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PROMOTING SOCIAL JUSTICE WITH OPEN SOURCE SOFTWARE AND SERVICE LEARNING

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Abstract

The open source "movement" seems to be gaining momentum due to a variety of factors. One beneficial use of open source software is the potential to help promote social justice. By lowering financial and intellectual property barriers, F/OSS can be used to bridge digital divides. At the core of social justice is the notion of equality of opportunity. Through the use of F/OSS, information technology literacy can be promoted among groups that might not otherwise have access to the tools necessary to build such literacy. This paper reports on an ongoing project that embodies this idea within a service learning context. While the project is in its emergent stages, early indications are that it has considerable potential.

I. INTRODUCTION

The concept of social justice has existed for centuries. While various views of "social justice" exist, for this paper, the core idea of social justice is the notion of equal opportunity. We

believe that it is important for modern societies to provide their citizens with the opportunity to gain the skills and resources necessary for personal success. While there are many dimensions to the idea of equal opportunity, here we focus on information technology skills. In an increasingly wired world, such skills are quickly becoming necessary for enabling individuals to fully participate in society.

We have two overarching goals for the paper. First, we discuss how F/OSS can bridge the digital divide, thus promoting social justice by enabling individuals to more fully participate in an information society. Second, we describe a service-learning project that is intended to implement some of the ideas promoted herein. The paper is organized as follows. First, we briefly discuss the equal opportunity aspect of social justice. This is followed by a short overview of the F/OSS landscape. Then we attempt to merge these two areas to show how F/OSS can be used to promote social justice. This is followed by an overview of service learning. Next, we briefly describe an early-stage project directed at operationalizing the views presented here.

SOCIAL JUSTICE AND INFORMATION AND COMMUNICATION TECHNOLOGIES

Let us begin by stating that we are technologists and educators in a business school, rather than experts in the complex topic of social justice. As a result, we are neither qualified nor inclined to discuss the many complexities of social justice and the debates and disagreements that surround the concept. We do believe that, in civil society, it is generally beneficial to provide citizens with the opportunity to gain the skills and knowledge necessary to fully participate in society and to achieve economic and social growth. Thus, we focus on one aspect of social justice -- equality of opportunity. The concept of equal justice is summarized nicely by Dr. Casta Tungaraza, "(Social justice) is about giving everyone a 'fair go" [Tungaraza, 2008].

In modern society, it is increasingly necessary to be information technology literate. Individuals who do not have the knowledge or tools necessary to use IT are at an economic and social disadvantage. The vast array of information and services available on the Internet

points out how digital divides result in economic and social disadvantages. For example, many governmental entities routinely make services and information available through the Internet. In some cases, these efforts have resulted in reduced staff available to help citizens through other means. While such projects are beneficial to many citizens, those without the knowledge and technology necessary to make use of online services become disadvantaged. One way to eliminate this inequity is to cease offering online services. However, we believe a better approach is to address the digital divides so that all citizens are able to take advantage of eGovernment. Similar arguments can be made about other areas. For example, healthcare information is increasingly available online. While this has many benefits to those with the necessary access and skills to make use of the information, those without these prerequisites are left out. Unfortunately, these are often the same individuals who are also underserved in terms of healthcare services [Chang, et al., 2004].

Another example that is particularly relevant for our purposes is how lack of ICT access impacts students. There is a growing trend towards making educational materials freely available online. For example, the Open Educational Resources movement (which is, coincidentally based on the open source software movement), makes texts and other educational resources freely available to students and educators across the world [Baraniuk & Burrus, 2008]. As one might expect, these materials are distributed online, making ICT access a prerequisite to taking advantage of these resource.

The issue of social justice and an information society has been widely discussed. For example, the United Nations sponsored the World Summit on the Information Society (WSIS), which was held in two phases with meetings in Geneva in 2003 and Tunis in 2005. (Ironically (from our perspective), documents related to the Summit are available in the proprietary Microsoft Word doc format, rather than open formats.) The relationship between information and communication technologies (ICT) and social justice is explained in Item 10 of the WSIS Declaration of Principles:

> *"10.   **We are also fully aware** that the benefits of the information technology revolution are today unevenly distributed between the developed and developing countries and within societies. We are fully committed to turning this digital divide into a*

> *digital opportunity for all, particularly for those who risk being left behind and being further marginalized."*

(http://www.itu.int/dms_pub/itu-s/md/03/wsis/doc/S03-WSIS-DOC-0004!!MSW-E.doc)

Thus, our operating premise is that both individuals and societies can benefit from increasing the diffusion of ICT tools and knowledge to those on the wrong side of digital divides. We believe that F/OSS, when properly applied and implemented, can be a key enabler of this goal. In the next section, we provide a high-level view of F/OSS.

II. OPEN SOURCE SOFTWARE

Open source software is software that allows users to access source code, freely use and modify according to their needs, and to redistribute the modified software [Nelson et al., 2006]. Most, but not all, open source software can be acquired without paying a fee. We refer to this type of open source software as free open source software (F/OSS). There are four major components to the concept of F/OSS, the software itself, the license under which the software is distributed, the process by which the software is developed, and the community that develops the software.

Open source software has been around for years [AlMarzouq, et al., 2005] but has not always had much attention. The real change took place with the advances made by the Linux operating system that began as a pet project by a Finish computer science student, Linus Torvalds. Since its inception, increasing numbers of volunteer programmers have joined the open source movement to advance Linux as well as other key applications. Increasingly, open source software is surfacing that encroaches on the markets traditionally held by their proprietary counterparts. Linux has lead the way and garnered support from major technology companies including HP, IBM, Dell, Sun, Intel, Oracle, Novell and SAP. This is only a partial list of companies that have strategically embraced Linux and open source software for the future. Today open source software is considered a permanent part of the computing industry. Notably absence from the list of supporters is Microsoft who stands to lose the most by open source software success since their business model is built on proprietary software. As most of the computing industry continues to embrace open standards and incorporate open source software into their product offerings, Microsoft has taken its own course that largely is based on its own standards. Customers are continuing to evaluate alternatives and

increasingly showing preferences for having choice instead of being locked into a particular vendor or proprietary standard.

III. ICT ACCESS AND LITERACY

Our projects address two sources of digital divides, knowledge and economics. In order to fully participate in an information-based society, two conditions are necessary, access to ICT tools and the knowledge necessary to effectively utilize those tools. (We acknowledge that other conditions may also be necessary.) Despite the falling costs of computer hardware, computer ownership is still beyond the reach of many, even in developed countries. This problem is exacerbated by the cost of software and network access. This is problematic because ICT access is a fundamental cornerstone of an information society. If one does not have access to the necessary technologies, s/he is unable to fully participate. One approach to increasing ICT access is to make the technologies available in shared facilities such as libraries, schools and community centers. While this is helpful, it is not, in our opinion, completely satisfying; it would be much more effective to provide families with their own ICT tools. Doing so would increase convenience and would likely lead to greater levels of utilization.

Access to ICT is not enough, however. Knowledge regarding the use of ICT is also necessary [Chen, 2004]. ICT literacy is a necessary condition for participation in an information society. One must know the fundamentals of how to use ICT tools to access information and services. ICT knowledge goes deeper than simply accessing information and services. As economies become increasingly information and knowledge based, those who are unable to use ICT tools become disadvantaged. This can lead to a downward spiral, both economically and socially. Gaining deeper knowledge of ICT opens the door to economic growth through employment in higher paying jobs that require such knowledge.

IV. PROMOTING EQUAL OPPORTUNITY THROUGH F/OSS

F/OSS has the potential to help provide more equal opportunity with respect to information technology literacy. F/OSS is ideal for this purpose for several reasons, which are discussed

in this section. Two major barriers to IT literacy are access and knowledge [Chang et al., 2004]. Therefore, we focus on how barriers in these areas can be overcome through the use of F/OSS.

LOWERING ACCESS BARRIERS

F/OSS can help eliminate economically-based access barriers to participation in two important ways. The first (and more obvious) comes from the "free" part of F/OSS. Second, some F/OSS operating platforms are less resource intensive than their proprietary counterparts. For example, many Linux distributions have much lower hardware requirements than Microsoft's Vista. Table 1 compares the minimum requirements of Microsoft Vista Home Basic and Xandros Home Edition, a popular distribution of Linux. (It is interesting to note that other distributions of Linux have even lower system requirements.) This allows for re-provisioning of seemingly outdated computers. Computers that are not sufficiently powerful to run newer proprietary operating systems can be rebuilt to run F/OSS that has lower requirements. Often, these older computers are simply discarded. These systems can be rebuilt around Linux and distributed to those without computers. Computers that would otherwise be relegated to the recycling heap can extend their useful life, while at the same time helping provide access to the economically disadvantaged.

Component	Vista Home Basic	Xandros Home Edition
Processor	1GHz	450MHz
RAM	512MB	128MB
Secondary storage	15GB	1.5GB
Other	DVD-ROM drive	CD-ROM drive

Table 1 – System Requirements Comparison

Sources: http://www.microsoft.com/windows/windows-vista/get/system-requirements.aspx.,
        http://www.xandros.com/products/home/home_edition/specs.html

In addition, there are literally hundreds of F/OSS applications, many of which can also run on older computer hardware. For example, Open Office 2.x requires only 128mb of RAM, 200mb of disk space and 800 x 600 resolution, compared with 256mb of RAM, 1.5gb of disk space and 1024 x 768 resolution for the basic edition of Microsoft Office 2007. Many of us are familiar with such F/OSS applications as Open Office and Firefox, but it is worth mentioning that there are also many educational applications as well.

Lowering knowledge barriers

As noted earlier, bridging the digital divide requires both access and knowledge. To a large extent, IT literacy requires access to ICT. Without access, there is no opportunity to gain experience and confidence with the use of IT. This is illustrated in Figure 1.

Figure 1 – Path to IT Literacy

Open source software helps overcome knowledge barriers by improving access, as noted above. This addresses knowledge barriers by giving individuals the opportunity to increase their knowledge through experience; by using ICT, their knowledge may increase. While this may be readily apparent, there are other, less obvious, ways in which F/OSS can address the knowledge barrier. As noted earlier, many educational resources are available online. These include resources related to IT literacy. By having access to ICT, individuals have the ability to access these materials, which may help increase their knowledge.

Interestingly, a core characteristic of F/OSS, the ability to modify source code, provides another opportunity to address the knowledge barrier problem. Because the source code is provided, and the license allows for modification, individuals and organizations can build interfaces that are customized to particular markets. Often, these interfaces are specifically

designed to be simpler, which lowers the level of knowledge required to use the system. Two recent examples illustrate this point. The One Laptop Per Child (OLPC) initiative (http://www.laptop.org) uses Fedora Linux as the foundation for a highly customized interface targeted at school-aged children. (A variety of F/OSS applications and languages are also installed on the laptop.) Figure 2 shows a screen-shot of the customized interface.
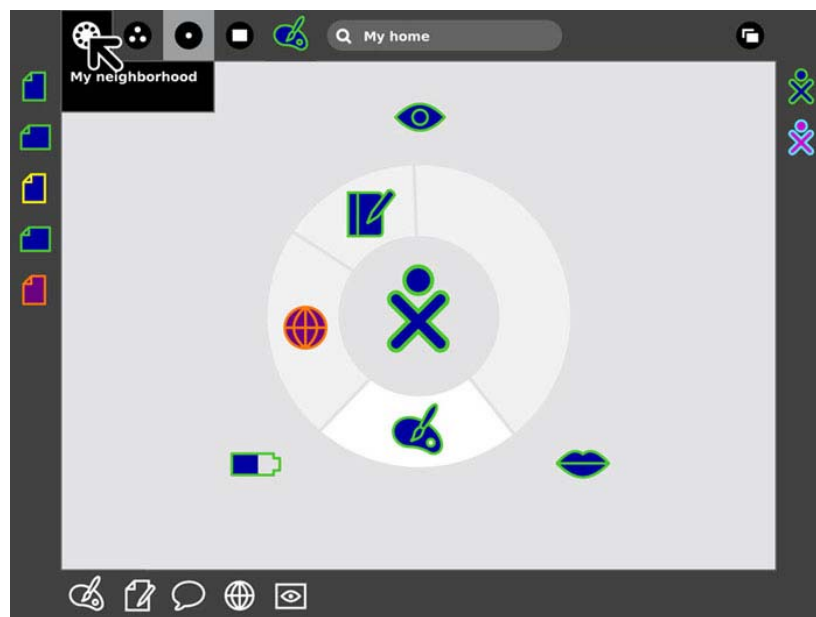

Figure 2 - One Laptop Per Child Customized Interface

Another example comes from Asus' eee PC, which is based on Xandros Linux. Although less radical than the OLPC's interface, the eee PC has a simplified interface that was originally intended to appeal to children. Interestingly, although the original market was school-aged children, the eee PC has been quite popular with adults as well. (As an aside, other modifications to the operating system were made to optimize performance on the small, relatively low-powered hardware of the eee PC.)

As can be seen from the above, F/OSS has the potential to help address two key barriers to technology literacy. We now turn attention to the educational aspect of our project, which involves service learning. The next section provides a brief overview of service learning and how it is implemented in our university.

V. SERVICE LEARNING

American colleges and universities have a long history of engaging students in community service in order to teach them to be responsible citizens and productive members of society. In particular, the decade of the 1960's saw tremendous growth in student service opportunities inspired by salient events such as the launching of the Peace Corps, the establishment of Volunteers in Service to America (VISTA), and the Civil Rights Movement. As service opportunities continued to flourish in the decades that followed, colleges and universities began looking for formal ways to combine students' passion for serving others with the educational mission of the academy, and from this marriage the concept of service-learning was born [Jacoby and Associates, 1996].

Service-learning can have varying connotations for different individuals and different institutions of higher education. As a result, it can be challenging to settle on a particular definition of the term. One definition that seems to effectively encapsulate the concept of service-learning, however, is from the National and Community Service Roles for Higher Education: A Resource Guide. "Service learning is the 'method and philosophy of experiential learning through which participants in community service meet community need while developing their abilities for critical thinking and group problem solving, their commitments and values, and the skills they need for effective citizenship'" [Lamb, Swinth, Vinton, & Lee, 1998, para. 2].

As this definition points out, service-learning has the benefit of both addressing community needs as well as helping students develop valuable skills that they can take into their professional lives. This can be especially true for college students who are studying business. "Universities in general and business schools in particular can indeed play an important role in helping community organizations operate with higher efficiency and effectiveness while enhancing the course-related learning experience of students" [Gujarathi & McQuade, 2002, p. 1].

While the value of service-learning seems clear, placing service-learning opportunities into a business curriculum can pose some significant challenges. For example, two common obstacles are the "development of an institutional infrastructure for supporting service learning, and demonstration of the relevance of service learning to business education" [Lamb, Swinth, Vinton, & Lee, 1998, para. 3]. The John Cook School of Business at Saint

Louis University addresses these challenges through a formal service learning curriculum called the Service Leadership Certificate Program.

The Service Leadership Certificate Program is a structured service learning curriculum that is exclusive to business students at Saint Louis University. In the broadest sense, the program "provides students in the John Cook School of Business the opportunity to develop and hone their leadership skills while serving the St. Louis community" [www.slu.edu, Retrieved July 28, 2008].   To earn the certificate, students must complete 5 courses, attend 24 leadership workshops, and complete 300 hours of community service.

Students have the opportunity to demonstrate the relevance of community service to their business education by choosing service sites where they can apply the knowledge that they gain in the classroom. For example, community service agencies often call upon students in the Service Leadership Certificate Program for assistance with accounting, computer information systems, and marketing. Beyond this, students are able to practice more general professional skills that will help them make the transition into the work world.   "By volunteering at service sites such as Big Brothers/Big Sisters, Cardinal Glennon Children's Hospital, Campus Kitchen or one of the many other available sites, students will practice critical thinking, decision making, effective communication and team building. These are some of the skills that will help students become more effective future business leaders" [www.slu.edu, Retrieved July 28, 2008].

In order to address the issue of improving IT literacy in disadvantaged areas, while providing service learning and leadership opportunities, the Social Justice Computing Service Learning Project was created. This initiative is described in the next section.

VI. THE SOCIAL JUSTICE COMPUTING SERVICE LEARNING PROJECT

This project aims to work towards improving ICT access in disadvantaged areas while also providing both learning and service opportunities to students. Students will manage and execute the project with faculty serving as advisors. The main goals of the project are to 1) provide meaningful learning and service opportunities to students, and 2) to improve the IT literacy of individuals (primarily children) in disadvantaged areas of the city. The approach for achieving these goals is to have students acquire and rebuild computers using F/OSS, then deploy these computers to individuals and institutions in disadvantaged areas.

The main idea behind this project is to take donated computers that would otherwise be discarded, rebuilding them with F/OSS, the giving them to individuals and organizations in areas affected by the digital divide. The high-level view of the project is diagramed in Figure 3. Of course, there are additional tasks that go along with the workflow illustrated below. For example, students must identify both donor organizations and "customer" organizations and individuals. In addition, installation procedures must be engineered and refined. Also, appropriate software must be identified and downloaded. Note that at present the project focuses on computer only and does not include other hardware, such as printers.

Acquire PCs   Select/refurbush   Install F/OSS   Test rebuilt PCs   Deliver and install
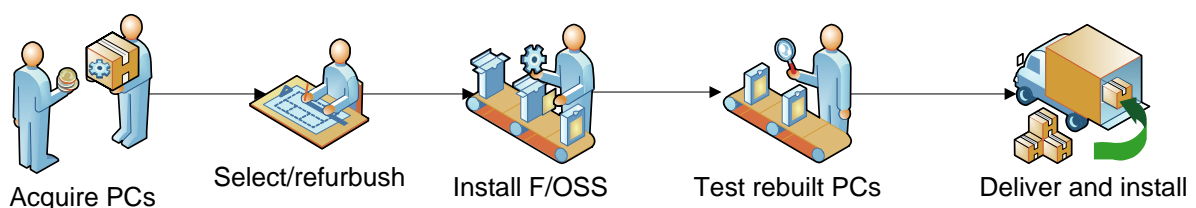
Figure 3 – Workflow

There are ongoing projects that use F/OSS and old, donated equipment to provide computers to disadvantaged individuals and the institutions that serve them. For example, at Linux World 2008, the "Installfest for Schools" was held during which open source experts installed Linux and other F/OSS on recycled computers, which were then donated to needy children. (For more information, see http://www.linuxworldexpo.com/live/12/ehall//SN264817 and http://www.untangle.com/index.php?option=com_content&task=view&id=351&Itemid=139.)

The local sponsor of this event was the Alameda County Computer Resource Center, a computer recycler that also makes F/OSS equipped, seemingly obsolete computers and donates them to economically and physically disadvantaged individuals, schools and non-profit organizations (http://www.accrc.org/). The existence of these and other efforts support the basic notion behind our project. However, to our knowledge, the Social Justice Computing project is unique due to 1) the fact that students run the project, and 2) the integration of formal service learning.

Students who are involved in this project are responsible for its execution. There are a variety of tasks that must be managed and completed, some of which are described below. For each task, broad learning objectives are also provided. Note that these are intended to be high-level, rather than detailed objectives.

- Project management

Students will be responsible for managing the entire project, including both planning and execution. This project is an excellent opportunity for students to engage in active learning of project management principles. The overall project is relatively complex (when compared to many course-related projects) and has a variety of stakeholders. This enables students to learn stakeholder management and communication skills.

Learning areas: Project management skills, with an emphasis on time management, quality management, and communication management

- Supply chain management

Supply chain management activities include identifying sources for computers and other equipment, coordinating the inventory of components, transporting the donated computers from the donor and transporting the finished computers to the recipients.

Learning areas: Procurement, inventory management, distribution and logistics

- Identify recipients (marketing)

Potential recipients must be identified and vetted. In addition, decisions must be made regarding which will actually receive the computers. Finally, a waiting list must be maintained. This group will work with the supply chain management group to forecast demand. Note that demand may come from individuals or institutions, such as schools and community centers.

Learning areas: Written and verbal communication, business case preparation, contact management, social networking

- Build computers (manufacturing)

The donated computers must be refitted with F/OSS. There are several steps involved in this process including assembling donated components into a full system, clearing the hard drives of existing software (assuming this was not done prior to donation), certifying that the computers will accept the operating system, loading and configuring the software and testing the system.

Learning areas: System testing, operating system installation and configuration, application software installation and configuration, problem-solving

- Deliver and install computers (logistics)

The finished computers need to be delivered and set up at the recipient's location. This may involve connecting the computer to the Internet.

Learning areas: Network administration, problem-solving, hardware installation

In future phases, we plan to add training to the list, which will help students develop organizational and communication skills. In addition, students may prepare training materials, which will further enhance these skills.

TIMELINE

At present, the Social Justice Computing project is in its initial stages. The faculty advising team is in place, and key student leaders have been identified. We expect to conduct a small pilot phase in the Fall of 2008. This will involve six to eight students who will run through the entire workflow process with approximately six donated computers (which have already been acquired). Initial client organizations have been contacted and have expressed great interest in receiving the first round of PCs. By the time of the conference, we expect to complete at least one cycle of the workflow. Therefore, we expect to be able to present results of this pilot study. These results will include impressions of the students and clients, as well as a review of "lessons learned."

VII. CONCLUSIONS

Full participation in an information society requires both access to and knowledge of ICT. Those without these are at a severe disadvantage economically and socially. Unfortunately if we do not address the digital divide now, individuals who are currently disadvantaged are likely to become even more so. The Social Justice Computing project, in some small way, hopes to help address the digital divide, while at the same time providing learning opportunities for students. By combining the talents, enthusiasm and energy of students with the capabilities of F/OSS, we hope to bring about positive change for our region.

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APPENDIX A – WSIS PLAN OF ACTION

(The below is an excerpt from WSIS Plan of Action. The full Plan is available at: http://www.itu.int/wsis/docs/geneva/official/poa.html)

Everyone should have the necessary skills to benefit fully from the Information Society. Therefore capacity building and ICT literacy are essential. ICTs can contribute to achieving universal education worldwide, through delivery of education and training of teachers, and offering improved conditions for lifelong learning, encompassing people that are outside the formal education process, and improving professional skills.

1. Develop domestic policies to ensure that ICTs are fully integrated in education and training at all levels, including in curriculum development, teacher training, institutional administration and management, and in support of the concept of lifelong learning.

2. Develop and promote programmes to eradicate illiteracy using ICTs at national, regional and international levels.

3. Promote e-literacy skills for all, for example by designing and offering courses for public administration, taking advantage of existing facilities such as libraries, multipurpose community centres, public access points and by establishing local ICT training centres with the cooperation of all stakeholders. Special attention should be paid to disadvantaged and vulnerable groups.

4. In the context of national educational policies, and taking into account the need to eradicate adult illiteracy, ensure that young people are equipped with knowledge and skills to use ICTs, including the capacity to analyse and treat information in creative and innovative ways, share their expertise and participate fully in the Information Society.

5. Governments, in cooperation with other stakeholders, should create programmes for capacity building with an emphasis on creating a critical mass of qualified and skilled ICT professionals and experts.

6. Develop pilot projects to demonstrate the impact of ICT-based alternative educational delivery systems, notably for achieving Education for All targets, including basic literacy targets.

7. Work on removing the gender barriers to ICT education and training and promoting equal training opportunities in ICT-related fields for women and girls. Early intervention programmes in science and technology should target young girls with the aim of increasing the number of women in ICT careers. Promote the exchange of best practices on the integration of gender perspectives in ICT education.

8. Empower local communities, especially those in rural and underserved areas, in ICT use and promote the production of useful and socially meaningful content for the benefit of all.

9. Launch education and training programmes, where possible using information networks of traditional nomadic and indigenous peoples, which provide opportunities to fully participate in the Information Society.

10. Design and implement regional and international cooperation activities to enhance the capacity, notably, of leaders and operational staff in developing countries and LDCs, to apply ICTs effectively in the whole range of educational activities. This should include delivery of education outside the educational structure, such as the workplace and at home.

11. Design specific training programmes in the use of ICTs in order to meet the educational needs of information professionals, such as archivists, librarians, museum professionals, scientists, teachers, journalists, postal workers and other relevant professional groups. Training of information professionals should focus not only on new methods and techniques for the development and provision of information and communication services, but also on relevant management skills to ensure the best use of technologies. Training of teachers should focus on the technical aspects of ICTs, on development of content, and on the potential possibilities and challenges of ICTs.

12. Develop distance learning, training and other forms of education and training as part of capacity building programmes. Give special attention to developing countries and especially LDCs in different levels of human resources development.

13. Promote international and regional cooperation in the field of capacity building, including country programmes developed by the United Nations and its Specialized Agencies.

14. Launch pilot projects to design new forms of ICT-based networking, linking education, training and research institutions between and among developed and developing countries and countries with economies in transition.

15. Volunteering, if conducted in harmony with national policies and local cultures, can be a valuable asset for raising human capacity to make productive use of ICT tools and build a more inclusive Information Society. Activate volunteer programmes to provide capacity building on ICT for development, particularly in developing countries.

16. Design programmes to train users to develop self-learning and self-development capacities.