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Overview

There are compelling reasons why technologically advanced and developing countries alike should adopt open source software as part of their ICT policies. In addition to the obvious cost advantages, recent studies of free/libre/open source (FLOSS) communities demonstrate that the process of learning and adapting software enables users to become 'creators of knowledge' rather than mere passive consumers of proprietary technologies. This Brief discusses the economic benefits of investing in open source software and points out some key factors that governments should take into account when defining "Open Standards" to govern technology transfer and enhance access to public information for all citizens.

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Open Source and Open Standards: A New Frontier for Economic Development?

Free software (also called open source software or libre software) has become one of the most talked about phenomena in the ICT world in recent years. This is remarkable, not only for the usual reasons—that open source has been around for many years as a volunteer driven success story before being discovered by big business and now government—but also because it has largely developed quietly on its own without the headline coverage and glare of international attention that it now receives.

The opportunity to "create and add value" provided by open source is particularly important for developing countries and other economically disadvantaged communities. Access alone limits them to the role of passive consumers in the knowledge economy; the ability to create transforms them into active participants.

As we shall see in the first part of this Policy Brief, open source software appears to provide a training environment that enables this ability to create; it increases the earning capacity of community participants without any explicit investment in training and is perhaps a novel form of technology transfer.

This in turn makes it more attractive to governments and policy makers. Countries around the world, regardless of their wealth, are trying to bring citizens into the Information Society and provide electronic access to government services. Many of them are considering open source software as a cost-effective means of doing so. Many more see an inherent injustice in requiring citizens and businesses to buy software from specific vendors in order to communicate with the government, and are looking at *open standards*—which allow products from different producers of open source or proprietary software to work together. Open standards, if defined carefully, can have unique economic effects. The remarkable case study of policy choices made by Massachusetts, one of the wealthiest States in the USA, has relevance worldwide and is described further below. This Brief concludes with key policy recommendations from a recent report on open source use in the UN System.

The FLOSS Revolution

What is the special value of open source software, and how can it be harnessed? The Free/Libre/Open Source Software (FLOSS) study led by MERIT (now

UNU-MERIT), in 2002, was a comprehensive analysis of developers and users that showed that the most important reason for developers to participate in open source communities was to learn new skills—"free-of-cost." These skills are valuable, help developers get jobs and can help create and sustain small businesses. The skills referred to here are not those required to use free software, but those learnt from participation in free software communities.

"Access [to ICTs] is not enough, it is the ability to create, to add value, that is important"—Felipe Gonzalez, former Spanish Prime Minister

Such skills naturally include programming, but also skills rarely taught in formal computer science courses, such as copyright law and licenses (a major topic of discussion in many free software projects). Teamwork and team management are also learned. After all, the team management required to coordinate smooth collaboration by 1500-plus people who rarely see each other is more intensive and far subtler than what is required to coordinate smaller teams employed in a single software company.

A follow-up study in 2005 for the European Commission under the FLOSSPOLS project found that developers *as well as employers* find that skills learned through participation in the free-software community are so valuable that they may compensate for the lack of a formal degree.

Informal apprenticeships—technology transfer in FLOSS communities

FLOSS communities are like informal apprenticeships but the apprentice/students and master/teachers contribute their own time "for free", without receiving monetary compensation for the training process. Everyone can benefit equally from this training—any employer can hire someone informally "trained" through participation in the free software developer community.

In the larger perspective, this training system—where all parts of society benefit from the products of the system but only some explicitly pay for it—represents a subsidy, or technology transfer. Effectively, knowledge is transferred from those who pay for formal training to those who do not (or cannot). Within countries, this represents a technology transfer from big companies, which often pay for formal training, to small and medium-sized enterprises (SMEs) that cannot afford to subsidize training. Globally, this often represents a technology transfer from the richer economies that can afford formal training, to the poorer ones that cannot.

Building local ICT competencies

Such skills development extends to the creation of new, local businesses that are able to provide commercial support for and build upon open source software, thanks to its low entry barriers, in a way that would not be possible with proprietary software. This effect is heightened by any public support of the open source software sector. For example, the take-up of open source by the Extremadura Region in Spain, through its support for the LinEx project (a localized, Spanish-language version of the GNU/Linux operating environment), has led to an economic regeneration in a relatively poor region of the EU (and which was subsequently awarded the European Regional Innovation Award in April 2004). This has not only allowed the implementation of activities at a lower cost, it has encouraged higher ICT

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investments in the education and training sectors that was simply not possible with proprietary software. The use of free-software in the region has opened up opportunities for local entrepreneurs to provide commercial ICT services since it is no longer necessary to approach a sole vendor for support.

This link between open source and the rise of small ICT businesses is especially important given the tendency of proprietary vendors to ignore local needs, especially in developing regions. So, for instance, a large multinational software company may not be interested in supporting Xhosa speakers (one of the official languages in South Africa), and yet it may prevent local users or businesses from providing such support.

Should a society encourage passive users of "black-box" software or active participants in the global ICT community? Being active requires being able to create—and to be able to choose, with the least barriers, one's level of creativity—so while you do not have to become a programmer, you should have the choice to do so. Developing countries need to avoid being locked out of acquiring skills and competencies. The adoption of open source policies provides environments that promote skills development and the ability to create.

The Economics of Open Standards

"Open standards" has become a very popular term in recent policy debates, but controversy abounds over what it actually means. In order to distinguish open standards from "standards" more generally, there is need to bear in mind the economic effects associated with the term. Open standards, properly defined, can have the unique economic effect of allowing "natural" monopolies to form in a given technology, while ensuring full competition among suppliers of that technology.

Many applications of technology in the Information Society are subject to *network effects*—the benefits to a single user are significantly enhanced if there are many other users of the same technology. The value to a user of an e-mail system, for instance, is limited unless the system can be used to send e-mails to many others, and increases enormously with the number of other users. This value, which is over and above the value of a single copy of the technology, is the *network externality*.

Network effects can go hand in hand with entry barriers for new technologies. A new technology may be adopted if it provides recognized benefits over a previous technology. However, since the value of a widely used system is, due to network externalities, much higher than the value inherent to a single user's copy of the technology, any new technology is seriously hampered by its lack of an existing user base. A new e-mail system must be far superior to an old system in order for its inherent benefits to outweigh the severe disadvantage caused by the lack of a pre-existing network. In applications highly susceptible to network effects, where the network externalities account for a large share of the total value of the system—such as e-mail—this hurdle may be impossible to cross. Indeed, the e-mail system most widely used today has remained more or less unchanged, in terms of its underlying technical protocols, for over 20 years.

This feedback loop leads to what economists call *natural monopolies*—found not only in e-mail, but also in older technologies such as railway gauges and electricity transmission systems. Monopolies are not obviously good for consumers, but natural monopolies are thought to provide a better value than a collection of various incompatible systems.

Usually, the monopoly in technology is related to the monopoly in the supply of the technology: a single company

Related UNU-MERIT Projects and Online Resources

FLOSSPOLS—Free/Libre/Open Source Software: Policy Support
Three specific tracks: government policy towards open source; gender issues in open source; and the efficiency of open source as a system for collaborative problem-solving.
http://www.flosspols.org

FLOSSWORLD—Free/Libre/Open Source Software:Worldwide impact study
Aims to build a global constituency for FLOSS and open standards research with partners from Europe, Argentina, Brazil, Bulgaria, China, Croatia, India, Malaysia and South Africa.
http://www.flossworld.org/

FLOSS—Free/Libre and Open Source Software: Survey and Study
FLOSS identified and developed indicators of "non-monetary/trans-monetary" economic activity in a case study of free/libre/open source software.
http://www.infonomics.nl/FLOSS/

UNU-MERIT Access to Knowledge Hub
Access to Knowledge (A2K) is the one-stop shop for UNU-MERIT's work on free/open source software, intellectual property, biotechnology and access to medicine. Join the discussion!
http://www.merit.unu.edu/a2k

therefore has a dominant position and can capture the value of network externalities. While monopolies have long been tolerated in the telecom, electricity and railway sectors, they are usually subject to regulation to limit their natural tendency to work against consumer welfare.

From technology monopolies to open standards

An alternative is to try to separate the natural monopoly in technology from the monopoly in the supply of that technology. This happens when the technology is treated as a *standard* and different suppliers make different products that *interoperate* based on the standard. This is the case with e-mail: there are hundreds of different programmes you can use to send e-mail, but because they all use the same underlying technology *standard* they can all *interoperate*. This is not the case with word processing software, where the most widely used file format is best read by a single brand of word processor, produced by a single company; if you use a different word processor, you may be unable to exchange documents with others.

The problem arises that the technology for interoperability—the natural monopoly—may have *rights* associated with it, typically patents, and these rights may be owned by one market player (or a consortium). Such rights may be exploited to give some producers of the technology an anti-competitive advantage over other producers. This leads to three kinds of technology standards:

1. *Proprietary technologies*: a natural monopoly in a technology results in a natural monopoly in the market for services and products based on the technology and results in a dominant position for the owner of the technology.
2. ("Semi-open") Standards: a natural monopoly in a technology arises or is agreed upon, but *some* competition in the market for products and services based on the technology is provided for with the mediation of a standards body (such as the International Standards Organization ISO).
3. Open standards: any monopoly in the technology is accompanied by full competition in the market for products and services based on the technology, with no *a priori* advantage based on the ownership of the rights. This occurs when access to the technology is available to all (potential) economic actors on equal terms.

Unlike railways, electricity or even mobile phones, in most software markets FLOSS often provides the main competing products. Thus for software, an open standard—as defined by its economic effect—can only be one that has licensing terms allowing equal access to FLOSS producers.

In the next section, we explore the real-life case of the state of Massachusetts, USA, which recently crafted an explicit policy to promote open source and open standards.

Rights can be exploited to give technology producers an anti-competitive advantage

Moving a Public Administration Towards Open Standards and Open Source: The Massachusetts Experience

This case study is based on a presentation by Peter Quinn, former

Chief Information Officer of the Commonwealth of Massachusetts, at the FLOSSPOLS workshop in Cologne, January 20 2006.

In 2003 the Commonwealth of Massachusetts (CoM) first announced it would start using open source software and support open standard file formats. It has since implemented an official policy that mandates the use of the Open Document file format, an open standard used by office applications. The experience of the CoM provides a model for other administrations that consider using open source software and open standards.

The Commonwealth of Massachusetts is the second-richest state of the US. It spends about US$700 Million on information technology each year.

In 2002 the Information Technology Division (ITD) found itself facing decreasing IT budgets, due to a difficult fiscal environment, while the existing infrastructure needed upgrading. At the same time a new business- and IT- savvy Governor was pushing for reforms. This presented an opportunity to transform the CoM's IT infrastructure.

As a first step, ITD defined a broad mission to guide all aspects of the way the administration would use IT in the future. The mission considers information as a strategic asset that can be used to improve governance, and enable stewardship of public records to preserve history. The ITD considered open standards to avoid that technical barriers could hamper future access to information.

The IT Division began drafting its Open Standards, Open Source Enterprise Technical Reference Model (ETRM) to develop the policy into binding and specific guidelines for the Commonwealth's computing environment. Over the course of 18 months it engaged with all stakeholders, including major proprietary software companies, and weighed the interests of industry, the administration, and the citizens of Massachusetts. The final version 3.5 of the ETRM mandates that by 1 January 2007 all new office documents must be created in the OASIS Open Document format, an open standard for office application files. At the same time all desktop computers must be equipped with software that can read and write the Open Document format. A number of applications already implement the standard.

However, the current version of the market-leading Microsoft Office suite

UNU-MERIT Library Goes Open Source

A number of interrelated initiatives are under way to enhance public access to scholarly output and research information available at UNU-MERIT.

In the course of 2006 the library catalogue will fully migrate to the Koha library information system (ILS). Koha is a free/open source system that uses library and web standards, making it a platform-independent ILS. It was awarded the "Trophees du Libre" in the Software for Public Administration category in 2003. Using Koha will not only enable compliance with modern ILS standards but also promote research output through the use of interactive links.

A second development is the launch of a new RSS based service to announce new books, journals and other catalogued materials. The RSS feeds will gradually replace the existing e-mail based service. Being user-driven, RSS offers many advantages over e-mail based systems. These include greater privacy, reduced administration, and a better overview of the information one receives. The beta version that is in use currently covers eight research areas and incorporates a broad range of sources—from academic publications to NGO outputs.

A third initiative relates to continuing improvements to existing metadata information. In addition to participating on the RePEc (an archive of publications in economics) and the UNU-managed RUN (Research in the United Nations) repository, the Institute is exploring ways to link to the Open Archives Initiative. This is a network of research repositories working to enable better scholarly communication of research activities and output.

For more information on these activities please contact Mr. Ad Notten, UNU-MERIT Librarian: notten@merit.unu.edu

does not, which makes it ineligible for use by the CoM administration. In addition the file format used by Microsoft Office is considered as not sufficiently "open" by the ITD.

The ETRM does not endorse one particular product, but mandates an open standard, which enables more software developers to create competing applications. Furthermore the ETRP explicitly requires IT procurement decisions to be made on the basis of technical and business merit, without preference for specific vendors or products.

The increase in competition is expected to have some immediate financial benefits. The CoM estimates that migrating to Open Document supporting products rather than a new version of the Microsoft Office suite could save approximately US$45 million.

The experience in Massachusetts holds some valuable lessons for governments that are considering open source or open standard policies, including:

- Considerable backlash can be expected, including legal, political and public relations efforts to influence the development and implementation of an open standards policy;
- There is lack of awareness of the economics of open source software. Providing stakeholders with a short overview of business models and economic imperatives can help address concerns about the impact of open standards on competition and the local software industry;
- The fact that free/open source software does not require payment of licensing fees does not imply it is free. Total cost of ownership analysis is recommended in the same way as for proprietary software;
- The common concern that free/open source software lacks appropriate support is not relevant in large public administrations in the US, where internal staff can solve virtually all problems in-house;
- Currently free/open source software office applications do not provide support for users with disabilities, and especially blind users, in the way that proprietary alternatives do. The CoM is working with the FLOSS community to resolve this.

The Massachusetts example shows that developed countries can also benefit from open source software and open standards

Massachusetts' decision to support open standards has implications that go beyond the use of IT by the Administration itself. For organizations that regularly exchange data with the government, it will provide an incentive to start using open standards. The example of Massachusetts shows that open source software and open standards are not solutions primarily for developing countries. Open standards have now been endorsed by one of the richest and most advanced states of the richest country in the world. Massachusetts has created a blueprint for development of an open standards IT policy that others can follow. This provides valuable decision-support for administrations that were hesitant to take the first step. In this sense, the CoM provides an example for other other regions and countries across the world.

Policy Recommendations from the UN Joint Inspection Unit Report on Open Source Software

In 2005, the Joint Inspection Unit (JIU) of the United Nations system published its report on "Policies of United Nations System Organizations Towards the Use of Open Source Software (OSS) in the Secretariats". The report is available at: http://www.unsystem.org/jiu/en/reports.htm

The JIU made a number of recommendations, the highlights of which are produced below.

Recommendation 1: The General Assembly should affirm that the following principles should guide the adoption of a software policy by United Nations system organizations:

- All Member States and other stakeholders should have the right to access public information made available in electronic format by the organizations and no one should be obliged to acquire a particular type of software in order to exercise such a right;
- Organizations should seek to foster the interoperability of their diverse ICT systems by requiring the use of open standards and open file formats irrespective of their choice of software. They should also ensure that the encoding of data guarantees the permanence of electronic public records and is not tied to a particular software provider.

Recommendation 2: The Secretary-General should take stock of the experiences of Member States and undertake the necessary consultations in order to establish a system-wide United Nations Interoperability Framework (UNIF) to be reported to the General Assembly at its sixty-first session, with the following considerations:

- The UNIF should be based on open standards and open file formats
- New software, upgrades or replacements should comply with UNIF with limited exceptions requiring justification.
- Customized software should be owned by the organizations and be made available to other system organizations and public administrations of Member States or licensed as OSS;
- Organizations should seek to avoid lock-in to proprietary ICT products or services and give equal consideration to all appropriate solutions available on the market including OSS solutions, as long as such products and services comply with the requirements under UNIF

Recommendation 3: Executive heads of UN system organizations should submit plans to their governing bodies on how they implement the new system-wide ICT strategy and the UNIF.

Recommendation 4: The Secretary-General should take the necessary measures to establish a data repository of mature OSS solutions used by United Nations system organizations and which could be accessed by the organizations and by public entities of Member States and other interested parties.

Recommendation 5: The Secretary-General should report to the General Assembly in the sixtieth session on the level of priority, savings potential, risk, effectiveness and organizational interest for implementing the proposed OSS initiative. Executive heads should assess the total cost of ownership (TCO) of their current platforms and implement processes measuring the total economic impact of their information technology (IT) investments including their use of OSS and CSS as well as the implications for Member States.

United Nations System Resources

UNCTAD
Expert Meeting on Free and Open Source Software: Policy and development implications
http://r0.unctad.org/ecommerce/event_docs/foss_exme_programme_en.htm

United Nations Joint Inspection Unit
Reports on Open Source Software for Development and in the Secretariats
http://www.unsystem.org/jiu/en/reports.htm

UNESCO Free & Open Source Software Portal
A gateway to resources related to Free Software and Open Source Technology movement
http://portal.unesco.org/ci/en/ev.php-URL_ID=12034&URL_DO=DO_TOPIC&URL_SECTION=201.html

UNDP-APDIP International Open Source Network
IOSN is a Center of Excellence for FOSS in the Asia-Pacific.
http://www.iosn.net/

FOSS Policy and Development Implications Mailing List
http://lists.apdip.net/mailman/listinfo/foss-pdi

www.merit.unu.edu

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UNU-MERIT is the United Nations University Maastricht Economic and social Research and training centre on Innovation and Technology. It integrates the former UNU Institute for New Technologies (UNU-INTECH) and the Maastricht Economic Research Institute on Innovation and Technology (MERIT). UNU-MERIT provides insights into the social, political and economic contexts within which innovation and technological change is created, adapted, selected, diffused, and improved upon. The Institute's research and training programmes address a broad range of relevant policy questions dealing with the national and international governance of innovation, intellectual property protection, and knowledge creation and diffusion. UNU-MERIT is located at, and works in close collaboration with Maastricht University in The Netherlands.

INSIDE:

Policy Brief

"Open Source and Open Standards"

An examination of the economic benefits of open standards and the issues that public organizations should consider when defining national and international frameworks.

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