Casting a Wider Net

Internet governance and policy expert George Sadowsky on using information and communication technologies to encourage economic development

George Sadowsky is currently the Executive Director of GIPI, the Global Internet Policy Initiative, as well as the Senior Technical Adviser to USAID's dot-GOV Program. He is also substantially involved in a variety of professional activities outside of his full time job, including being a long-term member of the Board of Trustees of the Internet Society and a consultant to foundations and governments.

UBIQUITY: What threads or themes go through your career?

SADOWSKY: Well, there are several. One is essentially a computer center management and direction thread — I've done that at Yale and at the Brookings Institution in the 1960s, at Northwestern in the late 1980s, and at NYU in the 1990s. Another thread is economic research, which I was involved in starting in the early '60s. The third thread, more recent, is Internet governance and policy, which I've gotten involved in through the Global Internet Policy Initiative and also now through the United Nations effort to define what Internet governance is. A fourth thread focused on developing countries and our ability to assist them in their social and economic development through the appropriate use of information and communication technologies (ICTs). In addition, at times I've been an applied mathematician and an applications and system programmer.

UBIQUITY: Out of those threads, which one is more vivid in your mind than the others?

SADOWSKY: I have a continuing passion for the developing country thread. I got into it somewhat by mistake in the early 1970s when I joined the United Nations for what I thought was going to be a year or two assignment. I ended up staying more than twelve years, and as a result of that, I got involved early in bringing both computing technology and the Internet to developing countries.

UBIQUITY: How did you approach that problem?

SADOWSKY: In 1992 a group of us — volunteers — organized to train people from developing countries to use the Internet in a number of ways. We trained one group to help to connect their countries to the global Internet (it was mostly by dial-up connection at the time!), another group to extend the infrastructure in their countries, a third group to understand how one could discover resources and obtain information on the Internet and provide one's own information servers for both national and international use, and a fourth group on how to manage a growing Internet in the larger ICT framework.

UBIQUITY: How long did all this take?

SADOWSKY: We did that for eight years, from 1993 through 2001. The workshops that I was involved in trained directly about 1,500 people during that period from just about every developing country except North Korea and Iraq. The workshop series that spun off from that first series of workshops trained another 2,000 or so. Vint Cerf says we probably accelerated the introduction of the Internet into the developing countries by two or three years. That's a pretty good achievement, and represents the intensive work of probably 150 to 200 volunteers over that period of time.

UBIQUITY: So where does that effort stand now? Is there any way of generalizing where it stands across the various developing countries?

SADOWSKY: The Internet is in every developing country as far as we know. In some countries it's penetrated enormously. In other countries it's still on the beach trying to dig its hands into the sand in order to get into the country. And it has changed lives. It's brought a lot of benefits and information to these countries. An example is provided by Vietnam where I first visited in October 1997 when the Internet was just about to be introduced. It was officially introduced into Vietnam in November 1997, and I think the bandwidth then was less than a megabit. The government there was very, very concerned about the liberalizing effects of bringing it in.

UBIQUITY: So how did it all turn out?

SADOWSKY: I was just there a couple of weeks ago, and they have something like 260 megabits of bandwidth going out and connecting to the global Internet. There are probably one million Internet users now in Vietnam, and there is a software industry that's growing rapidly and wanting to export to the West. Of course, the Internet makes all this possible.

UBIQUITY: Your Ph.D. was in economics. As an economist, what difference do you see that the Internet has made to the developing countries?

SADOWSKY: That's a more difficult question, because it's not clear the extent to which the Internet has really assisted in, for example, increasing international trade. That's a subject of interest now because the current question among the donor communities is how you measure the effect of your investment in Internet infrastructure or training — or for that matter any other kind of intervention in that sector — with respect to economic development?

UBIQUITY: And the answer to that question?

SADOWSKY: The results are somewhat mixed. There's a group of economists at the World Bank including Scott Walston that has done, I think, some of the first serious quantitative work in this area. They're seeing positive things but the effect of the Internet is difficult to measure.

UBIQUITY: Why is that?

SADOWSKY: Because you can't separate out the effects of the introduction of the Internet with many other things that are going on in the country. I saw a recent study that indicated that, for example, the presence of the Internet strengthens existing structures between producers and consumers internationally — yet it doesn't do nearly as much in terms of producers in developing countries being able to grow their markets to include new customers. There are so many variables involved here that it's very difficult to separate out the effect of any one. Some of those variables are, for example, changes in government, the position in the business cycle of the various countries involved, commodity export prices over which a producing country may have no control, the state of regulation and legislation in the country, and so forth.

UBIQUITY: Do you see any one of the developing countries as a particular star in terms of its recent history with the Internet?

SADOWSKY: India has done pretty well. If you look at the discussion of globalization and offshoring that's taking place in the US today, one of the primary sectors that is being offshored is ICT. It started at the low end with call centers, and now American companies are putting their factories and even some of their R&D labs into developing countries. India is a primary recipient of that outsourcing, and Malaysia is doing pretty well too, although the plans for Cyberjaya, the large cyber park that was established in 1997, appears to not have lived up to expectations.

UBIQUITY: What about the rest of Southeast Asia?

SADOWSKY: Singapore, of course, has done enormously well, but we no longer consider it a developing country. Taiwan has done fairly well in manufacture. Korea has done very well in manufacture.

UBIQUITY: What's the bandwidth situation?

SADOWSKY: Bandwidth has improved. I don't keep up with that very much because there's plenty of it around. I knew a lot about it in the early 90's when we were starting our workshop series. I remember when South Africa was connected with 64 kilobits per second, which was due to a connection to Randy Bush's house in Oregon. I think that he was keeping the South African Internet alive also. I remember, too, when I first started talking with people from Egypt — they also had a 64-kilobit link. Just this week I met

one of our old students from the Internet Society workshops who is now the technical adviser to the Minister of Communications in Egypt, and he tells me that they have hundreds of megabits per second bandwidth now. Bandwidth is getting cheaper but unfortunately not cheap enough because many developing countries still don't have enough bandwidth. Those countries tend to be the landlocked countries in Africa or countries such as North Korea or Myanmar, where the government has an interest in insuring that the transmissions are monitored — and so don't want too many of them going on at any one time.

UBIQUITY: Will the wireless revolution make a huge difference with regard to the developing landlocked countries?

SADOWSKY: It will make a significant difference, probably not so much for the landlocked countries as for the secondary distribution systems in a country. There are many strides going on in wireless now. IEEE 802.16 is a very promising point-to-point medium-range mechanism and it will eventually be fairly inexpensive. I think you can now go up to 50 kilometers or so, and though it hasn't entered general use yet, that's what the expectations are. The difficulty in these countries will now be to move from the point of presence in the country — which is generally the capital city in which infrastructure can be made available moderately easily — to the countryside. Wireless technologies are extremely important for that.

UBIQUITY: Examples?

SADOWSKY: There are many of them. In India, for example, Michael Best and the MIT labs are experimenting with an inexpensive network that doesn't use any existing standard but instead essentially uses a mesh of computers and antennae to transmit messages on a store-and-forward basis until they get to where they're going. That's a nice model for many areas in rural India because those parts of rural India don't look rural compared to, say, North Dakota, or anyplace that we would consider really rural in the US. There's enough population density to make that model of connectivity feasible and economical. But the distance that wireless can now span means that there can be less expensive forays outside of highly populated areas, and then local distribution of that signal at the end of the link, and that's going to be very important for a number of countries. It'll be less important for countries where population density is really quite sparse.

UBIQUITY: Do you think that, because of the Internet and wireless technologies, some of the developing companies could actually leapfrog into serious competition with developed countries?

SADOWSKY: Yes, I think so. Of course, when you say leapfrog, you need to remember that some frogs leap faster than others. If you look at India, I don't think you can claim

that there's a leapfrogging effect there. They started in ICT in the late '70s, and I believe they were doing systems programming for the Burroughs mainframe line in the early 1980s. Bangalore and the Indian growth in the ICT sector have had a 25-year history of involvement in the industry, and it's only now that they're becoming quite visible and very large. They now have the economies of scale all the way up the value chain into graduate study and PhD programs to be able to seriously compete.

UBIQUITY: Then India has the fast track on leapfrogging?

SADOWSKY: Actually, the more serious competitor may be China, in the sense that there's enormous Internet uptake there, and quite a bit of interest in the Internet. There's a fair amount of social control, but that doesn't seem to get into the way of learning, and the Chinese have a fairly serious work ethic. So it's quite possible that they're going to be able to out-produce us in some ways and out-class us in a variety of ways.

UBIQUITY: Because of work ethic and learning?

SADOWSKY: Yes. I'm picking up now from the trade press significant concerns from our academic sector that we're not turning out PhDs at anywhere near the same rate as China and other countries. We could conceivably be left behind in, say, 10 to 20 years if the current trends continue.

UBIQUITY: What's your estimation of the success or likely future success of large-scale distance-learning programs in developing countries?

SADOWSKY: First let me say that in our own country what we've mainly gotten into seriously is what I would call network-assisted learning, both in universities and in other organizations, rather than distance learning.

UBIQUITY: And do you think it's effective?

SADOWSKY: I recently went back to New York University, where I directed academic computing for 10 years, and I asked the person in charge what the effect of network-assisted learning was. He said that in the classrooms where you also have teacher-student contact, the learning process can be enhanced by creative professors who use the Web and tools like Blackboard creatively. On the other hand, in this country we haven't had very good luck with programs at the university level that involved distance learning. There was a flurry of activity in this area in the late 1990s, with Western Governors University starting out. I know that my own institution, NYU, got involved quickly and heavily. So did Columbia and others. But as far as I know, after spending a lot of money, both NYU's and Columbia's programs have gone out of business. I just heard that a major distance learning program in the UK, into which the British government had pumped more than $100 million, is being dismantled. I haven't heard many success stories at any

significant scale.

UBIQUITY: Then you think there's not much hope?

SADOWSKY: Oh, there's still hope, though I don't know how much. What I think has been interesting as counterpoint to the distance education efforts for money is MIT's open university initiative, which has just started. The goal of MIT, as you know, is to put all of their course material online in one form or another over the next 10 years. I looked at some of those courses recently; they clearly aren't the equivalent of an MIT education because the teacher-student contact is missing, but the material is there. The online notes for the two courses I looked at were somewhat sparse. On the other hand, it seemed to me that that is exactly the kind of material that developing countries could use if there were a teacher or teachers who could understand the MIT notes at the undergraduate level (and there are some), and then be able to use those as teaching tools or teaching resources for their classes. With respect to your question about the role of distance education in the developing countries, my guess is that it's being used here and there, but I have seen no large-scale efforts that have successfully used the Internet for training on a wide-scale basis, and I do not expect to find them soon.

UBIQUITY: What about smaller-scale efforts?

SADOWSKY: There was some hope for the African Virtual University initially. It started in 1996 or 1997, and it exists in Nairobi. Most of its classes are now being held through satellite video. The problem with the developing countries is insufficient bandwidth Courses that are created in developed countries for distance education tend to be multimedia-rich, so the media saturates the bandwidth. It's a totally inappropriate mix. Beyond bandwidth issues, the problem is that there aren't enough computers yet to be able to deploy such training on a wide basis.

UBIQUITY: What do you think is the great hope?

SADOWSKY: I'm not sure there is one. I think what we're going to see is gradual progress. I think maybe 10 or 20 years from now there'll be pretty good connectivity in all major cities of the world and probably in all major universities. There'll be a fair amount of resource sharing among those institutions so that the resources will be available on a global basis without major issues of bandwidth or price or availability of that content. But it's going to take time, and, of course, as you know, we now live in Internet time, so that if you look back 12 years to 1992, when the first country in Africa got connected, you have now by comparison enormous numbers of computers and enormous numbers of institutions connected. It's still not nearly enough. It's a few percent, but I'm not sure we could have foreseen the extent to which all countries and many, many institutions would be penetrated in 1992 if we were to project out to 2004.

UBIQUITY: What are the implications of that?

SADOWSKY: I think we're just going to see both a gradual and perhaps not-so-gradual evolution. If we can manage to direct our money into foreign assistance rather than wars we have a chance of making a big difference, but we can't expect it immediately — only gradually. I think the only communications technology that spread faster than the Internet was television, which had a very rapid adoption curve in the 1950s and 1960s. By contrast, it took the telephone an enormous amount of time to grow to the point where it penetrated that part of the world that it does. At the moment, according to ITU statistics, there are only a billion fixed telephone lines, whereas we now have by some estimates about 800 million Internet users. By contrast, in early 1992, I think we had less than three million. We've come a long way and we're just impatient. That's because the Internet has expanded so quickly and the amount of innovation that's gone on in terms of services has been so great and unanticipated. I'm thinking now of all the resource availability work that started in the early 1990s with FTP, Gopher, WAIS and then the Web, which has been a driving force since 1993, as well as things like comprehensive search engines like Google, which weren't available until the mid- to late 1990s.

UBIQUITY: So you're saying we have a new world now?

SADOWSKY: Yes, it's a new world. Now we not only feel that it's part of our environment and it's been there for quite a while, I think we'd be hard put to get along without it. The pace of hardware innovation, software innovation, new products, new services, etc., has been absolutely breathless. In the mid 1980s there were a set of fairly rigorous econometric studies performed by the Department of Commerce that went back and looked at technological progress in information technology since 1950. They computed that there was essentially a growth rate of 28 percent a year from 1950 through 1986. That is to say, you could get 28 percent more performance for the same price or that same amount of additional performance for the same price, every year during that interval. I wish my bank would offer those terms to me! My sense is that it has not changed, and this figure only accounts for the improvements in the raw hardware. That means that this includes only CPU speeds, memory prices, disk capacities and so forth. Now if you overlay that rapid rate of advance with the enormous improvements in the software services that we've seen, it's been a very exciting industry to watch and be part of. I don't think the pace is going to stop.

UBIQUITY: As you look back on the part you yourself have played in that very exciting industry, what are you most proud of in your own career?

SADOWSKY: Several things stand out, but let me give you a few incidents. I think probably the most useful program I ever wrote was written in three months in 1963, and it helped give birth to a new powerful technique in economics, called microsimulation modeling.

UBIQUITY: What were the circumstances?

SADOWSKY: I was approached in early 1963 to be a consultant for the US Treasury Department to help work on revenue estimation tools for what later became the Revenue Act of 1964. You may remember (and you may not) that President Kennedy decided in 1962 to battle the then ongoing recession by using Keynesian economics and cutting taxes. It worked spectacularly, but the question at the US Treasury at the time was how do you fashion a tax approach that does this best with respect to a number of criteria, some of them conflicting?

UBIQUITY: What strategy did you recommend?

SADOWSKY: There were several issues. One is how much revenue are you willing to give up in the aggregate? Second is what are you willing to see change — or what do you want to accomplish in terms of maintaining vertical equity? That is, how progressive do you want to make the tax so that people who earn more income pay proportionately more than people who earn less? Then there's the issue of horizontal equity, which means how do you make sure that people who are similarly circumstanced in life (at least to the extent that the figures on their tax return indicate) will pay the same or similar amounts of tax?

UBIQUITY: These weren't new issues, though.

SADOWSKY: Not at all, but before 1963 such calculations had been essentially a back-of-the-envelope exercise done on the basis of gross tables. What we did at Treasury was to obtain a stratified sample of tax return data — not a lot for each individual and clearly unidentified and anonymous. I then wrote a program that in effect read each tax return and computed the effects of a number of alternative plans for each return. Then we aggregated the results of those calculations and presented it to the economists and tax analysts involved.

UBIQUITY: It sounds pretty complex, but you referred to it as a "little" program.

SADOWSKY: In fact, this wasn't a terribly difficult program to write. As I recall, it was about 3,000 lines of what was then Fortran II, but the effect on the revenue estimation and on the political process was enormous, because every night Treasury analysts would go up to the old National Bureau of Standards complex on Connecticut Avenue, and they would define a new tax plan based on parameters and other methods of specification that I designed. Half an hour later, using an IBM 7094 they would have 500 pages of tables showing in rather explicit detail what the effect of their proposed tax plans were.

UBIQUITY: What became of the program?

SADOWSKY: It was used later that summer by the House Ways and Means Committee and by the Senate Finance Committee on an overnight basis. It was a real success because of the speed and the detail that could be produced.. I think that was a major contribution at the time. A postscript of interest is that I served on an IRS task force in the early 1990s, and the "tax analysis program" came up for discussion. I asked to see a copy of the source code and found that a lot of code that I'd written in 1962 in Fortran II still existed in a somewhat mangled form and some of it in somewhat improved form. So my source code was still in there and I thought, oh my, the stories are really true; once you write source code it just perpetuates itself through time. So that was one thing of interest. The other thing I feel very proud of was the series of Internet training workshops that we implemented for people from developing countries under the auspices of the Internet Society. I've already told you a little bit about that.

UBIQUITY: Yes, but you didn't tell us how it started.

SADOWSKY: I got the idea in June 1992 at INET92 in Kobe, Japan and approached Larry Landweber from the University of Wisconsin, who was at that time the Vice President for conferences of the Internet Society. Somebody had brought 20 Africans to Kobe, using UN money I believe, and I told Larry that this is a good start, but what these people really need is the training to be able to bring the Internet to their own country. Larry liked the idea a lot, and pledged some money. Lee Caldwell, who was then at Novell, gave a very generous grant of, I believe, $100,000, which was quite a lot of money in those times. We then went out and raised more, and we were able to bring 135 people from 67 countries from all over the world to Stanford University for a week of training and then for a week of participation in INET93 in San Francisco. Some of them were even able to stay on for Interop during the next week, as I recall.

UBIQUITY: Did they go back and put their countries on the Internet?

SADOWSKY: They did indeed, and that was a powerful result that we were able to accomplish. There were 20 of us, I think, all volunteers. Steve Fram headed the dial-up connectivity track, Randy Bush headed the TCP/IP track, and I think it was Art St. George and Ed Krol who handled the third track on resource discovery. The participants studied hard and quite a few of them were in the labs for a good part of the night — it was such a new and powerful opportunity for them. We probably paid full cost for 80 percent of the participants. From those who could pay, we used their money to increase the overall budget and subsidize more participants. The experience had an enormous effect in a number of ways. First, these people had by and large never been to the United States before, and some of them remarked that it was like a mini United Nations, so that they got to know people from all over the world. This was important because once they got onto the Internet they started to e-mail people. They had a network of people in almost 70 countries they could trade experiences with, and that made the effect of the

training all the more powerful.

UBIQUITY: How long were you involved with that program?

SADOWSKY: That workshop went over so well that I decided to do it another year, and then another, and then another. The volunteers turned over slowly. There were a number of people who should be commended for staying with the effort. I think the chief person is Alan Greenberg from McGill University. But I also remember people like Jill Foster from the University of Newcastle, who every year worked very hard to update materials on resource discovery and Website administration and so on. Nashwa Abdel-Baki who ran the Egyptian University Network and Geoff Huston from Australia formed and implemented the management track, and out of that experience came Geoff's book, the "Internet Survival Guide", published by O'Reilly & Associates. Tim O'Reilly was an extraordinarily staunch supporter, and every year gave literally thousands of books to the participants to take home. We would warn the participants ahead of time to bring empty luggage and plan to take up to15 kilos of books back home with them If you've ever visited libraries in developing countries, you know how valuable such a contribution was. The volunteers were people who gave up their vacations and much of their spare time to help these people from developing countries; they had an Internet spirit of sharing that was overwhelming.

UBIQUITY: What eventually became of the program?

SADOWSKY: We shut it down after 2001 primarily because it had served its purpose and there wasn't a need to bring people from all over the world to one spot to be able to learn these things. Workshops like this are now taught on a regional basis, on a country basis, and in some places on a provincial basis within countries. As a result of this, there is a community of Internet professionals in these developing countries who know each other, who talk to each other, and who in some cases have achieved fairly high positions. I'm thinking of Tarek Kamel in Egypt who is now the Technical Advisor to the Minister of Communications and Information Technology. He was a student of ours in 1993, and a teacher in 1994. He later joined the Board of Trustees of the Internet Society. He has managed to make the Internet available for anybody in Egypt for the cost of a local telephone call, an achievement that few countries have been able to come even close to in terms of accessibility.

UBIQUITY: How did he manage to do that?

SADOWSKY: By getting the telephone company and the Internet service providers to form a pact, so that when a person makes a local call to get onto the Internet via dial-up, they are charged the same as if they use that line for voice. The ISPs have collocated at every telephone central office in Egypt, and the telephone company and the ISP share the revenue from the local phone call. This is a magnificent outcome, and I think Egypt will

be really helped by it. That's the kind of thing that has come out of our workshops. We stressed that the obligation of everybody who came to the workshops was to go back to their countries and teach others what they knew. Although this certainly hasn't happened 100 percent of the time, it's happened enough. That spirit of sharing information and teaching others has propagated in a fair number of places.

UBIQUITY: Let's imagine that Daddy Warbucks wants to give you some large chunk of money — let's make it $1 billion. What would you do with it — professionally, of course?

SADOWSKY: Well, $1 billion is a lot of money, and you probably can't throw a billion into anything without severely diminishing returns. But let me give you one dimension of what I'd do with it. It relates to what I do now. After I retired from NYU a few years ago I was approached by Internews Network and the Center for Democracy and Technology to take on a project called the Global Internet Policy Initiative.

UBIQUITY: What's the background on it?

SADOWSKY: The hypothesis that underlies the project is that government policy now creates the major obstacles to the growth, spread and effective use of the Internet to enable all kinds of things for civil society. Previously, the major bottlenecks were the high cost of equipment, lack of trained professionals, lack of computers, and lack of other critical infrastructure. Now things are different. There are several ways in which the major roadblock is government policy. First of all, if the Internet is going to spread it has to be affordable, whereas many countries still have the original government-owned PTTs (national Post, Telephone and Telegraph organizations), the Ma Bells of these countries, which they own and which charge severely inflated prices for access to the telephone network. Second, countries license ISPs. Why do they license ISPs? In part because regulators think that they're there to license — otherwise, why would they be called regulators? : There's no good reason for licensing ISPs, but it's a method of control. It's a method of maintaining a monopoly. It's a method of getting revenue from yet another source. So in many countries ISPs don't flourish. The net effects of monopolies and barriers to entry are high prices and limited availability of Internet and Internet-based services.

UBIQUITY: Any other major obstacles?

SADOWSKY: In some countries content is severely restricted. We all know about the obvious cases, Singapore, parts of the Arab world, et cetera. The typical targets are pornography and government criticism, but for example in Kazakhstan we had a case where the Parliament passed a law saying that if you operate a Web site then you are a content provider and therefore subject to the same rules and restrictions as newspapers, radio stations and television stations. As you can imagine, this ruling put quite a chill into

the heart of anyone with a Web site in Kazakhstan. Fortunately, our GIPI coordinator was able to reverse that, but these are the kinds of things that governments do: they want to control, they want to get revenue, and they want to maintain their monopolies.

UBIQUITY: Can anything be done?

SADOWSKY: What we need to do is to put enough advocates in these countries who can work with all sectors of civil society, who can work with government, who can educate, advocate and in effect help these governments understand that they themselves by changing those policies are the key to being able to spread the Internet and make it work effectively for their country. So I'd put a lot of money into that. I'm trying to raise money for that now. This is a very important area, and if we can convince governments to get on board, then I think we can enormously accelerate the growth and use and exploitation of the Internet for good purposes in the world.

UBIQUITY: For our final question, we'll try to satisfy our curiosity about your association with the ACM. Tell us something about that.

SADOWSKY: I joined ACM in 1961 when I attended the ACM annual conference in Los Angeles, and I've been a member ever since. It was there that I first realized that I would have a long-term association with this profession and that I had better make sure that I keep up with the field as best I could. That has paid off in some spectacular ways, both in terms of reading articles that changed the way I understood certain fields, and in terms of meeting people who were helpful, some of whom are good colleagues to this day. In 1968 a group of us started SICSOC, a Special Interest Committee for the Social Sciences, which became a SIG, but then due to lack of binding with the relevant academic disciplines, transmuted itself in the early 1980s into SIGCHI.

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Source: Ubiquity, Volume 5, Issue 12, May 19 - 25, 2004, http://www.acm.org/ubiquity/