Science & Technology

The Reverse Brain Drain and the Global Diffusion of Knowledge

Jean M. Johnson

Students from developing countries who enter industrialized countries for doctoral education in science and engineering (S&E) and subsequently return home contribute significantly to the diffusion of scientific knowledge, a process that directly enhances world development. The increasing flows of such graduate students to wealthy nations and the high proportion that remain abroad for employment have been well documented.[1] Far less quantified, however, is "reverse brain drain," referring to those who study and perhaps work abroad for a time, but ultimately return to their home countries.

One issue with the reverse flow of foreign students after advanced S&E training in U.S. research universities is whether the United States is "giving away the store," allowing the transfer abroad of its technology and manufacturing base. Some feel that "the American taxpayer (both state and federal) is supporting extremely expensive research universities whose main educational purpose is to train students from abroad" and that "we are putting our money and our best talent into training our economic competitors."[2] This would be a troubling scenario if it were true that our so-called competitors were "walking away with the store," reducing U.S. economic opportunity. However, this does not appear to be the case. In fact, countries that have attracted their students to return from

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the United States have often opened up economic opportunities for the United States through science and technology (S&T) partnerships. Furthermore, this reverse flow also benefits the United States diplomatically by allowing America to demonstrate its leadership in enabling developing countries to advance their national scientific capabilities.

Countries that have attracted their students to return from the United States have often opened up economic opportunities for the United States.

However, in order for students to return home and contribute to national development, their home countries must establish some necessary conditions for employment in S&E occupations in order to attract them. Proactive programs and policies are often the most important appeal for expatriate scientists and engineers to return home and to apply their advanced training and research experience. Over the past three decades, research on return flow has considered an array of motivating factors. Robert Myers shows that social class and the financing method of an individual's graduate education influences the return flow of students.[3,4] Paul Pederson's research on the decisions of Taiwanese students to return highlights the multiple factors of family, culture, free press, and democracy that attract expatriates.[5] Hahzoong Song's research on reverse flows to South Korea emphasizes that educational and S&T policies aimed at attracting expatriates became effective when the economy started to develop.[6] Finally, Y. Guo postulates that economic growth in China to a per-capita income level of $4,000 would, following the examples of Taiwan and South Korea, create a heavy reverse flow to China.[7]

Research presented here builds on the above work and begins to quantify the reverse flow of scientists and engineers from the United States to Korea and Taiwan. Data indicate that return flows to these countries are positively correlated with educational and S&T policies that helped set the conditions or expanded S&T careers. Additionally, contributions to S&T infrastructure and economic development in both countries were linked to the return of expatriate scientists and engineers. After exploring these issues, this paper discusses the impact of encouraging students to return to their own countries and the implications for U.S. scientific leadership and diplomacy. Finally, it suggests a revitalized science dimension of U.S. foreign policy that would facilitate reverse flows of scientists and engineers.

Background. The flow of foreign students into graduate science and engineering departments in the United States and other industrialized countries (United Kingdom, France, Japan, and Germany) is increasing. Factors that have fostered this flow include an increasing focus on academic research and declining college-age populations in all industrialized countries.[8] Furthermore, the recruitment of foreign S&E graduate students is considered to be of increasing importance if the United States is to maintain its academic research and development (R&D) efforts and its position as an innovation leader.[9] Therefore, foreign students have become, and will continue to represent, a significant proportion of doctoral-degree recipients in the United States and other industrialized countries.

While the majority of foreign doctoral recipients in the United States and France plan to stay abroad for S&E careers, the decision whether to stay abroad or return home differs significantly by an individual's country of origin. For instance, a far higher proportion of students from China and India plan to remain in the United States compared to those from South Korea and Taiwan.[10] This is because South Korea and Taiwan were successful at implementing educational and S&T policies that contributed to their national scientific capabilities. These programs and policies set the conditions for a relatively large return flow.

South Korea.

Educational Policies. In the 1980s, South Korean universities dramatically expanded science and engineering departments to create a more highly skilled labor force. The resulting demand for more teachers opened attractive faculty positions in South Korean universities that expatriates returned to fill. At the same time, South Korea began to provide better laboratories and facilities for graduate study, in the hopes of expanding doctoral education and establishing a national capacity for design and innovation. Together, these policies resulted in a dramatic increase in S&E degrees earned at South Korean universities. Between 1975 and 1998, the number of S&E bachelor's degrees grew seven-fold, from 12,800 to 91,300, those at the master's level rose from 900 to 15,200, and doctoral degrees increased from 128 to 2,260.[11]

Another dimension of South Korea's educational policy was the promotion of study abroad programs, intended to help students acquire cutting edge science training and research experience. The removal of once-tight overseas study restrictions and government-financed scholarship programs increased the number of South Koreans studying abroad. From 1988 to 2000, approximately 12,000 Koreans earned Ph.D.s from U.S. universities in S&E fields,[12] and during roughly the same period the number of Koreans entering U.S. graduate programs for science and engineering reached approximately 9,000 per year.[13]

Science & Technology Policies. In addition to S&E careers in academia, changes in South Korean S&T policies created new research careers in both government and industrial laboratories. In the 1960s, the South Korean government established the Ministry of Science and Technology and supported the development of both the Korean Institute of Science and Technology and the Korean Advanced Institute of Science and Technology.[14,15] The military government provided continuity in funding public R&D, and created tax incentives to encourage industrial R&D. In the 1970s, major corporations such as Samsung, Hyundai, and Daewoo began investing in R&D facilities. Today, there are over 200 such corporate research centers.

To staff these new institutions, the South Korean government actively recruited overseas Korean S&E scholars. The government subsidized the moving expenses of returning scientists and engineers, and provided financial support for networking with overseas Korean professionals. The support allowed for the maintenance and updating of databases on Korean scientists and engineers abroad, listing their sector of employment, their research focus, and teaching experience. Korea used these databases to recruit for temporary and permanent positions by matching overseas expertise with national needs.

The Impact of South Korean Return Flow. The above educational and S&T policies implemented by the government were necessary, but insufficient for large reverse flows of expatriate professionals. Two other important factors were economic growth and political stability. South Korea's economy grew (in constant 1996 U.S. dollars) from $91 billion in 1975 to $597 billion in 1999, representing an annual growth rate of 8 percent.[16] By the early 1980s, an important threshold was crossed when South Korean income reached a per capita level of $4,000. After this point, recruiting policies began to truly succeed, as large numbers of expatriate scientists and engineers returned home to fill high-skills positions created by the growing, technologically oriented economy.

In the period from 1988 to 2000, only 37 percent of those earning doctoral degrees reported that they planned to stay in the United States following their studies.[17] In fact, Finn's research indicates that the actual stay rate of Korean doctoral recipients in the United States could be even lower. Of the nearly 2,000 S&E field Ph.D. recipients from U.S. universities between 1994 and 1995, only 23 percent were still employed in the United States in 1996. This figure fell to only 15 percent by 1999, resulting in an 85 percent reverse brain drain of South Korean doctoral degree recipients.[18]

The contributions of repatriates were particularly crucial for the development of the South Korean semiconductor industry, established in the early 1980s. Samsung was an initial entrant into the industry, and it was successful by drawing skilled Korean workers from major U.S. and multinational firms like Texas Instruments, IBM, and Fairchild. Within a few years, the South Korean semiconductor industry was stable, and by 1990, it surpassed that of Japan. South Korea is now the leading country in the semiconductor industry. Analysts estimate that the return flow of Korean scientists and engineers with R&D experience in semiconductors saved South Korea about ten years of catching up to U.S. companies.[19]

Taiwan.

Educational Policies. Due to the expansion of higher education and investments in R&D, a similar model of return flow occurred in Taiwan. In the last three decades, educational policies in Taiwan greatly accelerated higher education in science and engineering. At the bachelor's level, the number of earned degrees in S&E fields increased from 11,300 in 1975 to 35,000 in 1999. Graduate programs grew even faster, with the number of earned master's degrees in S&E fields increasing tenfold, from 920 in 1975 to 9,501 in 1999, and the number of doctoral degrees received at Taiwanese universities growing from 21 in 1975 to 892 in 1999.[20]

Taiwan also sent students abroad for graduate training in science and engineering. In fact, historically, a majority of Taiwanese doctoral recipients earned their degrees overseas. However, due to the build-up of Taiwanese graduate programs over the past three decades, fewer graduate students ventured abroad during the 1990s. By 1999, 892 students earned doctoral degrees in S&E fields at Taiwanese universities while only 732 Taiwanese earned such degrees at U.S. universities.[21]

Between 1988 and 2000, over 13,000 Taiwanese earned Ph.D.s from U.S. universities in S&E fields, and almost half (48 percent) planned to stay in the United States. Their actual stay rate was somewhat lower. Of the nearly 2,300 Taiwanese Ph.D. recipients from U.S. universities in S&E fields from 1994 to 1995, 45 percent were working in the United States in 1996. And by 1999, only 42 percent were still employed in the United States.[22]

Science & Technology Policies. Taiwan was proactive in developing an S&T infrastructure that would encourage return flow of its scientists and engineers. Taiwanese scientists and engineers were well represented in Silicon Valley,[23] and by networking with these individuals, Taiwan was able to emulate the Silicon Valley model with the establishment of the Gsinchu Science-based Industrial Park (HSIP). The HSIP is a concentrated area of high-technology-oriented companies, representing a number of different industries, and situated near top universities and research institutes. Thus, HSIP provides highly skilled returnees with private sector, commercial career opportunities.[24]

The Taiwanese government undertook other networking initiatives, such as its support of meetings and conferences between U.S.-based Taiwanese scientists, engineers, entrepreneurs, and executives and their counterparts in Taiwan. The government built networks between these two communities, and when unable to convince expatriates to return permanently, encouraged temporary returns and transnational employment. Currently, Taiwanese managers, engineers, angel investors, and venture capitalists travel between Silicon Valley and HSIP, linking industries in the two regions. Seventy HSIP companies now have offices in Silicon Valley, and these contacts allow Taiwan, as a distant producer, to upgrade its technological capabilities.[25]

The Impact of Taiwanese Return Flow. Like South Koreans, Taiwanese scientists and engineers returned initially for faculty positions in an expanded higher education system that was aimed at creating national science and engineering graduate programs. In addition to the improved educational sector, and at a later point in time, the pull of private industry recruitment was equally important. In 1983, HSIP hired twenty-seven Taiwanese from abroad; but by the year 2000, the cumulative growth of such hires reached over 4,000. The main industries employing these R&D professionals include integrated circuits, computers, opto-electronics, precision machinery, telecommunications, and biotechnology.[26]

The return migration of Taiwanese scientists and engineers educated abroad was especially important in Taiwan's high-technology-fueled economic growth of the late 1980s. By the end of the 1980s, the science-based industrial park, HSIP, had 121 high technology companies, many of which were set up by returnees. By the year 2000, the number of companies had grown to

289, and 39 percent of them were started by U.S. educated engineers, many of whom were from Silicon Valley.[27]

Overall, the Taiwanese economy grew, in constant 1996 U.S. dollars, from $52 billion in 1975 to $324 billion[28] in 2000, representing an average annual growth rate of 8 percent.[28] Over roughly the same period (1978–2000), investment in R&D increased 13 percent, from $671 million to $9.3 billion.[29] Finally, U.S. receipts of royalties and license fees generated from Taiwan's exchange and use of U.S. industrial processes rose from $21 million in 1987 to $148 million in 1997.[30] This economic growth, R&D investment, and trade with the United States all positively track one another.

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Conclusions. The reverse flow of South Korean and Taiwanese scientists and engineers contributed to the diffusion of scientific knowledge and to the development of their respective emerging economies. South Korea and Taiwan were successful because they were able to create career opportunities for expatriate scientists and engineers. Might other countries use this model of reverse flow? In general, yes, but it is principally applicable to those countries investing heavily in both higher education and S&T infrastructure.

In order to aid this process of reverse flow, and thereby enhance the prospects of trade with developing countries, the United States should improve the flow of S&T information to other world regions, and consider greater international scientific cooperation with emerging regions. U.S. science agencies are taking some steps in this direction. The Director of the National Science Foundation (NSF) has encouraged the U.S. science community to become even further engaged in the world by elevating international science within the NSF and expanding mechanisms for cooperative research. The Department of State has begun to revitalize the science component of U.S. diplomacy by sending "Embassy Fellows" from various U.S. science agencies to conduct 1-to-2-month assessments of research opportunities within specific disciplines. In addition, the National Science Board (NSB) prepared a report titled *Toward a More Effective Role for the U.S. Government in International Science and Engineering.* Some of its major recommendations are developing an overall strategy for coordinating the international activities of various federal agencies, and increasing collaboration with developing countries. Finally, the U.S. government has announced substantial increases in foreign assistance, including aid for science development programs.

If implemented, these policies would facilitate reverse flow and contribute to both the scientific development of emerging economies and the scientific leadership of the United States. The U.S. science community should become engaged throughout the world, mentoring former doctoral students in the establishment of laboratories, collaborative research, and faculty exchanges. The 10,000 foreign doctoral recipients from U.S. universities each year are the United States's natural science partners. Facilitating their reverse flow would benefit U.S. scientific leadership, increase trade opportunities with developing countries, and add to the advancement of science worldwide.

NOTES

1 National Science Board. *Science and Engineering Indicators 2002.* (Arlington, VA., National Science Foundation, 2002).

2 D. Goodstein, "Scientific Ph.D. Problems," *The American Scholar* 62 (Spring 1993): 215-220.

3 If social class gives the student opportunities in the home country, he/she will return after overseas study. Also, if the government paid for the education abroad, the student generally returns (Myers 1972)—see note 4.

4 Robert G. Myers, *Education and Immigration.* (David McKay, Inc., 1972).

5 Pedersen, Paul B. "The Reentry of Scientists and Engineers to Taiwan, R.O.C. after Study Abroad." Department of Human Studies, University of Alabama, Birmingham, August 1996.

6 Song, Hahzoong. "From Brain Drain to Reverse Brain Drain: Three Decades of Korean Experience," *Science, Technology & Society*, 2, no. 2, (July-December 1997).

7 Y. Guo, "Overseas Study Will Inevitably Lead to Integrating Chinese Scientists and Engineers into the International Community of Science." CIES Meeting, Washington, DC, 13 March 2001.

8 See note 1.

9 M.E. Porter and S. Stern, "The New Challenge to American Prosperity: Findings from the Innovation Index." Washington, DC: Council on Competitiveness, 1999.

10 See note 1.

11 Ministry of Education, Republic of Korea. *Statistical Yearbook of Education.* Annual series. Seoul.

12 See note 1.

13 Institute of International Education (IIE). *Open Doors 2000: Report on International Educational Exchange.* New York, and special tabulations. 2000.

14 Students who entered this Institute could fulfill their military service with two summer reserve sessions.

15 See note 6.

16 The GDP conversion uses official exchange rate.

17 See note 1.

18 M. Finn, *Stay Rates of Foreign Doctorate Recipients from U.S. Universities 1999.* Oak Ridge Institute for Science and Education, Oak Ridge, 2001.

19 See note 6.

20 Ministry of Education, Republic of China. *Educational Statistics of the Republic of China.* Annual series. Taipei.

21 Ibid and see note 1.

22 See note 18.

23 One-third of the total employees in Silicon Valley are foreign-born; two-thirds of these foreign-born are Asian, and of the Asian, 51 percent are Taiwanese.

24 Luo, Yu-Ling and Wei-Jen Wang. "High-Skill Migration and Chinese Taipei's Industrial Development," *International Mobility of the Highly Skilled.* OECD Proceedings. June 11-12, Paris, 2001.

25 Ibid.

26 Ibid.

27 Ibid.

28 The GDP conversion uses official exchange rate.

29 The R&D conversion uses purchasing power parities (PPPs), the preferred exchange rate for comparing international R&D.

30 See note 1.

The Digital Economy
EDventure

An Interview with Esther Dyson

Esther Dyson chairs EDventure Holdings, Inc., a global information services company that publishes *Release 1.0*, a monthly technology report, and sponsors two annual conferences. She recently finished a two-year term as founding chairman of ICANN, the Internet Corporation for Assigned Names and Numbers.

The impact of the "digital economy" is broad; it reaches all human activities and all sectors of the economy. As consumers, business owners, employees, government officials, educators, and students, we have all been transformed by it whether we directly use the underlying technologies or not. Though the digital economy encompasses much more than the technology sector and Internet dotcoms, these two high-profile components of the overall economy and the astronomical growth that they experienced during the 1990s came to embody our future expectations. These expectations were tempered somewhat with the bursting of the technology bubble in late 2000, an event interpreted by most as an inevitable transition point that every new and revolutionary technology must experience. The initial period of rapid yet unsustainable growth has come to an end, replaced by the more modest expectations of a mature technology. Opportunities in the digital economy have not disappeared altogether. Though certainly harder to come by, they continue to exist for high-technology entrepreneurs, corporations and their investors, and users.

Esther Dyson, a leading information and communications technology investor, commentator, and policymaker, views emerging companies and emerging markets as golden opportunities. She manages an active investment portfolio of over fifty Internet- and information technology (IT)-related startups, not just in the United States and Western Europe, but in Eastern Europe and Russia as well. The future success of these companies will depend on numerous factors, but one fundamental factor that has been taken for granted by the vast majority of Internet users is the proper functioning of the Internet itself. Ms. Dyson has been one of the few people not to take this for granted. As the founding chairman of the Internet Corporation for Assigned Names and Numbers, or ICANN, Ms. Dyson has worked to ensure that everyone with vested interests in the global Internet community's success has a say in the technical standards and management that will ensure its continued functioning.[1]

In a recent interview with *GJIA*, Ms. Dyson spoke candidly about the attitudes that drive technological innovation, the challenges of doing business in Central and Eastern Europe, and the problems with global consensus, connecting all these issues with the main focus of our conversation: the "digital economy."

GJIA: In your words, what constitutes the "digital economy"?

DYSON: The digital economy is ideally part of every company in every sector of the market. In the 1990s, the so-called "digital economy" was underpinning the total economy not because IBM and Microsoft were doing well, but because the economy as a whole—their customers—was doing well due to increased productivity and competitiveness. Furthermore, the digital economy is more than just a company putting a computer in an office; it is the attitudes that go with it. Attitudes such as a willingness to try new things and listen to the ideas of younger people, an acceptance of innovation and changing business models, and a responsiveness to customers are all part of it. All of these things come along with the digital economy, and it is these attitudes, rather than just the technology, that really make a difference. As an example, Western Europe had access to the same technology as the United States, but has not reaped the same benefits because the culture was not as open to it. In the United States, people say, "This is new, this is great!" without bothering to see if it works before they adopt it. Western Europe is smugger, with the attitude "What we've got works very well, thank you." These are stereotypes, of course, but they have a strong basis in reality.

GJIA: Where outside the United States do you see a culture that is open to technological change?

DYSON: Take a country like Estonia, for example, which adopted a lot of technology wholesale and is now doing very well relative to its neighbors. In a sense, Central and Eastern Europe are more open to change than Western Europe. There are of course many people in Central and Eastern Europe who are not amenable to change, but there are also those who say, "Gee, this is new. We should try it and see if it works."

GJIA: How does Russia fit into this model?

DYSON: Russia's basic problems are a lack of both a good commercial culture and management skills. What makes Russia

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still attractive, though, is the relatively large number of highly trained people; there is an abundance of engineers with good math and logic skills. What makes it challenging is that neither companies nor their customers know how to apply technology, and it is difficult to find skilled management. It may be easy to find people who know how to write software, but it is harder to find people who know how to use and support applications and understand business processes.

GJIA: How are you coping with these problems?

DYSON: For me, they are opportunities. Trying to fix these things is the real challenge, and if you can, you have a competitive advantage. Overall, things are heading in the right direction.

GJIA: Who are some of the other players that you see taking advantage of the opportunities in Russia?

DYSON: All the big U.S. IT companies are in these markets—companies like Intel, Microsoft, and Sun Microsystems, for example.

GJIA: Which companies are best at capitalizing on these sorts of opportunities?

DYSON: Well, it varies from market to market. I would say that both Oracle and Microsoft, while not being particularly civic minded, have done wonderful things for countries where they have invested because they have gone in there and trained people to use and sell their products. And, while not charitable ventures, they have fostered economic growth and economic value not just for themselves, but also for people in those countries.

GJIA: Recently there has been some concern over e-commerce in Russia. Russian lawmakers have advocated the monitoring of Internet and e-mail traffic for security reasons by way of a key-escrow system.[2]

DYSON: The Russian government has the somewhat old-fashioned notion that security depends on keeping the bad guys out and keeping everything visible to the government, and that is not the right way to approach the situation. Various individuals and even other governments are trying to persuade the Russians that this is not the best way to foster a vibrant economy. The Russians will eventually figure this out.

GJIA: Do you think a vibrant Internet economy can exist in Russia with such government regulation, or are the two mutually exclusive?

DYSON: It is a lot more complicated than that. First of all, almost anybody with a computer in Russia right now can be considered to be engaged in illegal activity because most computers use encryption that is not certified. So, it is just like the old days. If someone wanted to get you, it was pretty easy to find you doing something illegal.

One of the first things to do is to change the distinction between civil use and military use. Second, clearly the government should not pursue key-escrow. Not only is it wrong, it is also unworkable. Success in e-commerce, however, goes beyond security and transactions. It is not just about payments. It is about communication with vendors, and it is about web sites and information and competition and transparency. You can do an awful lot in e-commerce without necessarily implementing transactions over the Internet; the lack of credit cards and things like that—which are impediments—is not as big of a problem as people think. The real problem with e-commerce is the lack of trust and the assumption that if you do business with a stranger, you are probably going to be cheated.

Therefore, things like reputation systems and dispute-resolution systems are going to be very valuable. Vatera, one of the companies that I am involved with, is like eBay, but it operates in the Czech Republic and Hungary. One of the benefits we offer is that a customer can go to the site and see if the person he is dealing with has a good reputation through an online rating system. Payments are accomplished in many different ways. The issue is knowing who you are dealing with and generating trust, rather than payment mechanisms. Building a reputation can't be done overnight, though; it takes time, so people need to be patient. Fortunately, a lot of companies are beginning to do business online, and people are starting to get into the habit of sending e-mail and working with others over the Internet, so a network of trust is already being built, but it inevitably takes time.

GJIA: Does the issue of trust become more complicated when you are dealing with people from totally different cultures and societies?

DYSON: Yes, and that is why the promises of global e-commerce were somewhat misguided. But global communication and the ability to operate across borders with people you do not know is not a challenge specific to e-commerce. Those sorts of complications occur with international exchanges in any medium.

GJIA: Do you see the technology sector in Eastern European countries, whether in Estonia or Russia, as a key driver of the countries' economic reform and growth? Or do you think these countries are going to have to look at other elements of their economy to lead them?

DYSON: Again, I view technology as a key underpinning for every sector. The use of the information infrastructure drives efficiency, and the culture of the IT sector—its openness and transparency—are key factors. So, the question is not to measure the revenues of the companies that sell IT, but to look at how effectively their products and services and attitudes can penetrate the whole economy. It is the culture that comes *with* the computers; it is not the computers *alone*. It is all part of a more general trend, and certainly the technology sector and its people are leading a lot of it.

GJIA: There has also been much concern about the integrity of intellectual property rights in Russia and Eastern Europe, specifically in the software markets. What are some of the ramifications of these problems?

DYSON: Piracy is definitely an issue, and it hurts local developers as much as it hurts Microsoft and other companies. The local guys want Microsoft to be able to charge a lot so that they can charge somewhat less and still be successful. So it is not that these countries don't want good copyright protection. There are obviously a lot of people in these countries who steal software, but the problem is somewhat overstated. The fact that someone copied a piece of software doesn't mean that otherwise he wouldn't have bought it; it just means that otherwise he wouldn't have *had* it. There is certainly a proportionate revenue loss, but it isn't the 95 percent that you read about. These companies are learning, just as Western companies are, that the way to get paid for your software is to provide support and to offer it as a service. There are many new business models to take advantage of this fact.

It is certainly harder to succeed in Central and Eastern Europe because the communications infrastructure isn't there. However, the culture is developing in these countries and people are beginning to pay for software. In fact, Microsoft has recently had some success in getting large users to pay up. Even if just companies and governments begin to understand that they need to pay, the infrastructure will get better. More people are getting online and you will find that the problem will diminish over time. The problem is never going to go away, but it is becoming less of an issue. People in the IT industry tend to have more of a culture of honesty and transparency than perhaps people in other industries. It is not universal, but in general the people who come from academia and the technical sector tend to be more honest than people who "acquired" a large company through privatization.

GJIA: Do you think that the ICANN model of a global, non-profit, private-sector corporation can be applied to other international regulatory bodies?[2]

DYSON: I don't see that anytime soon. First, ICANN itself has to prove broadly successful, which it hasn't done yet. I was the founding chairman until 2000, and now I just finished a stint on the At-Large Membership Study Committee, an awkwardly named group whose duty is to forge a consensus on the best method for representing the world's Internet users as individuals within ICANN. We are trying to find a structure that would foster public input and improve representation of the public interest in its policy making.

> **Anytime too much** power is concentrated in one group or body, you are at risk of abuse of that power.

GJIA: A lack of public representation and public input has been one of the main criticisms of ICANN, correct?

DYSON: Yes, and even though it is a private organization, as it should be, it does have a public role and should have public accountability. ICANN has a limited but nonetheless important mandate. So it really does need a way to be accountable to the public at large. However, ICANN is not a model for many other things, because there are few things that really need global consensus or global policies. There are many things that can be decided locally. The less world government we have, the better, I think. So I don't see it as a wonderful model for most other things to follow.

GJIA: How should people respond to the trends of globalization that are increasingly embodied in international regulatory mechanisms?

DYSON: I think they should respond with local regulatory bodies, at least until human nature improves dramatically. I am speaking facetiously, of course, because I don't think it will. However, anytime too much power is concentrated in one group or body, you are at risk of abuse of that power. Therefore, the more decentralized you can keep things, the better. Multilateral governance might be a goal for the United Nations, and for Europe, but there are a lot of people who are not looking forward to a sovereign Europe, let alone world government, and neither am I.

GJIA: Do you ever see the United Nations getting involved in anything like ICANN?

DYSON: I certainly could imagine it, but that is what we are trying to avoid. The United Nations moves rather slowly. ICANN needs to be accountable to the public—to people who understand what it does—rather than to people who were appointed by elected officials who know very little about domain names and the Internet. Nobody ever got into office because of their policy on domain names; therefore, ICANN must be accountable in a very specific way to people who know what it does, rather than government officials. If you are working for the government, you probably have other concerns—and most likely not the ones that are particular to information technology.

GJIA: How do you envision ICANN's future?

DYSON: If it evolves successfully, it will remain a private body that sets a limited number of policies by the consensus of its members, including representatives of the public. It will not affect people beyond those directly involved with the Internet, such as the providers of the infrastructure, the developers of the technology, and its users. Those policies are the only things that really need to be agreed on globally, mostly domain name and address policies, so that you can reach anywhere on the Internet from anywhere else without fail. It has little to do with anything like content, freedom of speech, software piracy, what is appropriate for kids to see, or anything like that. ICANN's mission is to ensure that the domain-name system works and that domain-name conflicts are successfully resolved. That is as far as it should go. And if it is successful, it will get a lot less press in the next few years, and will do its good work in relative obscurity.

NOTES

1 Formed in October 1998, the Internet Corporation for Assigned Names and Numbers (ICANN) is a non-profit, private-sector corporation formed by a broad coalition of the Internet's business, technical, academic, and user communities. ICANN has been recognized by the U.S. and other governments as the global

consensus entity to coordinate the technical management of the Internet's domain name system, the allocation of IP address space, the assignment of protocol parameters, and the management of the root server system. See <http://www.icann.org/general/fact-sheet.htm>.

2 A key-escrow encryption system is an encryption system with a backup decryption capability that allows authorized persons to decrypt cipher-text.