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RICHARD FLORIDA

# Technology Policy for a Global Economy



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*The United States  
should embrace,  
not restrict,  
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technology  
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with foreigners.*

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The coming of the new Republican Congress has reopened the debate over the future of U.S. technology policy. Although there has been considerable speculation about looming cutbacks in federal technology programs, a great deal more is at stake than just the extent to which the federal government should subsidize the technology-development activities of private industry.

Indeed, the critical issue in the entire debate revolves around whether the government should concentrate its efforts on protecting U.S. technology assets or whether it should promote greater global technological and economic integration. Unfortunately, recent forays into technology policy have taken a decidedly "techno-nationalist" turn, combining larger government subsidies with a stronger government hand in limiting foreign participation in U.S. technology programs and foreign access to publicly supported research and development. The United States, we are

told, must protect its domestic technology assets from foreign encroachment by closing off access to technology programs and in some cases access to markets in order to bolster the competitiveness of U.S. industry.

The number of U.S. technology programs and policies that seek to impose requirements on or limit participation by foreign companies has grown considerably in recent years (Table 1). Certain stipulations in the Advanced Technology Program (ATP), a cornerstone of the Clinton administration's technology policy, illustrates the current drift and rank among the most pernicious federal efforts to "protect" U.S. interests. Designed to bolster the nation's technology base through federal funding of R&D and the stimulation of new R&D joint ventures and consortia, ATP requires that companies receiving funding conduct substantial R&D and manufacturing in the United States. It also requires that the home countries of foreign firms allow U.S. companies to participate in their publicly sponsored programs, afford local investment opportunities, and provide suitable intellectual property protection.

This kind of language has spread to a host of other bills supporting the development of critical

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Richard Florida is director of the Center for Economic Development and professor of management and public policy at Carnegie Mellon University.

technologies in aerospace, environment, information, defense, and manufacturing. In 1993, for example, the House passed an amendment sponsored by Rep. Thomas Manton (D-N.Y.) to the National Competitiveness Act, which would have imposed even tighter restrictions on participation by foreign firms by requiring that their home countries provide U.S. firms with access to information and resources equivalent to those authorized under the act.

There are several reasons to question this techno-nationalist tilt in U.S. technology policy. The faulty logic underlying such proposals contradicts the strong trend toward global technological and economic integration, the global spread of innovative activity, and growing technological cooperation among private firms. Such policies also fly in the face of recent successful efforts, such as the General Agreement on Tariffs and Trade (GATT) and the North American Free Trade Agreement (NAFTA), to open markets and harness the benefits of economic integration. Worse yet, restrictive measures threaten to cut off a critical source of innovation, productivity improvement, and economic growth for the United States—the huge influx of manufacturing and technological investment from abroad.

### **Misguided protectionism**

There are two key elements to the techno-nationalist turn in U.S. policy. Performance requirements oblige potential participants in federal programs to provide evidence that they operate manufacturing facilities, conduct significant R&D, or maintain significant employment in the United States. These requirements do not necessarily discriminate against foreign-owned firms; in fact, they typically apply to both U.S. and foreign firms.

Conditional national treatment seeks to make the participation of foreign-owned firms conditional on the practices of their home-country governments, requiring that these nations provide comparable or equivalent opportunity for U.S. companies to participate in government programs and that they afford comparable investment opportunities and intellectual property protection to U.S. firms. Such approaches

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are frequently posed as a tactical measure designed to open up foreign opportunities for U.S. companies. The congressional Office of Technology Assessment, for example, recently suggested that the measures could be used as part of a strategy of selective reciprocity to open up trade and investment opportunities for U.S. firms abroad.

Techno-nationalist policies are misguided attempts to protect and further U.S. interests in an era of rapid globalization of mar-

kets and technology. The dramatic expansion of multinational corporate activities has spurred the emergence of globe-straddling corporate networks. According to a recent United Nations study, some 36,000 transnational corporations operate an extensive network of 175,000 foreign affiliates around the globe. Surging flows of international investment have blurred national boundaries, and huge increases in foreign direct investment have brought about a heretofore unknown level of global economic integration. The global flow of foreign direct investment soared from roughly \$50 billion annually in 1980 to more than \$235 billion in 1990. The global stock of foreign direct investment rose from roughly \$500 billion in 1980 to more than \$2 trillion in 1992. The total value of goods and services resulting from foreign investment has reached \$6 trillion; the same figure for trade is \$4 trillion, with one-third of that taking place between affiliates of businesses located in different countries. Companies have vigorously pursued cross-border alliances—more than 1,000 alliances came into being in the 1980s alone—and technological cooperation among leading firms in the advanced industrial nations has expanded considerably.

Based on an overly simplistic "us-versus-them" attitude, restrictive techno-nationalistic approaches are potentially dangerous ways of addressing these important changes in the global economy and are more likely than not to backfire. Take the issue of performance requirements. The idea that federal program eligibility can be conditioned on the level or share of a corporation's activities completely ignores the fact that a large and growing number of firms in

key technology sectors absolutely must globalize their production activities to compete effectively in the world economy. These corporations must develop production systems in which some aspects of manufacturing take place in or near final markets and others take place in more distant locations. The balance of domestic versus international activities that companies undertake simply cannot be determined by any legislatively mandated formula.

Furthermore, the nature of this balance is likely to vary considerably by industrial sector and field of technology. Although automotive companies, for example, may be able to produce a large share of total content in the markets in which products are sold, similar content levels may be difficult to achieve in sectors such as electronics, which are subject to much higher degrees of wage-related competition and are organized in complex global production systems. Government attempts to force foreign-owned or domestic firms to conduct higher shares of their activities in the United States or to penalize them for their offshore activities are likely to have an adverse effect on the U.S. economy. Such measures will not only affect current investments; they are likely to make firms reluctant to undertake future investments, forfeiting who knows how many millions, if not billions, of dollars in inflows. They also may poison the broader climate for foreign investment in the

United States and cause investment to be diverted to other nations.

Performance requirements also are based on the premise that the overseas investments of U.S. corporations detract from domestic economic welfare. But recent research suggests that companies with overseas plants tend to outperform their purely domestic counterparts and that overseas investments tend to increase domestic sales without curtailing employment at home. In fact, overseas investment tends to have a net positive impact on domestic employment, by helping to keep companies competitive and by opening up foreign markets for their products. Overseas investments enable U.S. companies to expand their markets and gain access to state-of-the-art foreign technology and management practices, thereby strengthening their homebase operations. In addition, the sales generated by U.S. companies operating plants abroad more than offset the much-maligned trade deficit. Using a formula laid out in the 1992 National Research Council report, *Behind the Numbers: U.S. Trade in the World Economy*, the 1991 trade deficit of \$28 billion becomes a \$164 billion surplus when the production and sales of U.S. firms operating abroad are factored into the equation.

Conditional national treatment is even more problematic. Essentially a veiled form of investment protectionism, such restrictions would penalize private

<b>Table 1. Short List of Techno-nationalist Bills</b>	
<b>Bill</b>	<b>Provision</b>
Stevenson -Wydler Technology Innovation Act of 1980	Product R&D must be manufactured in U.S. Home government of foreign parties must permit licensing agreements.
Bayh-Dole Act of 1980	Product of R&D must be manufactured in U.S.
Defense Authorization Legislation National Critical Technologies Act of 1991 Advanced Manufacturing Technology Act of 1991	Product of R&D must be manufactured in U.S. Foreign government must allow U.S. firms to participate in R&D programs. Foreign government must protect intellectual property rights of U.S. firms.
American Technology Preeminence Act Technology Administration Authorization Act of 1991 Energy Policy Act of 1992	Product of R&D must be manufactured in U.S. Foreign government must allow U.S. firms to participate in R&D programs. Foreign government must protect intellectual property rights of U.S. firms. Foreign countries should afford local investment opportunities to U.S. firms.

firms for the practices of their home country governments—policies that they probably do not even support. Furthermore, conditional national treatment exposes U.S. firms to foreign retaliation and threatens to undermine the increased openness achieved under GATT. The European Parliament, for example, has already threatened to invoke restrictionist measures of its own, the so-called Metten resolution proposed by Alman Metten of the Netherlands. Ostensibly designed to open foreign markets, conditional national treatment would essentially cut off U.S. firms' access to foreign programs and markets. Such a breakdown in international economic and technological openness would be extremely costly for all involved.

Conditional national treatment also contradicts the principle of equal treatment that is at the base of the modern global economy. The United States has long been the world's most ardent proponent of equal treatment—the notion that all companies operating in a country be treated equally. U.S. negotiators have generally insisted on adhering to this principle in NAFTA and in the continuing campaign to encourage developing nations to enter into bilateral investment treaties with the United States. This country has similarly challenged the use of trade-related investment measures by other nations on the grounds that they impose unfair export requirements, local content demands, and technology conditions on U.S. firms. The United States has even pressed for the adoption of a code under GATT forbidding such practices. Ironically, U.S. policymakers are adding restrictions on participation in government-sponsored technology programs at the same time that other nations, particularly Japan, are loosening restrictions and encouraging foreign-owned firms to participate in government-sponsored efforts. Beginning in the late 1980s, Japan's Ministry of International Trade and Industry (MITI) launched a series of initiatives designed to explicitly include foreign companies in technology-development programs in fields such as jet engines, real-world computing, intelligent manufacturing systems, micromachines, and nanotechnology.

### **Global sources of U.S. renewal**

Far worse, techno-nationalism threatens an important source of recent gains in U.S. economic and technological performance: Foreign direct investment has been a key contributor to recent improvements in

productivity growth, innovation, and economic growth. Foreign direct investment in the United States surged upward from \$20 billion in 1985 to a peak of \$68 billion in 1989, and the foreign direct investment share of U.S. manufacturing doubled between 1985 and 1991. By 1990, there were 11,900 foreign-affiliated manufacturing establishments in the United States, which generated more than \$418 billion in shipments and \$177 billion in value added (13 percent of the value added by all U.S. manufacturing establishments). The preponderance of the available evidence, much of it compiled by our own Commerce Department, clearly indicates that foreign direct investment has helped to foster productivity growth, create higher-paying jobs, stimulate technological innovation, and expand U.S. trade abroad.

Indeed, a key competitive advantage of the United States lies in our ability to attract international investment. Japan certainly has great companies. So does Europe. But only the United States brings together the state-of-the-art plants of the best Japanese, European, and U.S. companies. This translates into a powerful performance advantage.

Recent studies by the Organization for Economic Cooperation and Development (OECD) and the McKinsey Global Institute conclusively demonstrate that economic globalization has been an important generator of productivity, employment, and economic growth. Comparing investment and productivity patterns in 15 advanced industrial nations, the OECD study found that foreign-owned companies are typically more efficient than domestic firms in both absolute levels and in rates of productivity growth. The increased efficiency of foreign-owned companies resulted from their use of more advanced technology than domestic industries or from adding capacity. By contrast, productivity gains by domestic companies more often resulted from downsizing and layoffs.

The OECD study also found that international investment has been a key source of employment growth across the advanced industrial nations. Foreign-owned companies created new employment more rapidly than did their domestic counterparts in 10 of 15 countries, sometimes expanding their operations while domestic firms were contracting. The wages paid by foreign-owned firms also were globally higher than those paid by domestic companies. In three countries, foreign-owned companies eliminated

jobs, but they did so more slowly than did domestic enterprises. The largest employment declines occurred in Japan and Germany, where soaring costs during the 1980s caused international investors to cut jobs.

The McKinsey study highlighted the role of transplant companies in transferring state-of-the-art technology and management approaches to the countries in which they are located. The study found that transplant factories "(1) directly contribute to higher levels of domestic productivity, (2) prove that leading-edge productivity can be achieved with local inputs, (3) put competitive pressure on other domestic producers, and (4) transfer knowledge of best practices to other domestic producers through natural movement of personnel."

Detailed analyses conducted by the Commerce Department support this thesis, providing clear evidence that foreign-owned manufacturing transplants have generated productivity increases and value added that are significantly greater than those of U.S.-owned manufacturers. Consider the following facts. The output of foreign transplants rose nearly four times as fast in real terms as that of all manufacturing establishments between 1980 and 1987. Labor productivity in manufacturing industries, measured as value added per production employee, was nearly 30 percent higher in foreign-owned establishments than for domestic firms: \$74 per hour compared with \$52 per hour. Furthermore, foreign-owned companies have invested more in plant and equipment over the past few years than have their domestic counterparts. From 1987 to 1990, for example, the rate of increase in plant and equipment expenditures for foreign-owned manufacturing establishments was five times greater than that for U.S. businesses: 106 percent versus 21 percent. Foreign-owned manufacturing plants in the United States, particularly Japanese-owned plants, have introduced new production technologies and state-of-the-art management practices, such as total quality management, team-based organization of work, continuous improvement schemes, and the participation of suppliers in the innovation process.

  
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Transplant companies also have functioned as potent job generators. Employment in foreign-owned companies rose by 2.7 million jobs, including 1 million manufacturing jobs, between 1980 and 1990. Today, foreign-owned companies provide nearly 5 million total jobs for U.S. workers, 2 million of which are in the manufacturing sector (nearly 11 percent of all manufacturing jobs), with employment concentrated in technology-intensive and high-wage manufacturing sectors. These are

often good jobs at higher-than-average rates of compensation and wages. Annual compensation levels in foreign-owned manufacturing establishments in 1990 were approximately \$5,300 higher than those for domestic firms (\$38,300 compared with \$33,000), and average hourly wages for production workers were also higher (\$12.57 versus \$11.04).

On top of this, foreign-affiliated manufacturers are a key source of U.S. exports. The Honda Accord, for example, is the United States' number one export car. Total exports by foreign affiliates increased from \$52 billion in 1980 to \$98 billion in 1990—nearly one quarter (23 percent) of U.S. exports for that year—while manufacturing exports by foreign affiliates grew from \$9 billion to more than \$32 billion.

The evidence is clear. Attempts by government to restrict or limit foreign direct investment make little economic sense. Foreign direct investment in manufacturing and technology has been an important source of U.S. economic renewal. In fact, such investment has done considerably more to bolster the U.S. economy than have federal initiatives to support industrial technology. Restricting inflows of foreign investment will only end up hurting us.

Europe provides a compelling illustration of the dangers of shutting out foreign direct investment and international competition. During the past decade, Europeans, particularly France and Italy, tried to limit foreign investment in automobiles and electronics while pumping government funds to so-called national champions. The result has been a slew of uncompetitive firms and industries. Europeans managed to forestall the industrial restructuring that U.S.

corporations went through during the 1980s with the quality movement, process reengineering, and the focus on productivity improvement and manufacturing efficiency. But they are now paying the price. Leading companies from Volkswagen to Fiat to Renault are scrambling to overcome stodgy bureaucracies, inflexible work arrangements, and huge production inefficiencies in an effort to close the considerable productivity gap with Japanese and U.S. competitors.

### **Globalization of technology**

More than anything else, the recent trend in technology policy fails to take into account the fact that technology itself has become more global than ever before. For most of the postwar era, the United States was the world's overwhelming generator of research and technology. But by the early 1990s, the combined R&D expenditures of Japan and the European Union exceeded those of the United States, and their R&D efforts were much more highly concentrated in commercial technology fields. Other nations have become important sources of technology and innovations in a host of key technology fields, from flat-panel displays to pharmaceuticals. And the share of both U.S. and world patents granted to non-U.S. inventors has risen dramatically, with foreign inventors capturing 46 percent of all U.S. patents in 1992. Techno-nationalism assumes that the United States is ahead in the R&D race across industries, but this simply is not true anymore.

As the pace of innovation has accelerated and the overseas sources of technology have grown, corporations have sought to leverage external sources of research and technology. The surge in cross-border technology alliances and consortia over the past decade is a clear reflection of this trend. IBM, Toshiba, and Siemens, for example, are collaborating on the development of 256-megabyte memory chips, whereas IBM and Toshiba are collaborating on the development and production of advanced flat-panel displays. Such technological collaboration reduces cost, spreads risk, and promotes cross-fertilization of ideas. This trend will certainly continue; a survey of large U.S. companies by the Industrial Research Institute found that nearly half expect to increase the number of joint ventures and alliances in which they participate. In addition, a growing num-

ber of companies are establishing R&D activities abroad. U.S. companies conducted roughly 12 percent of their total R&D activities abroad in 1991. Japanese companies have established a global network of more than 200 offshore research, development, and design facilities.

The past decade has seen the progressive globalization of the U.S. technology base as foreign companies have invested tens of billions of dollars in roughly 400 research, development, and design centers in the United States. The annual R&D outlays of foreign affiliates in the United States increased from \$1.9 billion in 1980 to \$12.9 billion in 1992, according to the Commerce Department. The foreign share of all industrial R&D in the United States grew from roughly 9 percent to nearly 17 percent during the same period—roughly one out of every six dollars of U.S. industrial R&D spending. R&D spending by foreign affiliates is concentrated in sectors where foreign industries are highly competitive: European companies in chemical and drugs, Japanese and German companies in automotive-related technologies and consumer electronics. Such companies are the source of technology that is useful to U.S. firms and the U.S. economy as a whole—technology that is transferred through joint ventures and alliances with U.S. firms and joint development projects with U.S. suppliers and customers as well as through foreign affiliates' U.S. employees.

Critics of foreign investment argue that it threatens U.S. technological leadership by giving international companies easy access to our technology. Some even argue that foreign R&D facilities are little more than listening posts whose main objective is to steal U.S. ideas and technologies. But a 1993 Commerce Department report found that foreign companies operating in the United States are technology generators as well, creating a net inflow of technology from foreign parents to their affiliates in the United States. Companies such as Honda and Toyota have not only transferred state-of-the-art production technology to their U.S. factories, they also have transferred advanced production equipment and management techniques to a large and growing number of U.S.-owned suppliers.

The main reason international corporations are doing more R&D abroad is not to steal technology. Globalizing markets means that companies must in-

creasingly establish integrated R&D and manufacturing capabilities in the major regions of the world to tailor products for those markets and to create a world-class manufacturing infrastructure wherever they produce. And in today's competitive environment, companies can no longer simply depend on a central R&D laboratory to capture all sources of relevant knowledge but must establish satellite connections to sources of ideas and technology throughout the world.

The rationale for limiting foreign participation may be to protect domestic technological assets, but restrictions are more likely to limit the ability of U.S. firms to form partnerships with foreign firms and to gain access to much-needed foreign sources of technology. One recent example is the Department of Defense's initiative to help create a domestic flat-panel display industry. By putting restrictions on foreign participation, the Flat-Panel Display Initiative potentially cuts off access to significant technological know-how—benefits that IBM, for example, clearly recognizes and gains from its joint venture with Toshiba to develop advanced display screens for notebook computers.

Given the current restrictive climate, it is not surprising that at least some U.S. firms, according to confidential statements made to me and other researchers by company executives, are already finding themselves in the awkward position of having to choose between participation in government-sponsored technology programs and technology partnerships with foreign companies. These executives fear that ties with foreign firms may jeopardize their ability to compete for federal technology dollars and perhaps endanger their ability to join and benefit from emerging technology consortia. Government economic policies should correct market failures, not create them.

### **New directions**

The time has come to craft a technology policy that is in tune with the new global economic age. As a first

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step, the administration and Congress should work together to halt the drift toward technonationalism. Congress should reject both performance requirements and conditional national treatment provisions in pending technology legislation and rescind such provisions in existing policies and programs.

Second, a more appropriate rationale for technology policy should start from the premise of increasing access to global science and technology and achieving a more integrated global technology system. The administration and Congress should therefore work

together to establish greater incentives for economic and technological integration on the part of private firms, regions, and the nation. Instead of restricting foreign access to U.S. science and technology programs, policymakers should pursue joint technology-development projects with other countries. Positive steps have already been taken in this direction. The United States and Japan have agreed to cooperate in the Real World Computing initiative to develop next-generation, massively parallel computer technology, including optoelectronics, virtual reality, and neurocomputing technology. On a multilateral basis, the United States, Japan, Australia, and the European Union and European Free Trade Association nations have agreed to jointly pursue development of advanced manufacturing technology in the Intelligent Manufacturing Systems Initiative.

Third and most fundamentally, the United States should work with other advanced nations to build new international institutions for economic and technological cooperation. The nation state is increasingly ill-equipped to deal with the extraordinary rise in cross-national technological cooperation, accelerating international investment flows, and an increasingly integrated global economic and technological order. In effect, the global investment and technological explosions have outpaced the existing international legal framework. A new round of multilateral policymaking and institution-building will be required to create a truly global framework for cross-national investment and cooperation in science and technology.

One option is to build special-purpose institutions to promote and encourage scientific and technological cooperation. The advanced industrial nations might, for example, consider establishing a jointly funded research and technology organization. Such an institution would have the added benefit of promoting efficiency in international research spending, limiting redundant projects, and leveraging public commitments on a global basis.

More importantly, a multilateral agreement on investment is badly needed to remove legal impediments to cross-border investments and ensure that all nations treat foreign companies as they treat domestic ones. Today, international companies are subject to a huge number of different national laws and provisions, including some 700 bilateral investment treaties, several OECD codes, and some specific provisions of GATT pertaining to services, intellectual property, and trade-related investment measures. The time has come to bring a greater degree of order and rationality to this critical aspect of the global economy.

The OECD has already gone some distance toward developing such a framework in its current discussions concerning a multilateral investment agreement. Such a framework would restrict the use of performance requirements and conditional national treatment, establish nondiscriminatory standards for national technology programs, and provide a level playing field for foreign direct investment in manufacturing and technology. It would instill greater confidence in the global economy by ensuring that foreign investors are not discriminated against either before or after an investment. And it would set in place a much-needed dispute-settlement mechanism for resolving conflicts between governments and between governments and investors. A multilateral investment agreement framework is a logical and necessary extension of GATT and is just as valuable for building a prosperous global economy and innovation system. As the world's largest source and recip-

ient of foreign investment, the United States has much to gain from such an agreement.

In pursuing these measures, U.S. policymakers can beat back the mounting tide of techno-nationalist solutions and put in place a technology policy framework that is in tune with the new global economy. Both the nation and the world will benefit.

#### *Recommended reading*

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