. interests and would increase the costs of resisting attempts to use such force."[386] Dr. Shih cautioned that the United States "must prepare for the eventuality that we will have to source critical military technology abroad as more of our domestic capabilities wither away."

A recent case that attracted much interest involves a 50–50 joint venture between GE Aviation and the systems branch of Aviation Industry Corporation of China (AVIC), a Chinese state-owned group corporation which has both civilian and military components. The joint venture will develop and market integrated avionics systems for the global civil aviation industry.[387] Members of Congress raised concerns that AVIC could divert U.S. commercial avionics technology to China's military systems, as China has done with missile, jet, and satellite know-how.[388] On a voluntary basis GE has sought and received an official ruling from the U.S. government that the joint venture does not involve controlled military technology.* In press statements and in a meeting with the Commissioners, GE has also noted that the joint venture will have in place several safeguards to prevent diversion of technology to China's military. Examples of such safeguards include not hiring any AVIC personnel or other Chinese citizens who retain military- or intelligence-related employment or responsibilities, and having separate information technology systems and facility locations. Some U.S. security officials have commented anonymously in the press that such measures, especially relating to employment prohibitions, will be difficult to enforce.[389] (For more information on U.S. involvement with China's aviation programs in 2011, see chap. 2, sec. 1, of this Report.)

For the U.S. economy more generally, the large-scale outsourcing of high-tech manufacturing activities may lead to a hollowing out of America's industrial base (a diminishing of skills within the labor pool, supplier base, and infrastructure),[390] the outsourcing of high-wage professional jobs (in addition to assembly jobs),[391] and the inhibition of future U.S.-led innovation.[392]

*The technology in question, the civilian version of the integrated modular avionics (IMA), does not require a license for exports to China.

According to Andy Grove, chief executive officer and later chairman at Intel from 1987 to 2005, as the "scaling process" (the process by which "technology goes from prototype to mass production") has moved to China, it has taken the potential for future breakthroughs with it. Mr. Grove illustrates the danger of breaking "the chain of experience that is so important in technological evolution" with the example of advanced batteries:

> *It has taken years and many false starts, but finally we are about to witness mass-produced electric cars and trucks. They all rely on lithium-ion batteries . . . [and] the U.S. share of lithium-ion battery production is tiny . . . The U.S. lost its lead in batteries 30 years ago when it stopped making consumer electronic devices. Whoever made batteries then gained the exposure and relationships needed to learn to supply batteries for the more demanding laptop PC [personal computer] market, and after that, for the even more demanding automobile market. U.S. companies did not participate in the first phase and consequently were not in the running for all that followed. I doubt they will ever catch up.*[393]

Conclusions

- One of the main objectives of the 12th Five-Year Plan is to redirect China's economy to one more focused on domestic consumption and less on exports and investment. The plan assumes that China's growth would therefore be more balanced and sustainable. The plan also emphasizes higher value-added production and increased government support for domestic high-tech industries.
- There is cause for skepticism about China's prospects for carrying out the rebalancing goals of the 12th Five-Year Plan. The Chinese government had similar goals in previous plans, but their implementation was sidelined in favor of pursuing higher export and investment growth.
- Increasing household consumption, a major goal of the 12th Five-Year Plan, and the subsequent emergence of a more assertive consumer class, may be in direct contradiction to the Chinese government's policy of keeping economic power firmly in the hands of the state and may compromise lending to many vested interests, including SOEs and the export sector.
- The 12th Five-Year Plan also advocates a move up the manufacturing value chain with the explicit mention of seven strategic emerging industries: New-generation information technology, high-end equipment manufacturing, advanced materials, alternative-fuel cars, energy conservation and environmental protection, alternative energy, and biotechnology. These industries, which will receive targeted government support, have the potential to be a source of economic growth and advanced innovation.
- Analysts and foreign business leaders fear that the emphasis on industrial upgrading will lead to the introduction of new govern-

ment subsidies, which in turn will disadvantage foreign competitors.

- As part of its indigenous innovation policy, China incentivizes foreign companies to transfer technology in exchange for market access.
- Chinese government requirements that foreign corporations transfer technology to Chinese joint venture partners in exchange for market access violate written WTO prohibitions on forced technology transfers. The new requirements for technology transfer from foreign partners are often made in implicit rather than explicit terms, which may make challenging them in the WTO dispute procedure more difficult.

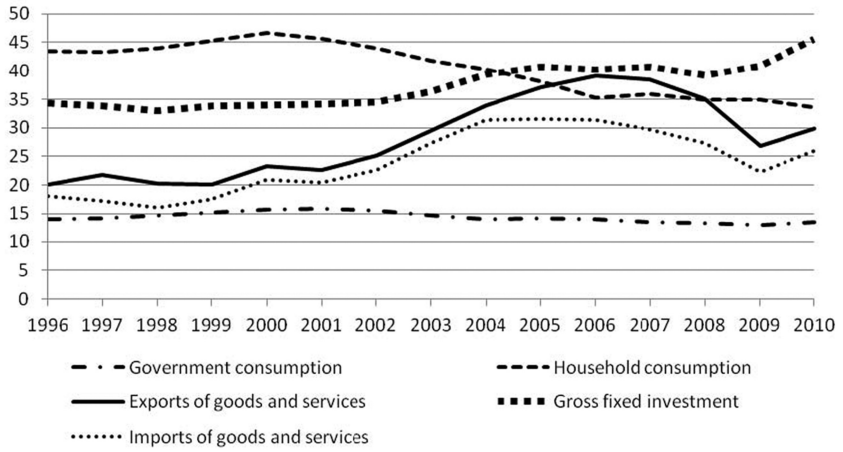
Addendum I: Key Economic Indicators (11th and 12th Five-Year Plans)*

Target	11th FYP (2010 Target)	2010 (Actual)	12th FYP (by 2015)
Average GDP Growth	7.5% (E)	11.2%	7% (E)
Average GDP Growth Per Person	6.6% (E)	10.6%	N/A †
Service Sector as % of GDP	43.3% (E)	43%	47% (E)
Service Sector as % of Total Employment	35.3% (E)	34.8%	N/A
Urbanization (%)	47% (E)	47.5%	51.5% (E)
R&D as % of GDP	2% (E)	1.75%	2.2% (E)
Patents per 10,000 People	N/A	1.7	3.3 (E)
Strategic Industry as a % of GDP ‡	N/A	N/A	+8.0%
Average Educational Attainment	9 Years (E) (+0.5 Years)	9 Years	N/A
Rate of Nine-Year Compulsory Education Enrollment	N/A	89.7%	93% (R)
Rate of High School Enrollment	N/A	82.5%	87% (E)
New Urban Jobs Created (5-year total)	45 million (E)	57.71 million	45 million (E)
Urban Registered Unemployment Rate	5% (E)	4.1%	Under 5%
Urban Annual per Capita Disposable Income (RMB)	13,390 (+5%) (E)	19,109 (+9.7%)	>26,810 (>+7%) (E)
Rural Annual per Capita Income (RMB)	4,150 (+5%) (E)	5,919 (+8.9%)	>8,310 (>+7%) (E)"

* In the chart, restricted targets have an (R) next to them, and expected targets an (E).
† N/A indicates that this was not a designated key indicator in the relevant Five-Year Plan.
‡ This is not officially included among key indicators in the Five-Year Plan but is instead only stated later in the plan. Therefore, it is neither "restricted" nor "expected.

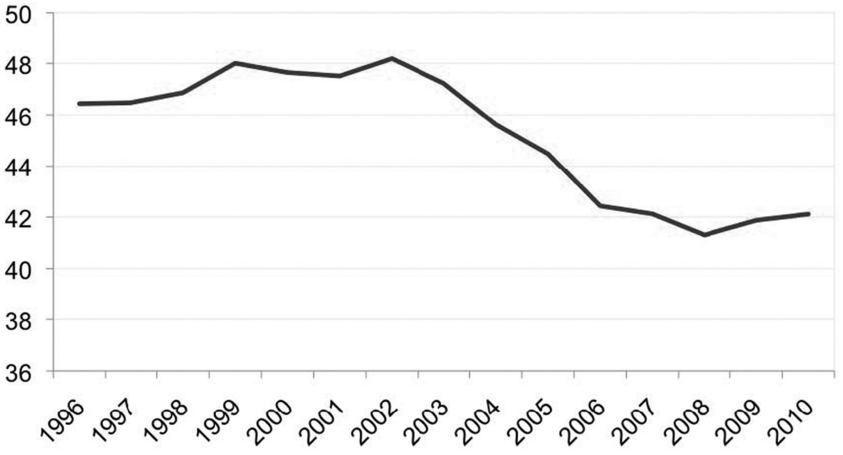
Addendum II: Figures 1–2

Figure 1: Composition of China's GDP, 1996–2010
(as share of GDP; in percent)



Source: World Bank China data. *http://data.worldbank.org/country/china.* Note: Data for 2010 are Economist Intelligence Unit (EIU) estimates.

Figure 2: Personal Disposable Income as Share of China's GDP, 1996–2010[394]
(in percent)



Source: EIU Country Data. Data for 2009 and 2010 are EIU estimates.

Addendum III: China's Seven Strategic Emerging Industries and 37 Projects for Subindustries included in the 12th Five-Year Plan [395]

Energy Saving and Environmental Protection	• High-efficiency and energy saving • Advanced environmental protection • Recycling usage • Reusing waste products
Next-generation IT	• Next-generation mobile communications • Next-generation core Internet equipment • Smart devices • Internet of Things • Convergence of telecom / cable TV / Internet networks • Cloud computing • New Displays • Integrated circuits • High-end software • High-end Servers • Digitization of culture and creative industries
Bio Industries	• Bio-pharmaceuticals • Innovative pharmaceuticals • Biomedicine • Bio-agriculture • Bio-manufacturing • Marine biology
High-end Assembly and Manufacturing Industries	• Aerospace and space industries • Rail and transport • Ocean engineering • Smart assembly
New Energy Sources	• Nuclear power • Solar power • Wind power • Biomass power • Smart power grids
New Materials	• New function materials • Advanced structural materials • High performance composites • Generic base materials
New Energy-Powered Cars	• Electric hybrid cars • Pure electric cars • Fuel cell cars