

Open Standards and Open Source Software Policy

Pema Choejey, Department of Information Technology

{ mail2pemac@gmail.com }

Abstract

There are strategic importance for adopting and using open standards and open source software. Adoption of open source software is not only a choice of software, but also a means of acquiring knowledge. For a small country like Bhutan, it can be used as alternative to proprietary software, as a way to gain knowledge about the technology itself and as a way of creating technology products that fit government's specific needs. This paper presents the need for adoption of open standards and open source software. It articulates government policy which is essential to implement and deploy open source software in government administration bodies and beyond.

Keywords: Open standards, open source software

1. Introduction

1.1 Definition of terms used in this document

Free software

Free software is software that provides users with freedom to “run, copy, distribute, study, change and improve the software”. The Free Software Foundation (FSF) defines four kinds of freedom guaranteed by free software:¹

- The freedom to run the program, for any purpose.
- The freedom to study how the program works, and change it to make it do what you wish.
- The freedom to redistribute copies so you can help your neighbor.
- The freedom to improve the program, and release your improvements (and modified versions in general) to the public, so that the whole community benefits.

Open source software² is:

¹ GNU Project - The Free Software Foundation (FSF), “The Free Software Definition,” www.gnu.org, Oct. 27, 2009. [Online]. Available: <http://www.gnu.org/philosophy/free-sw.html>. [Accessed: Dec. 3, 2009].

Software where the underlying “source code is freely distributed, the source code is accessible to user, allow modifications and derive works, license must not discriminate anyone, distribution of licenses must be equal for all users without further restriction, licenses for the same code may not differ if they are used in conjunction with other software and license must be technology neutral”.

The definition of free software and open source is close in meaning, but they are not identical. Richard Stallman of FSF stresses that “free” software is a matter of liberty with “free” derived from “freedom” and not from “no price”. This is a matter of freedom, not price, so think of “free speech,” not “free beer.”³

Therefore, free and open source software does not necessarily mean free of charge. However, free software guarantees that “liberty or freedom” which open source may or may not guarantee to the users.

The terms free software, open source software and free open source software (FOSS) are also often used as is free/libre/open source software (FLOSS).⁴

Open standards

There are many definitions of open standards. Relevant to this document is the definition provided by Open Source Initiative (OSI)⁵. It defines the requirements and criteria for open standards as follows:

The Requirement

An "open standard" must not prohibit conforming implementations in open source software.

The Criteria

To comply with the Open Standards Requirement (OSR), an "open standard" must satisfy the following criteria. If an "open standard" does not meet these criteria, it will be discriminating against open source developers.

1. No Intentional Secrets: The standard MUST NOT withhold any detail necessary for interoperable implementation. As flaws are inevitable, the standard MUST define a process for fixing flaws identified during implementation and interoperability testing and to incorporate said changes into a revised version or superseding version of the standard to be released under terms that do not violate the OSR.

² Open Source Initiative (OSI), “The Open Source Definition”, www.opensource.org. [Online]. Available: <http://www.opensource.org/docs/osd>. [Accessed: Dec. 3, 2009]

³ R. Stallman, “Why Open Source misses the point of Free Software”, www.gnu.org, Oct. 15, 2009. [Online]. Available: <http://www.gnu.org/philosophy/open-source-misses-the-point.html>. [Accessed: Dec. 3, 2009].

⁴ The terms “open source software”, “libre software” and “free software” are often used interchangeably throughout the ICT Profession to refer to the same phenomenon.

⁵ Open Source Initiative, “Open Standards Requirements for Software”, www.opensource.org, [Online]. Available: <http://opensource.org/osr>. [Accessed: Dec. 4, 2009].

2. Availability: The standard MUST be freely and publicly available (e.g., from a stable web site) under royalty-free terms at reasonable and non-discriminatory cost.
3. Patents: All patents essential to implementation of the standard MUST:
 - o be licensed under royalty-free terms for unrestricted use, or
 - o be covered by a promise of non-assertion when practiced by open source software
4. No Agreements: There MUST NOT be any requirement for execution of a license agreement, NDA, grant, click-through, or any other form of paperwork to deploy conforming implementations of the standard.
5. No OSR-Incompatible Dependencies: Implementation of the standard MUST NOT require any other technology that fails to meet the criteria of this Requirement.

Other definitions of open standards can be found in Wiki.⁶ The above definition basically means that any open standard should be transparently published, made publicly available and its use must not require payment of a special license fee, or should not be protected by patent to the extent that would restrict the right to use and propagate it.

The Hyper Text Markup Language (HTML), Portable Document Format (PDF), Open Document Format (ODF), Internet Protocol/Transmission Control Protocol (IP/TCP), Portable Network Graphics (PNG) are some of open standards, to mention a few.

Proprietary software

The term "proprietary software" is often used to mean computer software which is neither free nor open source (as these terms are variously defined, especially by FOSS advocates such as the Free Software Foundation and the Open Source Initiative). A related term is "closed-source software" which usually describes software whose source code is not published, in contrast with "open source".⁷

Popular examples of proprietary software are Microsoft Windows, Adobe Photoshop, Mac OS, WinZip and some versions of Unix.

Commercial software

Russell McOrmond defines "commercial software" as simply software used in commercial environment or software developed that has "profit as chief aim".⁸ Most commercial software is proprietary, but not all. Some companies produce commercial software for which users must

⁶ Wikipedia, "Open Standard", www. www.wikipedia.org, Nov. 21, 2009. [Online]. Available: http://en.wikipedia.org/wiki/Open_standard. [Accessed: Dec. 4, 2009].

⁷ Wikipedia, "Proprietary Software", www.wikipedia.org, Nov. 24, 2009. [Online]. Available: http://en.wikipedia.org/wiki/Proprietary_software. [Accessed: Dec. 5, 2009].

⁸ R. McOrmond, "What is Commercial Software?" www.linuxtoday.com, Jan. 4, 2000. [Online]. Available: http://www.linuxtoday.com/news_story.php3?ltsn=2000-01-04-005-05-NW-SM. [Accessed: Dec. 5, 2009].

pay but which is free software such as Internet Explorer and Netscape. Equally, non-commercial software that is not free also exists, for example Red Hat software.

1.2 Background

Open source phenomenon is already here in Bhutan.

Many people may not be aware of, but in most of the government organizations, open source software is being used on the server front, as well as applications. Well known servers based on open source are Red Hat Linux, Fedora Core, Debian Linux, Linux OS based on Berkeley Software Distribution (BSD) and Apache web server. MySQL, Postgres SQL and PHP are the most popular applications used by government organisations for designing, development and deployment of new applications. Open source content management systems such as Drupal and Joomla are being used for content creation, management and administration.

Since 2004 DIT has been implementing the PAN Asia Networking (PAN) program to localise open source software and applications in our language. This program is supported by the International Development Research Centre (IRDC) and the National University of Computers and Emerging Sciences (NUCES), Pakistan. The program's ultimate goal is not only to have local language computing tools, technologies and applications in open source environment, but also to bring policy changes in use of open source software and advancement of open source technologies to enable content creation and access in local languages.⁹

The localization program resulted in numerous localized open source software and applications. As of today, two versions of Dzongkha Debian Linux¹⁰ have been released in 2006 and 2007 respectively with the motto: "our language, our software". The Dzongkha Debian Linux has the Penguin in monk's red robes as mascot of the software, and interestingly this is "born in Bhutan" and "everyone can bring it home" for free. Packaged applications which come together with Dzongkha Debian Linux are OpenOffice applications such as Writer, Impress and Calc, Firefox browser, Thunderbird email client and Gaim messaging application, to mention a few.

Similarly, Samtse College of Education (SCE) has started conducting Distance Teachers Education Programme (DTEP) using open learning management software called Moodle.¹¹ In

⁹ PAN, "PAN Localisation Project", www.pan10n.net, [Online]. Available: www.pan10n.net/. [Accessed: Dec. 5, 2009].

¹⁰ P. Geyleg, "Dzongkha Linux". [Dzongkha.sourceforge.net](http://dzongkha.sourceforge.net), Apr. 9, 2007. [Online]. Available: <http://dzongkha.sourceforge.net/html/web1024X768/home.html>. [Accessed: Dec. 5, 2009].

¹¹ Samtse College of Education, "B.Ed Distance Education", www.sce.edu.bt. [Online]. Available: <http://www.sce.edu.bt/progDetail.php?id=10>. [Accessed: Dec. 5, 2009]. Moodle stands for modular object dynamic learning environment, moodle is also known as course management system (CMS), virtual learning environment (VLE), see www.moodle.org.

1995, DTEP was introduced to improve the quality of education, and to provide greater access and flexibility for in-service teachers to upgrade their qualifications.

Furthermore, Bhutan ICT Policy and Strategies (BIPS) articulate the establishment of policies on use of free and open source software by 2005 to make governance of “state administration more efficient, transparent and inclusive”.¹² It also articulates to use open source as an alternative technology to “reduce cost” of ICT hardware and software. Furthermore, it articulates adoption of open source software in schools for achieving basic “IT and computer skills”.¹³

Against this background, it has become appropriate for government to start mainstreaming open source software into development processes.

2. Why open standards and open source software?

There are strategic importance for adopting and using FOSS. Adoption of FOSS is not only a choice of software, but also a means of acquiring knowledge. For a small country like Bhutan, FOSS can be used as alternative to proprietary software, as a way to gain knowledge about the technology itself and as a way of creating technology products that fit government’s specific needs.

Most countries have embraced FOSS¹⁴. South Asian countries like India, Bangladesh, Pakistan and Sri Lanka have already adopted FOSS but not in a well organized fashion. In Asia-Pacific region, China and Malaysia is leading the FOSS movement and have come up with a well organized structures and strategic framework.¹⁵ In contrast, Bhutan is just contemplating to adopt it.

However, the manner in which different countries adopt and implement FOSS differs. Some countries pursue FOSS through legislation, some do through formal endorsement of government policy programs and others by just using procurement methods. Centre for Strategic and International Studies divides open source policies into four categories: research, mandates (where the use of open source software is required), preferences (where the use of

¹² Royal Government of Bhutan (2004, July). “*Bhutan ICT Policy and Strategies*”. [Online]. pp.18. Available: http://www.dit.gov.bt/guidelines/BIPS_Final_Report-v5.1.pdf. [Accessed: Dec. 5, 2009].

¹³ Ibid. pp. 22-25

¹⁴ Centre for Strategic and International Studies, “*Government Open Source Policies*”. www.csis.org, Aug. 2007. [Online]. Available: http://csis.org/files/media/csis/pubs/070820_open_source_policies.pdf. [Accessed: Dec. 8, 2009].

¹⁵ International Open Source Network, “*Country Profiles*”. www.iosn.net Oct. 10, 2007. [Online]. Available: <http://www.iosn.net/publications/country-reports> [Accessed: Dec. 8, 2009].

open source software is given preference, but not mandated), and advisory (where the use of open source software is permitted).¹⁶

Some of the main motives of embracing FOSS are as follows:

1) Reducing imports/conserving foreign exchange

Most developing countries invest huge amount in importing software and hardware. Bhutan is not an exception. Obviously, the whole of government administration bodies spend significant portion of budget in procuring both hardware and software from external suppliers. The total computers nationwide (although guesstimated) stands at 13, 500 compared to 10,000 in 2003, according to the Media Impact Study, 2008.¹⁷ There is no specific figure or record showing how many software licenses are being imported by the government.

Most well known software that we used here in Bhutan are Microsoft Operating Systems, Adobe Photoshop, MS Office Applications, etc. As we do not have our own local software industry, we are totally dependent on proprietary software which are manufactured and controlled by few companies based in United States. Countries that have to license copyrighted software land up importing software licenses, thereby placing enormous burden on financial resources of developing countries, resources which can be used for other development needs.

In contrast to proprietary software, FOSS can be obtained at little or no cost, and therefore, saves a massive amount of foreign exchange. The costs of this more service-oriented model of open source are then also normally spent within the economy of the governmental organization, and not necessary to large multinational companies. This has a positive feedback regarding employment, local investment base, tax revenue, etc.

Whatever money is spent on FOSS in a country usually stays in that country, which leads to the previously mentioned benefit – the development of local industry.¹⁸

2) Developing local capacity/industry

There are two elements in developing local capacity: capacity to use the software and capacity to develop software products. FOSS provides excellent opportunity to develop local capacity and local industry since there is no licensing cost and is freely distributable for everyone's use. FOSS is also an excellent training system. Apart from free source code and software tools FOSS

¹⁶ Ibid. see n14.

¹⁷ Department of Information and Media (2008), "Media Impact Study". www.moic.gov.bt. [Online]. Available: http://www.moic.gov.bt/pdf/mediainpact_2008.pdf [Accessed: Dec. 8, 2009].

¹⁸ K. Wong, "Free/Open Source Software", www.iosn.net. Nov. 4, 2006. [PDF]. Available: <http://www.iosn.net/publications/FOSS-primers/government/FOSS-government-primer/FOSS-govt-policy.pdf> [Accessed: Dec. 8, 2009].

provides, there are many technical manual, guides and “how-tos” provided in every FOSS distribution. Further, it has excellent team of professionals and experts working on voluntary basis, many working during spare time, across the globe.

On contrary, local capacity development is not feasible at all. This is because the cost of proprietary hardware and software products are too high. And access to source code and standards are not readily available.

The local capacity to utilize ICTs is traditionally held back by the high cost of both hardware and software. The ability to participate in the information society and build local knowledge communities is severely constrained when the cost of a basic operating system is equivalent to several years’ wages for the average citizen.¹⁹

3) Enabling localization

Localization is the process of modifying products or services to account for differences in distinct markets.²⁰

Localisation of proprietary software is not possible since source code of programs is zealously guarded and presented in executable form only. Customers are given license for a fee the rights to run the program which is defined as the capacity to copy, install, and use and access the product. There are also no provisions or interfaces where customers can access the source code, modify and re-engineer the products or services.

In addition, two third of the world’s populations do not commonly speak English whereas commercial software are mainly produced in English. Therefore, developing countries where English is not their main language can be at serious disadvantage when it comes to the use, development and dissemination of ICTs.

But that is the not case with FOSS. FOSS provides the source code and rights to modify and upgrade the software products.

The localization initiative undertaken by DIT would not have been possible without FOSS. We now have localized Operating System based on Debian Linux, localized office applications based on OpenOffice, and other essentially required applications such as open source web browser and email reader.

4) Reducing copyright infringement

Copyright infringements in the form of unauthorized duplication of software (often called software piracy) are a problem in almost every country around the world. The Business Software Alliance estimates that unauthorized software copying in 2002 alone costed US\$13.08

¹⁹ Cited in n18, pp.3

²⁰ The Localisation Industry Association, “The Globalisation Industry Primer”, www.lisa.org, [PDF]. Available: <http://www.lisa.org/Business-Decision-Da.512.0.html#c2077>. [Accessed: Dec. 9, 2009].

billion. Even in developed nations where software is affordable in theory, software copyright infringement rates were as high as 24 percent in the United States and 35 percent in Europe. The rates in developing countries, where lower incomes make software far more expensive, are upwards of 90 percent.²¹

Certainly, in Bhutan, copyright infringement is rampant both in public and private sector organizations. The reason is simple and straight forward. This is happening simply because the proprietary software is not affordable and is beyond purchasing power of any individual Bhutanese citizen. Bhutan, as a youngest constitutional democratic and responsible country, cannot allow this to happen unchecked.

Copyright infringement and lax laws can and often do hurt a country in many ways. A country with a poor track record in copyright protection is not as attractive to foreign investors. Membership in the World Trade Organization (WTO) and access to its benefits are strongly influenced by the level of protection given to copyrights and patents in a country. Bilateral and multilateral trading agreements with developed nations often involve requirements to reduce copyright infringements as well. A culture of copyright infringement hurts local software development, as there is less incentive for local software developers to create a local product.²²

Therefore, FOSS is alternative choice to proprietary software and would enable Bhutan to reduce copyright infringement.

5) Enhancing national security

At the surface, it might seem that ‘closed door’ proprietary software would provide better security features as their source code is well protected and distributed in executable binary form only, whereas FOSS products are left open for anyone to use freely – both hackers and non-hackers communities. That is not true; FOSS is more secure than the proprietary software. So how FOSS does enhances the national security.

Could there be hidden back-doors or holes in the software, possibly allowing a remote attacker to easily compromise data? In the case of governments other than the United States of America, there is some mistrust of Microsoft’s software, especially after the infamous “NSA Key” incident. Other recent cases include the acknowledgments by both Netgear and Cisco systems that there were secret user names and passwords hard-coded into certain models of their wireless routers.²³

The above incidents clearly indicate that proprietary software is as much vulnerable to attacks, mistrust and suspicion even though the binary format provides limited protection. FOSS, on the other hand, is developed and tested by thousands of developers and as well by hackers,

²¹ Cited in n18, pp.6

²² Ibid., n18, pp. 6

²³ Cited in n18, pp. 5

security loop-holes and bugs are detected and bug-fix patches are uploaded immediately, thereby making it more secure. There is no mistrust or suspicion as it is made open for all.

Mistrust of “black-boxed” foreign software that cannot be audited has been cited as one of China’s reasons for its adoption of FOSS and one of the reasons why other governments are considering FOSS.²⁴

6) Reducing total cost of ownership

There is cost in acquisition of off-the-shelf software and development of new software products. There is cost in implementing and introducing software in government administrations. There is cost in operation and maintenance of information systems. The cost factor is everywhere wherever software products or services are required.

One of the biggest advantages of using FOSS is the zero licensing cost as it is freely distributed. Future upgrades and maintenance of FOSS is much cheaper than proprietary software as it provides volumes and volumes of well organized documentations, manuals and how-tos. Experts and professionals are aplenty to provide solutions to every problems faced by open source communities. FOSS also provides better security features and is interoperable on different platforms.

Intel reportedly saved US\$200 million from a move to GNU/Linux from Unix, and Amazon reported a savings of US\$17 million from switching their servers to GNU/Linux. Major financial institutions such as Credit Suisse First Boston, Morgan Stanley, Goldman Sachs and Charles Schwab are moving a significant portion of their infrastructure to FOSS systems to reap these cost savings.²⁵ A TCO study performed by the Robert Frances Group showed that GNU/Linux costs roughly 40 percent of Microsoft Windows and as low as 14 percent of Sun Microsystem’s Solaris. NetProject reported that the TCO of GNU/Linux was 35 percent of Microsoft Window’s TCO.²⁶

Use of FOSS will provide significant leverage in reducing costs in the Bhutanese economy and the state administration, consequently increasing its competitiveness and efficiency. This does not necessarily mean complete and automatic adoption of open source software, but it does mean equal treatment of all solution providers and individual assessment of the suitability of each solution separately.

7) Reducing dependency to external suppliers

²⁴ Ibid.

²⁵ Cited in n18, pp. 7.

²⁶ Cited in n18, pp.7

Local software industry is non-existent and software markets are completely dominated by commercial companies based in United States. The whole of government administrations is fully dependent on software purchases and supplies from outside. Capacity to provide back-up and maintenance support to clientele are not available locally as well. This means that we always remain in a state of 'lock-in' to one particular product and are completely controlled by a few external suppliers.

FOSS can change this scenario. There are software products as equally good as those products provided by commercial software companies, some even better ones. Bhutan can really take leverage of FOSS and promote its use in the public sector, not only to reduce dependency to external suppliers but also to promote local software industry.

8) Improve access to information

Access to information is everyone's rights. Access to information and public services does require basic set of both hardware and software. The exorbitant cost of both hardware and software sets big hindrances to access, knowledge sharing and dissemination.

A regime built around the free diffusion of tools has an interesting characteristic: the degree to which a software tool can be utilized and expanded becomes limited only by the knowledge, learning, and innovative energy of the potential users; not by exclusionary property rights, prices, or the power of countries and corporations.²⁷

Adoption of FOSS has the potential to overcome barrier to access and ICT usage. It may not be possible to cut down the cost of hardware but it can cut down the cost of software as it is freely available for use, modification and re-distribution.

Furthermore, there are loads and loads of knowledge resources, knowledge banks and information archives published by open source communities and proponents of FOSS movement.

3. Government Policy

The government policy shall dwell into these policy areas: adoption, procurement, ownership, education and training.

- The Government of Bhutan shall adopt and actively participate in the promotion of development and use of open software and open standards by directly implementing open source software into state administration bodies, as well as in the information and communications technology used to provide public services for the citizens and the

²⁷ Cited in n18, pp. 10.

economy. FOSS adoption should be based on the least disruptive and fit for purpose implementation.

- The Government of Bhutan shall treat open source and proprietary software solutions equally in context of development and procurement of the information solutions regardless of its business or licensing model. FOSS procurement should be based on merits, values for money, transparency, security and interoperability, as well as in accordance with the Government procurement policies and procedures. Government preferences of any particular software should be based on careful evaluation of advantages and disadvantages provided by FOSS and proprietary software.
- The Government of Bhutan shall to the greatest possible extent develop, create and procure software based on the use of open standards. Information systems or solutions thus developed should enable better exchange of data between government domains, between government and citizens and between government and the private sector. Therefore, the use of open standards and protocols should enable the highest possible degree of connectivity, interoperability and data exchangeability.
- The Government of Bhutan shall to the greatest possible extent, where already implemented and operational information systems or solutions with closed, proprietary software, ensure that all subsequent upgrading and modifications in these systems shall have to be based on the support of open source and open standards.
- The Government of Bhutan shall make information systems or solutions developed based on open standards and protocols freely available to public. This is because open source information systems are open to adaptation and improvement and upgrades, which can furthermore be further distributed among various bodies of the state administration with similar requirements. This makes it possible to achieve a greater degree of adaptability and connectivity in planning, developing and connecting our information systems, and to reduce costs due to the multiple use of systems already developed.
- The Government of Bhutan shall, in all instances when it is economically or financially justified, request from the supplier full ownership and the right to use and distribute the source code or procured software and information systems or solutions financed by government funds.

- The Government of Bhutan shall ensure that FOSS ownership should include software licensing that allows rights to use and modify software. Licensing for software developed within the public sector should be compatible with the GPL license, the BSD or generally accepted version of GPL licensing.
- The Government of Bhutan shall ensure that appropriate Knowledge Banks are established for knowledge sharing, dissemination and access. The Knowledge Banks shall serve as knowledge and content repositories and as a platform for sharing knowledge and experience.
- The Government of Bhutan shall, in all instances when it is financially, economically and technologically justified, advocate a more widespread use of open source software in state administration bodies and other budget beneficiaries alike. Along with supporting open source software, the Government shall also attempt to achieve as favourable and acceptable market, financial and other terms of use of the proprietary software in state administration bodies.
- The Government of Bhutan shall ensure that new upgrades of software solutions shall primarily contain improvements regarding the performance and use of the existing software and must have appropriate provision for installing national language into existing software the use of which is based on foreign language. Through these actions, the Government of Bhutan shall promote the development of domestic proprietary software based on open standards.
- The Government shall promote localization and translation of open source software to support national language for computing and content creation, generation and dissemination. The localized software and applications should be promoted in and outside the government administration bodies alike.
- The Government of Bhutan shall promote integrating the knowledge related to the software solutions based on the open source into educational programs. It shall support training, re-skilling and education of employees, and their introduction to working with open source software and will also actively promote the transfer of knowledge and good practice in this field among users.
- The Government of Bhutan shall introduced FOSS education through structured programs in school IT labs for primary, secondary and tertiary education levels. The Government shall

funds for open source research and development activities, seminars and workshops, open source community networking and knowledge sharing beyond schools.

- The Government of Bhutan shall It shall promote the development of materials used to educate civil servants, students and general masses in the area of open software and open standards.
- The Government shall promote the development of standard training and re-skilling kits and materials to be used to educate civil servants, students and general masses in the area of open software and open standards.
- The Government of Bhutan shall ensure agencies to be committed in educating, re-skilling and certification of its personnel to ensure their competency in FOSS.
- The Government of Bhutan shall commit funds for instituting formal research centre for research and development, creating affiliations with other professional FOSS communities, creating partnership with national institutions and colleges.

4. Next Step

Given strategic importance and benefits that FOSS will bring in to Bhutan, the next step is to start implementing above stated policies. Below table shows some of activities and target to be achieved within next five years.

Targets to be achieved by 2015

Activities	Target
National Awareness	100% of ICT Personnel are FOSS literate 60% of Bhutanese society are aware of FOSS
Re-Skilling	60% of IT Personnel are FOSS trained 20% of IT Personnel are FOSS certified 30% of teachers responsible for School IT Labs are FOSS trained
Education	40% of Institutions of Higher Education utilize FOSS education and teaching tools 20% School IT Labs utilize FOSS education and teaching tools
Procurement	20% of all new servers (hardware) procured are able to run open source OS

Implementation	<p>20% of School IT Labs have FOSS installed</p> <p>60% of web servers (software) use FOSS</p> <p>30% of office infrastructure (email, DNS, proxy) use FOSS</p> <p>30% of desktop solutions (eg, web browsers, email client) use FOSS</p>
Policies and guidelines	<p>Formulate policies and guidelines to standardized and promote use of FOSS in different solution areas such as desktop applications, infrastructure applications and business applications.</p>
Activities	<p>Target</p>
National Awareness	<p>100% of ICT Personnel are FOSS literate</p> <p>60% of Bhutanese society are aware of FOSS</p>
Re-Skilling	<p>60% of IT Personnel are FOSS trained</p> <p>20% of IT Personnel are FOSS certified</p> <p>30% of teachers responsible for School IT Labs are FOSS trained</p>
Education	<p>40% of Institutions of Higher Education utilize FOSS education and teaching tools</p> <p>20% School IT Labs utilize FOSS education and teaching tools</p>
Procurement	<p>20% of all new servers (hardware) procured are able to run open source OS</p>
Implementation	<p>20% of School IT Labs have FOSS installed</p> <p>60% of web servers (software) use FOSS</p> <p>30% of office infrastructure (email, DNS, proxy) use FOSS</p> <p>30% of desktop solutions (eg, web browsers, email client) use FOSS</p>
Policies and guidelines	<p>Formulate policies and guidelines to standardized and promote use of FOSS in different solution areas such as desktop applications, infrastructure applications and business applications.</p>

5. Conclusion

This paper presented the open standards and open source software policy of the government of Bhutan. FOSS provides strategic, economic and social benefits to the users. It can reduce full dependency and 'lock-in' state on proprietary software. It can enhance security and access to information. It also improves data exchangeability and interoperability between information systems. This document also presented the next step for implementing the stated policies.

Acknowledgement

I would like to sincerely thank DIT for giving me the opportunity to write this paper on open standards and open source software policy for the government. All relevant comments and suggestions from colleagues in DIT are heartedly acknowledged.