

Research Article

An ICT Skills Cascade: Government-Mandated Open Source Policy as a Potential Driver for ICT Skills Transfer

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Abstract

The purpose of the article is to illustrate a government policy-centered approach to universal ICT skills transfer. We believe that the recent laws passed in Venezuela, while specifically aimed at universally migrating government offices, agencies, and industries to Open Source Software and Systems, constitute a new approach to the problem of how to augment the number of skilled IT workers, citizens, and IT-focused companies. We assert that these policies have the potential to change the operating systems and infrastructure of the entire country of Venezuela and provide opportunities for the transfer of ICT skills to traditionally underserved populations. We find that the mandatory migration to OSS policies and laws has the potential to produce massive IT skills transfer. In contrast with the approaches taken by other nations, the Venezuelan government has not relied on the private sector to invest in large-scale projects to build the IT sector. The Venezuelan government has instead created its own large-scale project. In addition, the Venezuelan government has created IT training and educational centers, as well as its own software development centers and small business incubators. Through this approach, the government has been able to close the IT development circle, controlling all aspects of the development process more tightly than in other nations. The Venezuelan policies and OSS migration are relatively new, and the data to measure their success does not yet exist. However, the strategies employed by the government are interesting in themselves because of their potential to begin a cascade of change throughout the country.

Introduction

Globally, basic skills in using information and communication technology (ICT) have become essential to participation in local and global economies. The demand by employers for professionals with basic ICT skills crosses national boundaries, socio-economic classes, and industries. It is no longer the case that the software development, technical support, and scientific industries are the sole drivers of the need for ICT-skilled employees. Nearly all industries, including local medical, financial, industrial, and social-support enterprises increasingly require employees to have basic IT skills for a wide range of jobs.

The development of technological skill improves the capacity of students to absorb technology when they move to the workforce (Kozma, 2005; OECD, 1999). The Organisation for Economic Co-operation and Development (OECD) also emphasizes the economic importance and impact

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of ICT in developed countries and points out the need for these countries to develop a workforce with the skills to use ICT to increase productivity, as well as the need for young people to develop ICT skills in preparation for adult life (OECD, 2001a; 2001b; 2002; 2004). For employees, basic ICT skills have become the key to opening the door to employment and advancement; for entrepreneurs, ICT skills have become essential to starting a business and finding skilled employees; and for industry, having a population that is well-trained in basic ICT skills is essential to issues of staffing, productivity, and participation in wider markets.

For governments, ensuring citizens have opportunities to gain basic ICT skills allows for both the fostering of national economies and full participation in global ones. According to Garrido,

Governments in developing countries, foundations, and international development organizations recognize that ICT is a key component to improve the competitiveness of nations, to foster economic and social development in marginalized communities, and to increase transparency and effectiveness in the provision of public services. (Garrido, 2004, p. 1)

In more developed nations, ICT training is available from multiple sources, including both public and private formal educational systems, both public and private supplementary training programs, and often through private, proprietary employer- or product-driven training programs. These ICT skills training programs are not often aimed at basic skills, but at offering higher-level engineering or developer skills, product certification skills, or employer-specific advanced skills. While governments in developed nations may play a role in offering basic ICT skills to marginalized groups through community technology centers and public Internet centers, they often do not do so directly, and especially not at the federal levels. The basic ICT skills training programs in these more developed nations may have government participation or sponsorship, but they are often found only at the very local, community level, addressing marginalized groups such as the urban poor, rural populations, immigrants, or the elderly.

In the developing world, some countries have taken a much more active role in promoting basic ICT skill acquisition. Some would argue that this is due to the fact that the gap between those with

and without skills is greater, and that the sheer numbers of those without skills is greater. Others might argue that the national government's role in directly offering basic ICT training programs, unlike the model of the developed world, is attributable to the lack of private entities making those offerings. The cases of Ireland and South Korea are good examples of developing nations that have used ICT skills acquisition to promote economic development (see Trauth, 2001).

The most publicized ways in which national governments in the developing world have promoted basic ICT skills acquisition have been through the development of Community Technology Centers or Telecenters. Telecenters have developed multiple forms, including public-private and NGO partnerships to manage funding issues strategically. Telecenters have also experimented with offering devices, service, training, access, and support in different amounts and combinations. Regardless of the form, telecenters are a direct mechanism for national governments to transfer basic ICT skills to marginalized populations (see Rissola, 2007).

In this article, we are focusing on another, less direct mechanism used by a national government to transfer ICT skills to its citizens. The purpose of the article is to illustrate a government policy-centered approach to universal ICT skills transfer. We are especially interested in the role played by national policy in those centralized and developing countries in which changes made to government's work produce similar changes in the rest of the nation's work. What might be a small change in a decentralized, developed nation may rather be a fundamental change to national infrastructure in developing, more centralized nations. Specifically, in this article we use the term "centralized" to refer to governments in which power and authority are held by a core, consolidated government, and which intend to intervene in the social and economic life of the country much more than others. We do not use the term "socialist" to refer to Venezuela in this article because, despite claims made by Venezuelan officials, it is unclear whether Venezuela can completely fit this definition.

Venezuela has recently mandated the development and use of OSS (Open Source Software) within public agencies. Venezuela has one of the largest petroleum and mineral reserves in Latin America, and increasing oil prices have provided the country

with enough resources to try new policies in order to achieve development. These circumstances effectively opened a policy window (Kingdon, 1995) in which the nation began to develop science and technology policies and the wealth to support them.

In this article, we seek to present a big-picture view of the actions the Venezuelan government has taken to promote the use of Open Source Software and Systems. Venezuela has chosen to encourage, develop, and support the use of Open Source operating systems and software for all of its government agencies and affiliated partners. Since the country has recently moved to nationalize its largest industry, oil, and its telecommunications sector, this move to Open Source is more significant than it might have been in a country with a less centralized government.

We do not yet know if the approach taken by the country of Venezuela will transfer ICT skills to a wide, diverse, and perhaps, marginalized segment of the Venezuelan population. The laws passed in Venezuela that have prompted this migration are recent, and therefore the data as to how successful they have been are slow in coming. It is also possible that these policies may end with only limited success, with no impact on underserved populations, or by causing some unanticipated detrimental effect on the population. The jury is still out. Our aim with this article is to show the intentions and potential for such laws as yet another possible tool in the national arsenal combating digital inequality and building a well-trained, ICT-skilled workforce.

National ICT Policy Skills Cascade: Skills for the Masses

National policy makers, in their struggle to craft policies and programs that support economic growth and the public good, often see ICT as a way to promote educational change, improve the skills of learners, and prepare them for the global economy and the information society (Haddad & Draxler, 2002; Kozma & Wagner, in press; McNamara, 2003; UNESCO, 2002; Wagner & Kozma, 2005).

The matter of national government policy as related to the transfer of ICT skills in developing countries has been significantly understudied. However, national ICT policies can serve several important functions (Jones, 2003; Kozma, 2003). An economic argument is often used to support these policies, as

in the case of Egypt's ruling National Democratic Party, which stated, "integrating modern technology into education has astounding positive influence on nations' educational development, economical progress, and global position" (National Democratic Party of Egypt, 2003, p. 3). While the economic rationale is frequently used to justify ICT investments, and the investments in educational ICT have been substantial, national plans have often lacked explicit causal connections between these investments and the desired economic and social impact stated in national goals (Kozma, 2005).

Without explicating the relationship between ICT-based educational and training policy and the desired social and economic outcomes, and without building these outcomes into policies and programs, it is less likely that these training efforts will add to overall national economic and social efforts and have the ultimate intended effects. The connection between these educational investments and their economic and social returns is a concern for all countries, but it is nowhere more important than in developing countries, where the resources are few, and both the costs and stakes are high (Kozma, 2005).

Additionally, investments in the ICT sector for developing countries may also not be as successful as similar investments in developed nations. Studies have found that, under specific conditions, "countries with higher growth rates in IT investment achieved consistently higher growth rates of GDP and productivity" (Kraemer & Jason, 1994, p. 2). Nevertheless, this situation seems to be the case only for developed countries, since for developing countries the returns on capital investments are not substantial (Kraemer & Dewan, 1998). Kraemer & Dewan assert that, in the case of developing countries, perhaps there is a learning effect, in that countries accumulate experience before the investments in the ICT sector payoff.

ICT skills transfer in developing countries is fundamentally different. In some ways, it can be seen as a vicious circle, one including the activities related to ICT skills transfer, the productive sector, economic returns, and development. First, the educational system does not meet the demands of students and professionals in the sector (because of either massive desired enrollment or undersized educational facilities). Second, given the lack of ICT-skilled human resources, ICT companies are not attracted to invest

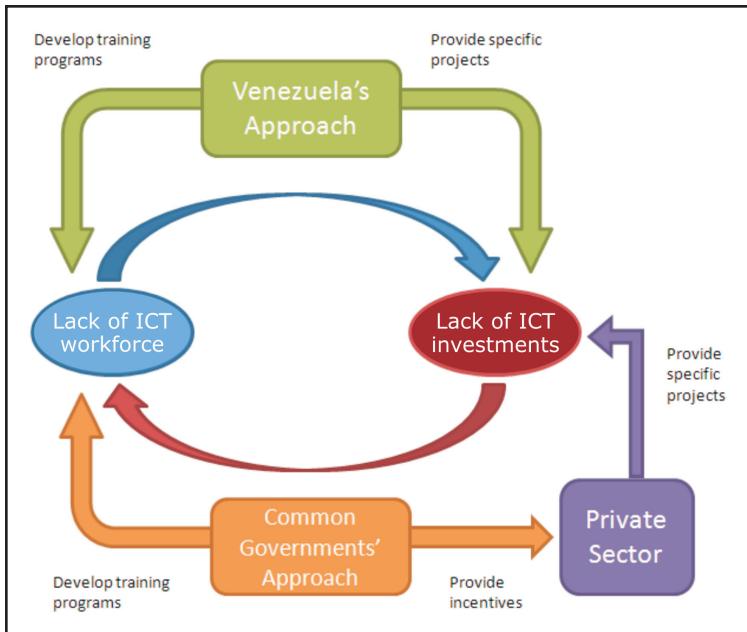


Figure 1. Vicious Circle of ICT Workforce and ICT Investments.

or relocate to the country. Third, because there are less ICT firms, fewer resources are devoted to ICT training through private and public sources. There is a balance between ICT training and ICT investments that must be found. Countries such as Ireland have found a successful formula in increasing technological training and lowering taxes for new firms. The problem with this approach is that the government only has control of one side of the equation. A country can train its workers on specific skills, but it still needs the intervention of the private sector to hire the workforce and invest on infrastructure.

The Venezuelan government saw, through the introduction of Open Source Software, a possibility for having control of both sides of this equation, or at least for a big sector of the Venezuelan ICT market.

Figure 1 provides a description of the vicious circle. At the bottom, it is the usual approach of countries looking to break the circle: The state provides funding for training and incentive for companies, so the companies can hire the local workforce. The approach of the Venezuelan government is shown at the top: The state is providing funding for education and is also creating the projects that will hire the workforce.

With this work, we seek to engage in theory extension as we develop the concept of an “ICT skills cascade.” A cascade is defined as a succession of stages, processes, operations, or units, the output of each serving as the input for the next, a process that occurs in successive stages, each of which is dependent on the preceding one, and often producing a cumulative effect. An ICT Skills Cascade is the setting-in-motion of a multi-stage transfer of ICT skills from a few to many, with the goal of changing both the qualities and quantities of ICT skills in the general population of a country. Unlike more traditional ICT skills training programs, educational reforms, and national telecenters, an ICT skills cascade is indirect and indiscriminate in its

targets. Kozma (2005) has already hinted at the existence of ICT policy making and its role in a form of ICT skills cascade:

The appropriate policies, strategies, trajectory, and pace of change would vary from country to country based on unique strengths and competitive advantages. In one country, **a strategic economic change, such as supportive macroeconomic policies, may be the appropriate way to launch change within the economic system, which then ripples into the social and educational systems.** In other countries, it may be changes within the social or educational systems that ultimately affect the economic system. (Kozma, 2005, p. 144–145) (Emphasis added)

Drawing on the aphorism, “a rising tide lifts all boats” (associated with S. Lemass and J. F. Kennedy) the idea is presented that improvements in the general economy will benefit all participants in that economy, and that economic policy, particularly government economic policy, should therefore focus on the general macroeconomic environment first and foremost. We believe that an ICT skills cascade is formulated with similar intentions to change the ICT skills levels in the nation. This concept is often asso-

ciated with the pejorative “trickle-down economics” and “trickle-down theory,” terms used in political rhetoric to classify economic policies perceived to create incentives for top earners to invest more into business infrastructure, which will in turn lead to more goods at lower prices, while at the same time creating jobs for middle and lower class individuals. An ICT skills cascade might function similarly if the initial wave of ICT skills change were large enough and forceful enough to impact all sectors of a nation.

Drawing from the literature on skill transfer programs, Garrido (2005) identifies three dominant approaches: project-based, industry-specific, and skills-based. We associate an ICT skills cascade with Garrido’s industry-specific approach, expanding the concept of industry to be that of the entire public sector of a nation, and then expanding it further to be that of a centralized nation in which the majority of the country’s employees are public employees. In other words, when this government changes, the entire nation changes. The industry-specific approach is defined as training in which ICT skills are tailored for specific sectors of the economy. This form has employability or income generation as the main goal. This approach has the advantage of being the strongest for achieving employability goals. However, when these programs are offered by local telecenters, NGOs, or private organizations, they are very difficult to construct, and instruction may be problematic when it relies on so many different experts to teach different components of the training. In addition, the goal of telecenters is fundamentally one of social integration, not skills transfer.

This drawback may be mitigated when the authority and power of a national government is behind the training program and establishes links directly with economic centers. Telecenters are an entry point to ICT, but the main responsibility in the generation and multiplication of knowledge workers still relies with the university (Rissola, 2007). However, in most developed and developing nations, the university typically acts independently, disconnected from the productive and industrial sectors. Venezuela has attempted to solve this problem by creating and controlling its own institutions for both education and production, forcing a clear link between the knowledge/skills centers and the economic agents.

Open Source Software for National Governments

The use of Open Source Software and Systems by national-level governments is a relatively recent and understudied socio-technical phenomenon (a notable exception is Tessler, Barr, & Hanna, 2003, p. 1). While the development, environments, and use of OSS in a general sense have been well studied, its development, use, and policy context in the national public arena have not. Of the studies that have examined this space, most have focused on interconnection between OSS and economic development for developing nations (Maldonado & Tapia, 2007a; 2007b; 2007c; Weber, 2003; Weerawarana & Weeratunga, 2004).

A 2007 report from the Centre for Strategic and International Studies shows that there are 268 OSS policy initiatives which can be categorized into four forms: mandatory, preference, advisory, and research & development (CSIS, 2007). Of those approved, only six (3.4%) mandated the use of OSS. However, since 2004, the percentage of OSS initiatives that were mandatory, compared with recommended, advised, or under study, rose from 1.3% to 3.4%, suggesting a trajectory toward more mandatory forms of deployment.

For the purposes of this article, we are specifically interested in national governments which mandate the use of OSS. However, there have been several sub-national, regional, and local governments who have made this change. For example, in Brazil, Rio Grande do Sul was the first administration to pass a law making FOSS use mandatory in both government agencies and non-government-managed utilities. Four cities in Brazil have passed legislation requiring preference for “software libre” where an open source option is available. Since then, 10 municipalities and seven states in Brazil have evolved laws giving preference to, or mandating the use of, FOSS in the public sector (Mannila, 2005). The Rio Grande do Sul State law from 2002 was suspended by the federal Supreme Court after one of the parties in the state Government filed a petition claiming the law was unconstitutional. The case remains to be settled. Despite this setback, Brazil is also interested in a national OSS law. A federal technical committee for FOSS implementation was instituted by presidential decree in October 2003, aiming for

80% migration to GNU/Linux for public sector computers (ibid.).

Open source software and systems refers to the “development of software through collaborative, informal networks of professional or amateur programmers, and the networked distribution making it available to developers and end-users free of charge” (Ghosh, 2005, p. 3). OSS is software that, in its distribution, includes the source code along with the executable program; so anyone with the right knowledge is able to make changes to it. For the purposes of this work, the definition of OSS used is the one given by the Open Source Initiative. The OSI provides a list of 10 characteristics that any software must have in order to be considered OSS. The 10 points can be summarized in three features:

1. Source code must be distributed with the software or otherwise made available for no more than the cost of distribution.
2. Anyone may redistribute the software for free, without royalties or licensing fees to the author.
3. Anyone may modify the software or derive other software from it, and then distribute the modified software under the same terms. (Weber, 2003, p. 10)

Exactly how a nation should approach supporting OSS has been well debated (see Bessen, 2002; Evans & Reddy, 2003; Smith, 2002). The approaches can be categorized into three forms: 1) (red) government should be neutral in the adoption of any form of technology, 2) (yellow) governments “naturally” ought to choose OSS given the benefits that this provides, and 3) (green) governments should be actively involved and promote the adoption of OSS.

The authors in favor of the red approach argue that the software sector has been successful without the intervention of the government and that “the best catalyst for software innovation and industry growth is the marketplace” (Smith, 2002). The yellow approach acknowledges the value of OSS, but considers that government should be careful when intervening in the market. The partial neutrality of the yellow approach is demonstrated by Lee: “The ultimate conclusion is that when two systems are equally suitable, governments may reasonably choose OSS over proprietary software because software industry market failures may justify such sup-

port of OSS development” (Lee, 2006, p. 48). The green approach has been gaining attention during the last four years as the number of governmental OSS projects has increased. The arguments in support of the green approach typically are that OSS can contribute to solving the universal access problem; provide independence, local control and local economic growth; and improve transparency and democratic accountability. The increased interoperability, security, and cost of OSS are another advantage (Ghosh, 2005).

Theoretical E-Development

In order to understand the actions taken by the Venezuelan government around mandating OSS, we seek to locate them within the literature on e-development. The term e-development has been well and diversely used. Arriving at a single usable definition is challenging. For the purposes of doing so, we have grossly categorized the uses of e-development into several conflicting, and sometimes overlapping, categories.

The first category of use frames ICTs in the role of furthering development of an existing information and knowledge economy in which information and technological products make up the majority of products produced by the country (i.e., case studies of Ireland, South Korea, and Singapore). Key to this category of use is sustainable growth through technology. This category often has little to do with developing countries, alleviation of poverty, or transfer of basic ICT skills.

The second category sees ICTs as playing a more traditional development role, as both the means and the end of development. In other words, the ICTs are both the “how” and the “what” which must be developed. “Increases in human, institutional, and technological capabilities are, in turn, major sources of new knowledge and innovation, which then feed economic growth. From this perspective, technological innovation and new knowledge are both the engine and the product of economic growth” (Kozma, 2005, p. 118). This definition may or may not have anything to do with developing countries or alleviating poverty, depending on the starting point of the country in question. Blinde states that this definition is concerned with how “[T]he diffusion of information and communication technologies creates new

opportunities for development” (Blinde, 2005, p. 18). Arquette adds to this definition, “I use a more encompassing definition of e-development: human development facilitated by ICTs” (Arquette, 2002, p. 3). Carayannis et al. state:

e-Development is a set of tools, methodologies, and practices that leverage ICT to catalyze and accelerate social, political, and economic development. Or in other words, e-Development is ICT-enabled and KE-inspired development that may enable the economies of developing, and especially transitioning, countries to become Knowledge Economies. (Carayannis, Popescu, Sipp, & Stewart, 2006, p. 422)

It should be noted that even the structure of the term “e-Development” has been challenged. Heeks suggests that e-Development has traditionally been associated with “electronic development.” He suggests a new term: “*i*-development,” “the approach to ICTs must be *i*nformation centered, *i*ntegral to its environment, *i*ntegrated with development objectives, *i*ntermediated, *i*nterconnected, and *i*ndigenized. Above all, it must be *i*ntelligent”(Heeks, 2002, p. 10). Heeks’ discussion contrasts with Ballantyne’s idea of e-development. For Ballantyne, the “e” on e-development should not be related with electronics, but with terms and concepts such as effective, empowerment, and efficient (Ballantyne, 2002, p. 7). He suggested that “we need to work for development for ICTs, and not with ICTs for development” (p. 7). Ballantyne’s definition of e-development is “ICT-enabled ways to do development different and better” (p. 8).

Perhaps adding to the confusion, while e-development may or may not address issues in developing countries and alleviating poverty, it is often conflated with the term ICT for development (ICT4D), which has such a mission at its core. While these terms are often used interchangeably, we have categorized the use of ICT4D as focused on the development of developing countries and the alleviation of poverty using information and communication technologies (see Weigel & Waldburger, 2004).

From this discussion, we have arrived at our working definition of e-development as a dynamic process through which a nation develops policies which promote ICT as both a mechanism and a goal for economic and social development.

Research Design

This article represents a small part of a much larger research project. The overall research project has examined the development of the ICT infrastructure in Venezuela as a result of the changes made by the central government since 2004.

This smaller project focused on the nature of the policy and institutions created by the Venezuelan government and their potential impact of the IT skills of the Venezuelan people. The research questions that drove this work were,

1. **What are the perceived potential impacts of the Venezuelan policy mandating a migration to OSS for all government agencies on the IT skills of the average Venezuelan citizen?**
2. **What are the perceived potential impacts of the Venezuelan policy establishing the *Academy for Software Libre (education)* on the IT skills of the average Venezuelan citizen?**
3. **What are the perceived potential impacts of the Venezuelan policy establishing the *Fábrica de Software Libre (production)* on the IT skills of the average Venezuelan citizen?**

The overall research design for this smaller project was one of a case study. The selection of case study as a methodology for conducting this research is appropriate for five reasons. One, case studies have been identified as an appropriate and important tool for the study of information and communications technologies in organizational contexts (Darke, Shanks, & Broadbent, 1998). Two, the case study is a viable method for studying areas that are underdeveloped in the literature (Benbasat, Goldstein, & Mead, 1987). Three, the case study method is particularly well suited for studying phenomena that cannot easily be distinguished from their context. In addition, case studies may also be exploratory and even explanatory (Yin, 2003). Lastly, case studies are considered to be appropriate for theory development and extension (Flyvbjerg, 2006; Stake, 1978).

When conducting a case study, the researcher often relies on multiple sources of evidence (Benbasat et al., 1987; Yin, 2003). For this case study, we used three forms of data: interview data with Venezuelan

government officials; official policy documents; and unofficial government documents such as press releases, internal memos and reports, and other forms of internal and external textual communications. The data discussed in this article were collected between September 2006 and June 2008. Data were collected in two principal forms.

The four main policy documents highlighted here are the core of our research data. To understand the context of these policy documents and their potential implications for the Venezuelan people, we also conducted approximately 30 interviews with a variety of Venezuelan officials, including policy makers, OSS software developers, OSS educators and trainers, agency staff initiating OSS migration, and community leaders. Most of these interviews were conducted in person in Venezuela in Fall 2007 and Spring 2008. These interviews were recorded, transcribed, and coded using an open coding system. The documents were analyzed using the same codes as developed by the interviews, as well as some open coding. The observations led to better quality coding of both the interviews and documents, in that they provided much-needed context. It must be noted that while the key informants for this study covered a wide range of government organizations at many levels of a highly complex hierarchy, they were all, indeed, government employees. In a country where near 20% of the working population works for the government in some form, this is hard to avoid. However, this also has introduced significant bias into the study. Few of the interviewees would be motivated to discuss the policies and their outcomes in a negative light.

The larger research focused on the development of an IT sector in Venezuela continues. We expect, in 2009, after the policies and institutions have been in operation for several years, to go back and collect more data concerning the results of some of these policies. At that time, we plan to include many non-governmental subjects in our research pool.

It is important to understand that, within the bounds of this case study, we conduct policy analysis. Policy analysis is defined by Nagel as associated with determining the nature, causes, and effects of government decisions or policies designed to cope with specific social problems (Nagel, 1980, p. 3). Policy analysis often is speculative in nature, using available data and likely outcomes from similar poli-

cies in other situations to anticipate the outcomes of a policy in any given situation.

Data and Findings: Open Source Initiatives in Venezuela

In the past 10 years, the government of Venezuela made four efforts to change its technology and telecommunication sector through the establishment of governmental organizations and policies. The government has created two new ministries related to technology and telecommunication policies. The government has passed four major laws regulating technology and telecommunications development and use, directly addressing the Open Source issue (CLAD, 2008). The government has created two governmental organizations that support the aims of these laws. Lastly, Venezuela has established one official General National Plan in 2005 and has another under development for 2007 which is specifically related with telecommunications.

Just after the election of the President of Venezuela, in 1999, the Ministry of Science and Technology (MST) was created. Immediately, the Minister of Science and Technology was asked to create a comprehensive plan for her new office. The Ministry published its principal policy document, the National Plan for Science, Technology, and Innovation 2005–2030 (NPSTI) in 2005 (Ministerio de Ciencia y Tecnología de Venezuela, 2005a).

The NPSTI encourages the development of a new culture, in which scientific and technological activities should be participative, multidisciplinary, integral, and collective-oriented (ibid.). The policies clearly make the connection between cultural changes and economic development in the technological sector. Following this line of thought, the policies espouse three main goals: 1) to achieve scientific and technological independence, 2) to promote science and technology oriented for social inclusion, and 3) to build national human resources.

Soon after the development of the NPSTI, the Venezuelan government also published Decree 3,390. This law seeks to stimulate the creation of a strong software sector that intends to create an internal source to amplify “the production of [technological] goods and services to satisfy the needs of the population.” In addition, this new law recommends the creation of educational and research in-

stitutions for the development of Open Source Software and Systems:

Considering: That is the Nation's priority to stimulate and foment the production of goods and services to satisfy the needs of the population,

Considering: That the use of Open Source Software developed with Open Source's Standards will fortify the national software industry, increasing and fortifying its capacities.

Decree: The National Public Administration will use Open Source Software as first priority in its systems, projects, and informatics services. To such aims, all the institutions and offices of the National Public Administration will initiate the progressive adoption of Open Source Software. ("Decree 3,390," 2004)

In a legislative sense, governmental Decree 3,390 provided the legislative platform that made the use of OSS mandatory in all governmental offices. In the educational sense, this same decree created educational institutes, or academies, for the formation and training of OSS developers. This legislation also stated that the government would provide political and economic support for the development of these institutes.

Because of Decree 3,390, in 2004, Venezuelan governmental offices began a mandatory migration to OSS. In the long term, the migration will also include primary and secondary educational institutions, as well as other parts of the national government (Ministerio de Ciencia y Tecnología de Venezuela, 2004). In order to demonstrate the importance of this migration, the Venezuelan government made the case that IT-based sovereignty is akin to food-based sovereignty for the nation (Ministerio de Ciencia y Tecnología de Venezuela, 2004, p. 14).

The NPSTI and Decree 3,390 are directly linked. The three goals expressed in the NPSTI above include, in a broad sense, the specific roles developed by the Minister of Science and Technology in order to fulfill Decree 3,390. This connection is clearly spelled out in the *National Plan for Open Source Software Adoption in the Public National Administration*. In March of 2005, the Ministry of Science and Technology presented the *National Plan for Open Source Software Adoption in the Public National Administration* (Ministerio de Ciencia y Tecnología de Venezuela, 2005b). The Plan provided

four "programs": 1) migration and standards, 2) OSS sensitization, 3) formation of OSS human resources, and 4) stimulation of the national software industry.

Venezuela has had an Open Source community that, by tradition, has not been related to the governmental sector. One of the older and more active organizations is GLoVE (Organized GNU/Linux Users of Venezuela). Created in 2002, GLoVE has organized three offerings of the National Congress of Software Libre. This is a traveling exhibition that visits several Venezuelan states, promoting OSS with talks, workshops, and demonstrations related to Open Source Software solutions. Although the organization has maintained its independence from the government, the country's Open Source policy provides funding and support to some activities of GLoVE. GLoVE maintains a list of people that are interested in the OSS movement, both public and private, and provides a common point for the interchange of ideas among them.

Growing Open Source in Venezuela

In this article, we seek to present a big-picture view of the actions that the Venezuelan government is taking to promote the use of OSS. In the following section, we describe each of the actions, discuss their current status, and present some possible implications for the actual adoption of OSS. In this section, we discuss six forms of government action in regards to OSS: mandate, proselytize, build, educate, seed/stimulate, and limit illegal alternatives.

MANDATE: Venezuela Makes the Adoption of OSS in All Public Offices Mandatory

In 2004, the government of Venezuela gave each governmental agency a period of 90 days to create a migration and adoption plan for its move to OSS. Since that time, each governmental entity has been given 24 months to enact their plan and complete their migration and adoption.

To truly understand the status of this action, one must first understand the magnitude of the migration process through a description of the structure of the Venezuelan government. At present count, the Venezuelan government comprises over 400 organizational divisions at the highest level, not count-

ing the multitude of subdivisions at the state and local levels.

The size and complexity of the Venezuelan government may present a challenge for Decree 3,390, since the law does not provide any guidelines to enforce OSS migration and adoption. The deadline for having completed the migration and adoption was October 18, 2007. While it is well known that several government bodies are engaged and working hard in the migration and adoption process, it is not known how the ministry will enforce the migration and adoption if governmental bodies are found to be non-compliant. One compliant example is the State of Mérida. In its official "Plan for Science and Technology 2005–2010" (Fundacite Mérida, 2005), the state included the adoption of OSS as a priority goal in the areas of public management and education, in line with the Federal-National law.

While the actual percentage of compliant government bodies is unknown, even to Venezuela itself, these deadlines have inspired some significant change. It is known that, two years ago, each government agency wrote a plan for migration to OSS. Despite some deviations in planning and implementation, the creation of these proposals remains significant. In this plan, each governmental body was forced to review their then-current computing and information needs and project what they might need into the future. This kind of self-review leads to strategic planning efforts and better decisions when it comes to IT use, development, and management. The writing of these plans led to an increase in exposure to OSS ideas, customs, and values as each agency had to grapple with the migration and what it would mean for its management. In addition, these deadlines have indirectly led to the need for a support structure for the migration itself, leading to the foundation of the Academies and Factories for OSS, where the software was developed and the personnel trained (see below).

Perhaps more important is the fact that the Government of Venezuela is the country's largest employer. By June 2007, according to the Venezuelan Statistics National Institute (Instituto Nacional de Estadística), 17.6% of the working population of the country was employed by the government in some form (Tejero Puntos, 2007). This figure may have increased since June due to the recent nationalization of the biggest telecommunication company

in the country, CANTV (Compañía Nacional de Teléfonos de Venezuela), and the biggest electricity company of the country, EDELCA (Electricidad de Caracas). Therefore, the migration of OSS within governmental offices and agencies is better seen as a migration of near 20% of the adult working population in the country. As governmental employees become comfortable with the new OSS at work, they may also bring those to the neighborhood, the church, the community, and the home.

PROSELYTIZE: Venezuela Brings OSS to Offices, Neighborhoods, and the People

The Ministry of Science and Technology and the Ministry of Telecommunications and Informatics have jointly presented materials on the advantages of OSS to all government bodies. In addition, they have hosted conferences, seminars, and other events to promote the use of OSS in the public sector and in the rest of the population. The presentations included in this action can be categorized as both internal and external marketing. Internally, the two ministries have made several presentations. An example of these activities was the forum "Policies for the Use and Development of Open Source Software in the Public Administration," which took place in 2004. That forum included academics, stakeholders from the private ICT sector, decision makers from the public sector, and developers. There were more than thirteen presentations from a range of participants, including an IBM Linux-marketing manager and Richard Stallman (a known personality in the OSS area). The topics included examples of OSS adoption in other countries and the philosophical bases of the OSS movement. The results of the event were published in *The Yellow Book of Open Source: Use and Development in the National Public Administration* (Oficina de Tecnologías de Información, 2004).

In addition to these internal presentations, the government has also hosted large educational events open to the general public. For example, in 2001, the Third National Congress of Open Source took place in thirteen states and included the participation of Richard Stallman in the closing ceremony. The Congress not only provided information and solutions for the general public, but also presented demonstrations and hands-on activities in which the participants were encouraged to bring their systems (desktops or laptops) and have OSS installed on

them. The Web site¹ promoting this Congress shows that at least 15 similar events have taken place in 2007.

In addition to these Congresses, the Ministries of Science and Technology and Telecommunications and Informatics also have carried out forums, conferences, seminars, and other events to promote the use of OSS in the public sector. For example, the Venezuelan National Radio Station ran a program on Open Source Geographical Information Systems (September 10, 2007). In this program, the Ministry of Telecommunications and Informatics introduced the Spanish system Proyecto Sextante, an OSS for territorial analysis and education. The Ministry representative highlighted the variety of OSS solutions that are available for the public and how they might contribute to Venezuelan technological independence (Radio Nacional de Venezuela, 2007).

While the initial laws regarding the mandatory move to OSS by the Venezuelan government can be considered top-down, there is a strong sensitivity among the government that it needs the buy-in of the general public to be successful. The government understands that if Venezuela is to truly make the move to Open Source in all government offices, including education, it must also make the same move in the general public and private sectors.

BUILD: Venezuela Builds OSS Factories to Supply Needed Software

With government investments, the Minister of Science and Technology has created regional bodies for the development of Open Source Software called "Fábrica de software libre" (Open Source factory) (Ministerio de Ciencia y Tecnología de Venezuela, 2006). These institutions are tasked with developing Open Source Software to be used in some governmental bodies, such as municipalities, hospitals, and elementary schools, as well as in other forms of entrepreneurship sponsored by the government, such as small tourism-related businesses.

The OSS Factory has carried out several projects. One of the most successful products of the OSS Factory is SAID, Sistema Administrativo Integrado para Instituciones Públicas Descentralizadas (administrative system for decentralized public institutions) (Fundacite Mérida, 2007). The system is an ERP (en-

terprise resource management system) focused on governmental activities. SAID has been deployed since December 2006, and it has had a positive response from public offices (CENDITEL, 2008).

EDUCATE: Venezuela Opens OSS Academies to Educate Both Governmental and Non-Governmental Employees

The second resolution created the Open Source Software Academy (Academia de Software Libre, or ASL). The ASL was created to form an IT workforce that is knowledgeable and skilled in Open Source technologies. The ASL provides courses and training free of charge, and due to the fact that it is a governmental institution, it has a direct connection with most governmental offices. Therefore, it is not surprising to find most of the students to have come from government employment.

There are several ASL located throughout Venezuela, but the original ASL is located in the state of Mérida. This ASL provided the data used in this part of the article. The ASL-Mérida offers short courses of approximately 20 hours and long courses of 500 hours. Most of the courses offered by this ASL are those oriented to providing more concrete skills and knowledge about the use and development of OSS. The ASL has more than 20 different short courses that cover a range of topics, from the use of Open Source Office suites to technical support related to Open Source Technology. In addition, there are two main long courses, each one with five levels. After completing these five levels, students receive a certification: Administrator of Networks and Services or Software Developer. Both the number of courses and the number of enrolled students in the ASL have increased over time. In 2006, a total of 3,806 people attended these courses, and the numbers of courses, types of courses, number of students, and diversity of students have all increased. When asking about Open Source-related activities, most public workers indicate that the ASL is one of the most successful initiatives of the Venezuelan OSS adoption process. The number of participants from the public sector was 1,779 for the year 2006, and the number of non-officials was 1,255, only in the Mérida chapter. The ASL also has expansion plans that will maintain this growth.

1. <http://www.cnsl.org.ve>

Perhaps most interesting, the ASL has a short course named Sensitization to OSS. The course focuses on the advantages the Open Source philosophy brings. In 2006, more than 98 people attended these sensitization courses. Most of the participants were decision makers from public administration.

Table 1 provides a summary of data provided by the ASL (the OSS-Sensitization course is also included on the table as a short course).

From this data, we have learned several things. The number of non-official students has increased from zero in January 2006 to 197 in November of the same year. The peak numbers of students, 263 and 273 in August and September, took place because of the summer holidays, which allow more free time for students to take extra classwork. The drop in numbers during the month of December is easily explained by the holiday season, in that there is little free time beyond family responsibilities for students to take classes. The number of official participants for short courses has also increased over time, a behavior also observed for the number of non-official participants. The number of official and non-official students taking the long courses has remained relatively steady. The Academy has graduated several classes from the long course, with five to six students in each. This year, the large course will double its graduating class as the ASL plans to graduate 12 new IT-OSS professionals with certifications.

The existence of the ASL offers citizens a mechanism for education and training in computing that has several advantages: firstly, it is free, and thus presents no cost barrier to entry as might some other certification programs, such as with MSCE and Cisco; secondly, taking these courses is tied to government employment, the largest employer in all of Venezuela; and lastly, the courses demand no university-level education, allowing average citizens, and not just the upper classes, access to these educational opportunities.

SEED and STIMULATE: Venezuela Establishes OSS Incubators and Cooperatives Linking to Industry

The government of Venezuela has taken action to provide incentives for the establishment of cooperative enterprises created to support OSS-related busi-

ness. The post of Minister for Popular Economy was created in 2004 with the objective of administrating resources for building small and medium enterprises with a Venezuelan-endogenous approach. In 2007, the post was re-named the Minister of the Popular Power for the Communal Economy. The focus of the Minister is to provide funds for entrepreneurs arising from overlooked populations.

In that sense, since 2005, the Minister for Science and Technology has promoted the creation of Government-Sponsored Small Enterprises (GSSE), which have been typically focused on offering external technical support for the adoption process (Maldonado & Tapia, 2007b). These GSSEs are often hybrids which combine elements of both public and private funding sources and business models. In addition, some of the people that have established these enterprises have received training at the ASL. GSSEs have been created under a cooperative philosophy, which means that, in these small economical initiatives, employees are owners. The government's funding campaign that finances small to medium enterprises has given more opportunities to GSSEs. These GSSEs worked as contractors, providing services of technical support and consulting for public offices. To facilitate the process, the government has created a Web site named INVESOL² where governmental institutions can post their requirements and GSSEs can post their service offers. The focus of the Venezuelan government on small and medium-sized enterprise is another OSS approach that looks to include segments of the society that are out of the reach of the public sector.

LIMIT: Limiting Illegal Pirated Alternatives

According to the BSA (Business Software Alliance), Venezuela has a serious and significant problem with illegal software piracy. The BSA reported that, for 2006, Venezuela had a piracy rate of 72% (6 points over the entire Latin America region). In conjunction with its efforts to mandate the use of OSS in government offices, the government has also created SAPI (The Intellectual Property Service Agency), which, among other services, will support the migration to OSS by fighting software piracy. The government is of the belief that software piracy is a direct threat to the adoption of OSS by all Venezuelan citizens. Pirated software provides a false

2. <http://www.softwarelibre.gob.ve/invesol/>

Table 1. Participation in the ASL-Mérida.

	Number of Short Courses	Number of Long Courses	Participants Short Courses Officials	Participants Short Courses non-Officials	Participants Long Courses Officials	Participants Long Courses non-Officials	Total Participants Short Courses	Total Participants Long Courses	Total Participants Officials	Total Participants non-Officials	Total Participants	Total Courses
Jan Feb-06	11	1	148	0	4	0	148	4	152	0	152	12
Mar-06	13	4	168	10	38	17	178	55	206	27	233	17
Apr-06	10	0	126	21	0	0	147	0	126	21	147	10
May-06	16	2	158	27	23	20	185	43	181	47	228	18
Jun-06	57	2	148	72	27	7	220	34	175	79	254	59
Jul-06	32	1	124	71	4	2	195	6	128	73	201	33
Aug-06	53	1	292	245	11	18	537	29	303	263	566	54
Sep-06	47	3	139	260	27	13	399	40	166	273	339	50
Oct-06	27	2	189	190	5	8	378	13	194	198	392	29
Nov-06	23	1	116	197	10	0	313	10	126	197	323	24
Dec-06	8	1	20	64	2	13	84	15	22	77	99	9
2006	297	18	1,628	1,157	151	98	2,784	249	1,779	1,255	2,934	315

sense of free-ness to the general population, so with illegal “free” software, there is no motivation to move to truly free OSS software.

Discussion

Here, we seek to examine Venezuela’s actions in light of their potential to create a system that cascades ICT skills throughout the population. In order to do this, we must first examine the intention of the national policies that are driving this potential cascade.

Scholars have not always ascribed a central role to government policy in development (Chang, 2003). Classic economic theories demonstrate the importance of the free market. Supporting this, in the 1980s and 1990s, there came the rise of the “Washington Consensus,” in which the belief that economic growth depended on macroeconomic stability was adopted by many nations (Williamson, 1990, 2000). However, after a series of economic crises in Latin America, among others, in the late ’90s, this consensus unraveled (Bird, 2001; Lall, 2004; Ranis, 2004; Rodrik, 1996; Stigliz, 1998; Williamson, 1990, 2000). With the failure of the Washington Consensus, there has been a reassertion of the importance of government policy and intervention in economic and social development (Kozma, 2005).

In some Latin American countries, socialism has re-emerged in recent years, with an anti-imperialist stance, a rejection of the policies of neo-liberalism, and the nationalization or partial nationalization of oil production, land, and other assets. The Venezuelan President, Hugo Chávez, coined the term “21st Century Socialism.” As part of this effort, Chávez developed an economic model called “endogenous development,” whereby state oil money finances the creation of thousands of small-scale cooperatives in order to provide jobs and to foster community development. A second leg of Chávez’s master plan is something known as “co-gestion,” roughly translated as co-management, where the state is helping workers purchase shares of companies they work in, so as to give them a greater say in management. Chávez’s goal is to lift millions out of poverty by reducing Venezuela’s reliance on oil, which has left the country both with a weak manufacturing and agricultural base, as well as over-dependence on imports of food and almost everything else.

Chávez describes his new 21st Century Socialism in the following way:

We must transcend the capitalist model, and this is only possible through the cooperatives. It’s necessary to pay special attention to them within the strategy of the New Productive Model and the New Economic System that have already been introduced in the country. We have to stop granting contracts to private companies, or to the contractors disguised as cooperatives. Those who don’t follow this are opposing the New Productive Model, proposed by the nation, and indirectly incur in treason to the Bolivarian Revolution. The capitalist economic model is unviable. It’s in the Bolivarian Constitution, where the most important characteristics of the Social Economic Model can be found, the Humanistic Economy, the Egalitarian Economy, all of which are represented by the Cooperatives. (Bowman, 2007)

The Open Source Software policies and initiatives that are the core of this article are essential to the plan for endogenous development. Chávez once said of the switch to open source software that it was crucial to “stop depending on software owned by others.” In addition, “If knowledge doesn’t have owners, intellectual property is a trick of neo-liberalism,” he said (*Taipei Times*, 2006).

Therefore, in the case of Venezuela, the government migration to Open Source, concepts of socialism, and endogenous development are all intertwined.

Drawing from the policies themselves,

The proposed role for science and technology is to push for real development, with a concept larger than the narrow economical vision that merely provides priority to the market. The new vision should put the human being at the center and his/her circumstances, within a framework of sustainable ecology. (p. 82)

Particularly, it is worthy to note how the new model of the country that privileges the inclusion of everybody shapes new scientific institutions. (p. 81)

Within the framework of this development model, concepts such as profit and individual revenues have lost their hegemony as a main production goal, since the real goal is to achieve the happiness and wellbeing of the whole nation. (p. 78)

Basically, [the project] is a form of development focused on the human being as a protagonist of the policies. (p. 80)

(Ministerio de Ciencia y Tecnología de Venezuela, 2005a)

In these lines taken from the NPSTI, we see the clear case being made for a very inclusive policy initiative. Here, we can see the mandatory migration to OSS as tied with all citizens of Venezuela, as tied to a human-centered pursuit, and one leading to national happiness. According to the NPSTI, development is a response to previous inadequate science, technology, and development policies that overlooked whole classes of citizens. Using sovereignty and social inclusion as its primary goals, this approach suggests using the competitive advantages within the nation and changing its style of consumption. The policy initiative is aimed at “everybody,” taken to mean all citizens of Venezuela. Human beings are at “the center” of the target, not the market. The goals of making the move to Open Source technologies are stated as the “happiness and wellbeing” of Venezuela. In order for this OSS policy to achieve these goals, there must be some intended trickle-down effect, in which the skills taught to the numerous government employees will end up in the hands of the average citizen. Perhaps this transfer of skills can be conceived as a ripple effect as proposed by Kozma (2005) (although not yet tested). However, we see this potential Skills Cascade as comprising the following four steps.

Step 1: With the authority of the national government, mandate a wholesale change in basic IT software infrastructure for the largest employer in the country.

This is the initial push of the skills cascade. In order for the skills cascade to be effective, this initial push must be substantial, using both the force of legislation and the reach of a large institution. The move to OSS in a centralized country is a far larger undertaking than in a non-centralized situation. This massive undertaking involves the training of hundreds of thousands of government employees and migrating of the software that runs not only their public agencies, but also their oil industry (which accounts for 80% of the country's economy and is one of the largest business enterprises in Latin America).

This push takes place in all nationalized industries, including all health services, all education services, all social services, and all telecommunications services, in addition to the expected government and oil industries. This means that, as offices are migrated to OSS in each of their industries, so will the employees be trained. Once these employees change the mechanisms in which they work, they may feel some dissonance if they do not also change the mechanisms with which they compute at home. As OSS is pushed into the office and the school and the hospital, it may end up in the neighborhood and the home.

Step 2: With the authority of the national government, create the Open Source Factories (FSL) and Government-Sponsored Small Enterprises (GSSEs) where the OSS systems are being developed.

As the Venezuelan government migrates all of its agencies to OSS, the demand for customized OS software to support a diverse set of needs across these agencies will rapidly increase. While some off-the-shelf OSS is being adopted under the time pressure imposed by the government, the Open Source Factories, also created by the same legislation, are working to meet this growing demand for software. In addition to the Factories, the same legislation has encouraged the development of GSSEs in which OSS are also being developed. These cooperatives are helping the government meet its migration needs for all types of agencies. This increasing demand for software puts pressure on the Factories and the GSSEs to produce more software, which in turn increases the demand for ICT-skilled professionals to develop the software and support it once it has been installed.

Step 3: With the authority of the national government, create the Open Source Academy (ASL) where new OSS professionals are being trained in their development, deployment, and use.

Both government agencies and the OS Factories are demanding ICT-skilled professionals at an increasing rate. The creation of the Open Source Academy (ASL) has been one mechanism that the government has used to create these new ICT-skilled professionals. The ASL offers courses, which are free, welcomes both public and private students,

welcomes students with and without a university degree, and has various geographic locations dispersed around the country. The ASL has done a lot to make education and training in computing available to a larger, more diversified population than traditional universities and private industry-related certification programs. From our data, we know that the numbers and types of students at the ASL are growing and diversifying.

Step 4: With the reach, wealth, and influence of the national government, create open communication channels with citizens to engage with OSS.

There is a strong sensitivity in the Venezuelan government that it needs the buy-in of the general public for its migration to OSS to be successful. Venezuela is thinking in the long term with these educational efforts, attempting to change the computing value structure from that of a PC/Windows environment to that of OSS for the entire nation. Although the use of pirated software inhibits the overall migration to OSS, it is possible in the case of Venezuela that both OSS and proprietary software are being used in the same households, offices, and institutions. It is possible that, with the additional consciousness-raising and educational efforts on the part of the Venezuelan government, the average Venezuelan is making more educated choices about his or her software needs and uses.

Conclusion

We do not yet know if the approach taken by the country of Venezuela will transfer ICT skills to a wide, diverse, and perhaps marginalized segment of the Venezuelan population. The purpose of the article is to illustrate a government policy-centered approach to universal ICT skills transfer. We believe that the recent laws passed in Venezuela, while specifically aimed at universally migrating government offices, agencies, and industries to OSS, have the potential to change the operating systems and infrastructure for the entire country and provide opportunities for the transfer of ICT skills to traditionally underserved populations.

The laws passed in Venezuela that have prompted this migration are recent, and therefore the data as to how successful they have been are slow in coming. Our aims with this article are to show the intentions and potential for such laws as

yet another possible tool in the national arsenal for combating digital inequality and building a well-trained ICT-skilled workforce.

We find that the mandatory migration to OSS policies and the new laws have the potential to produce massive ICT skills transfer for the following four reasons:

1. In strongly centralized nations, changes made to the technological infrastructure of the government impact the entire nation;
2. The migration policies and laws have included language that implies the intention for the change is widespread social, cultural, and economic change, not simply technological;
3. The migration policies and laws have included the establishment of both software factories for development and educational and training academies for ICT skills transfer;
4. The migration policies and laws have included proselytizing efforts outside of government to private industry, neighborhood associations, and community groups, which have included the advantages of OSS, basic skills training, and offerings of free devices and operating systems.

We assert that these four reasons have created a “perfect storm” for Venezuela and have enabled what we have come to call a Skills Cascade, a mechanism that would convert these policies and laws into ICT skills for the populace. In this case, the government uses these policies as a lever to enact changes throughout the country. As each government agency, office, and industry converts to OSS, the demand for OSS products and skilled professionals increases. This demand creates opportunities for employees with ICT skills to find work, which in turn motivates citizens to seek ICT skills training to become competitive in the new environment. If the government also provides the mechanisms to gain the ICT skills training, reducing the barriers of cost, location, and preparation, it smoothes the path toward continued skills transfer. If the government also provides some social and cultural incentives in the form of nationalism, such as “Venezuelan ICT for Venezuela,” this adds additional motivation for citizens to participate.

At this time, this is all potential change, not ac-

tual, measured change. The subjects of this study expressed their perceived, hoped for, and perhaps, expected, change. None provided proof of change. Here we wish to introduce a note of caution and skepticism. In order for this kind of skills cascade to take place, the process requires: 1) a high degree of social cohesion or "welfare state" development; 2) a developed scientific research system; and 3) a wide network of institutions (universities, telecenters, etc.) acting as interfaces between knowledge and economic agents (Prieto, 2007). But Prieto's work is focused on developed nations in Europe; by comparison, Venezuela seems to fail in more than one of these requisites. Venezuela does not have a clearly developed scientific research system, nor does it have a wide network of heterogeneous institutions, nor does it have much of an interface between public and private institutions. However, it may have also solved some of these issues through the government acting as a strong agent of social cohesion, thereby erasing the needs for an interface between the public and private.

While Open Source Software is being embraced by the private sector worldwide, governments have been slow on the uptake. Venezuela is one of the few countries in the world that has decided to make the use of Open Source Software mandatory. Venezuela continues on this mandatory trajectory. Currently, the National Assembly is reviewing the existing "Technologies of Information" law. Initially, the law was intended to provide a comprehensive approach to government procedures related to the use of information technologies.

Venezuelan Open Source Software policies are still being crafted. Article 75 of the "Technologies of Information" law specifies that the software to be used in governmental offices must have licenses that:

guarantee in an irrevocable way access to the source code of the program by the user; to execute it with any intention; to modify it and to redistribute the original program as much as its modifications in the same decided conditions of licensing to the original program, without having to pay exemptions to the previous developers. (Asamblea Nacional, 2007)

However, in a later, second discussion, the name of the law was changed, and the guidelines for OSS were made more stringent. The new name was

Infogobierno Law (Government-information Law). The Infogobierno law has an article that specifies the character of the software to be used in governmental offices. The article specifies four characteristics of public software: 1) access to the code, 2) freedom of use, 3) freedom of modification, and 4) freedom of publication. This law has not been approved yet. A possible explanation for this is that the government is planning to launch the *National Plan for Telecommunications, Informatics, and Postal Service 2007–2013* (Ministerio para las Telecomunicaciones y la Informatica de Venezuela, 2008). The plan is expected to be published in 2008. Given the direction of the legal framework of Venezuelan OSS policies, it is likely that the mandatory nature of the law will be kept. The authoritative and perhaps coercive power of these mandatory OSS laws appears to be growing. If this is the case, what impact might this have on the potential ICT skills cascade downstream?

Venezuela has made the first, tentative steps toward developing an internal IT workforce. Due to the recent oil boom, it has gained economic power and perhaps the potential of growth opportunities that other similar nations do not have. With the recent creation of Venezuela's ministry of Science, Technology, and Innovation and its formal policy documents, the country has demonstrated its strong desire to become technologically independent and to build a strong national technical workforce. We believe that through these laws and policies that mandate the use of OSS, Venezuela also has the intention and the potential to transfer ICT skills to the wider Venezuelan population, leading to this hoped-for technical workforce, as well as less overall internal digital inequality. The next step is to collect data on several indicators over the next few years to see how successful Venezuela has been in transferring these skills and building its workforce. ■

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