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## Executive Summary

Free/Libre/Open Source software (FLOSS)<sup>1</sup> holds numerous benefits for developing countries. Yet use, development and deployment of this type of software remain far below potential in Asia, Africa and Latin America, the target regions of the FLOSSInclude project.

Based on expert input from the FLOSSInclude partners in those regions, as well as on the the analysis of available data and the relevant literature, this report describes what is required to increase the use, development and deployment of FLOSS in Asia, Africa and Latin America.

These requirements can be grouped into six areas: Skills, Businesses, Localisation, Policy, Infrastructure and Usability. It is notable that beyond the infrastructure level of access to electricity, computers and connectivity, the identified needs are overwhelmingly socio-economic rather than technical.

The *need for higher levels of FLOSS skills* emerges as a key issue across all areas. Taking a broad perspective, programming abilities are only one element in a much larger puzzle. Fundamental skills useful to the creative interaction with technology must already be acquired early in an individual's life, in particular critical thinking, problem solving and digital literacy. General education systems in the target regions frequently continue to rely heavily on rote learning, which fails to develop these skills. On the other hand, FLOSS communities are increasingly recognised as a source of improved methods for learning and teaching.

In higher education, the focus should be on imparting a sufficient level of programming skills as to allow students to participate in developer communities, while providing students of other subjects with at least a basic introduction to FLOSS concepts and techniques.

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<sup>1</sup> In this report we refer to the single phenomenon known by the various terms libre software , free software and open source software as Free/Libre/Open Source Software (or FLOSS). We note that the EU/FP5 FLOSS developer survey of over 2800 respondents showed that a majority of developers themselves identify with the term free software , while Libre software (logiciel libre, software libre, software libero) is the favoured term in southern Europe and Latin America.

Beyond the education system, trainings are an important route towards acquiring FLOSS skills. Trainings may require seed efforts by capacity building agencies, but should quickly become economically self-sustaining. Certification that is qualified, recognised and affordable would provide those skilled in FLOSS with an easy way to signal their competence to the market.

While skills are a severe limitation for the greater spread of FLOSS in the target regions, the lack of *awareness* is an even greater hurdle to widespread FLOSS adoption.

*Businesses* are at the core of the idea that FLOSS can promote social and economic development. If FLOSS is widely recognised as a profitable business opportunity, then this type of software will have reached a tipping point after which efforts to spread FLOSS become much easier.

The key to making possible a vibrant ecosystem of FLOSS businesses is to solve the chicken-and-egg problem where a lack of awareness implies low or non-existent demand for FLOSS products and services, which in turn discourages businesses and entrepreneurs from engaging with FLOSS.

It is the public sector that has the potential to break this vicious circle by creating demand. Public bodies are under obligation to spend taxpayers' funds wisely, and contracting local FLOSS businesses certainly is a way of doing so, as most or all of the value added by their work is retained locally, providing jobs and fostering economic growth. Fixing public procurement is one way to contribute to the creation of a fully competitive market for software and services, through policies that *encourage FLOSS offerings for public bids*. At the same time, donor organisations and capacity building agencies would do well to engage with FLOSS.

Public bodies in particular may benefit from the set-up of FLOSS *resource and competence centres* which provide information that helps them switch over to FLOSS and helps them deal with the challenges of FLOSS implementation.

With a view towards *localisation*, technical and socio-economic issues again have to be considered jointly, as software and services required need to be tailored to the specific local context in which they are going to be used.

The public sector is a potentially massive user of localised software even more so if schools and universities are included in the definition - and should therefore be looked upon as a key actor in localisation efforts. It would be helpful to develop and make accessible models for FLOSS localisation efforts, based on past experiences. This should include guidelines for government-funded localisation efforts.

If FLOSS is a tool for social and economic development, then this tool is often most effective when wielded by local, regional and national governments. Integrated into *policy* strategies, FLOSS stands the greatest chances of making a real difference for social and economic development. Both local and international actors should *raise awareness of FLOSS and its strategic potential among policy makers in the target region*. Like for many of the other requirements, international cooperation with similar organisations both in other parts of the target regions and in Europe will lead to a fruitful exchange of knowledge and the spread of best practices. *Interoperability and open standards* are key to a fully competitive market in software and services. They are another area that is clearly within the purview of the public sector.

FLOSS solutions designed for the target regions should aim for low power consumption, and should be *able to deal with power cuts* or, where necessary, the lack of electricity from the grid. They should function on affordable hardware. In order to make FLOSS easier to deploy, sets of *applications may be pre-packaged* for distribution to various target groups.

In the long term, *network infrastructures* of countries in the target regions need to be improved in order to remove limitations not just on FLOSS, but on the development of the ICT sector as a whole. In the meantime,

*creative solutions for dealing with scarce bandwidth need to be found, collected and shared between the target regions.*

The fact that ICTs have become so central not only to peoples' lives, but to the economy as a whole means that FLOSS as a social and economic issue cannot be discussed in isolation. The requirements identified in this report show that FLOSS touches upon number of questions of policy and governance which go far beyond what would commonly be associated with software from a technology-centred point of view. Indeed, technical and socio-economic requirements have turned out to be so closely intertwined as to make it impossible to clearly separate the two categories.

FLOSS is clearly not a silver bullet for the world's ills; no tool is. But this tool, used with wisdom, creativity and courage, can make great contributions to a country's or region's social and economic development.

## 1 Introduction

Free/Libre/Open Source software (FLOSS)<sup>2</sup> holds numerous benefits for developing countries. Many of these are detailed in the FLOSSImpact study, published by the European Commission and led by UNU-MERIT and published by the European Commission in January 2007.<sup>3</sup> One obvious factor is cost. With no license fees to be paid, and no upgrade choices imposed by vendors, costs can often be much lower with FLOSS, especially in the long term.

A second important feature of FLOSS is its adaptability to different needs. In many parts of the world, FLOSS communities have allowed computers to reach people who were previously ignored by proprietary vendors. For

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2 In this report we refer to the single phenomenon known by the various terms libre software, free software and open source software as Free/Libre/Open Source Software (or FLOSS). We note that the EU/FP5 FLOSS developer survey of over 2800 respondents showed that a majority of developers themselves identify with the term free software, while Libre software (logiciel libre, software libre, software libero) is the favoured term in southern Europe and Latin America.

3 Ghosh et al. (2007): The impact of Free/Libre/Open Source Software on innovation and competitiveness of the European Union.  
<http://ec.europa.eu/enterprise/ict/policy/doc/2006-11-20-flossimpact.pdf>

instance, KhmerOS,<sup>4</sup> a FLOSS initiative, first provided to Khmer speakers - the majority of the population in Cambodia - the ability to use computers in their own language across several application areas.

In the software market, by far the most money is made in services and the development of tailor-made software. In the EU and in the US, under one fifth of software investment is in (proprietary) packaged software; the rest is in custom software and in-house software.

Developing countries need to avoid being locked out of acquiring skills and competencies. Skills are crucial to technological take-up and innovation. The process of learning and adapting software helps users to make technology truly their own. They become creators of knowledge, rather than merely passive consumers of proprietary technologies.

FLOSS works as a free-of-charge high quality training environment. For a budding programmer, participating in FLOSS projects works like an informal apprenticeship. She not only hones her technical skills but also learns about teamwork and management. Such skills are often more effectively learnt through community participation than from formal courses.

Employers recognise this value of FLOSS communities, and believe that proven participation in such communities can compensate for a lack of a formal degree in computer sciences. The earning capacity of participating developers grows, even without an explicit investment in formal training.

Such informal apprenticeships are, in effect, a form of technology transfer between those who pay for formal training and those who do not, or cannot. Knowledge flows from big companies to small ones and from rich countries to poorer ones. As the necessary skills spread, business activity increases.

Taken together these experiences support a key finding of the FLOSSImpact study, namely that FLOSS can generate greater economic growth by allowing local economies to retain a higher share of value added locally.

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4 <http://www.khmeros.info/drupal/>

The purpose of the present report is to describe what is required to increase FLOSS use, development and deployment in the project's target regions of Africa, Asia and Latin America. The analysis of available data during the first phase of the FLOSSInclude project has produced a list (D1.2) of problem areas regarding the greater use, development and deployment of FLOSS in the project's target regions Asia, Africa and Latin America. Based on previous data, on the relevant literature and on input from the FLOSSInclude partners in the target regions, the report analyses the complex situations in the regions concerned, and deduces a detailed list of starting points for solutions.

The report takes a broad perspective, viewing FLOSS as a tool which governments, businesses, organisations and individuals can use to their advantage, contributing to social and economic development at the same time.

Problems regarding the use, development and deployment of FLOSS show great variations between the target regions. Generally, communities are oriented nationally or regionally, often showing no strong involvement in international projects. As a result, network effects are limited, with the consequence of fewer spillovers in the form of processes of institutionalisation and FLOSS-related economic activities.

With regard to FLOSS as a learning environment, data, where it exists, shows that FLOSS is a powerful learning environment everywhere. However, there are regional differences regarding employers' views of the qualifications obtained by participation in FLOSS communities. Learning communities in the target regions, often appear to be comparably small. Problematic areas are infrastructure, educational policies addressing FLOSS, and FLOSS awareness (or the lack thereof) in the relevant communities.

In the target regions' public sectors, FLOSS is shown to be relevant almost everywhere. However the potential for growth remains significant indeed, in some regions being enabled by FLOSS policies. Besides another

er instance of lower-than-optimal community awareness, the lack of better links between the public sector and FLOSS communities poses a problem for greater FLOSS penetration.

These problem areas have been merged with the diverse issues known to and reported by the FLOSSInclude partners, who have knowledge of the target regions that goes far beyond what can be captured by quantitative analysis. On the basis of their knowledge, together with the analysis of available data performed in the first phase of the FLOSSInclude project, this report is able to produce an extensive description of the various actions that could usefully be undertaken to put FLOSS to use as the powerful tool for social and economic development that it is.

## **2 Skills**

### ***2.1 Education and capacity building***

#### **2.1.1 General education**

Adoption and use of FLOSS in schools is a key foundation phase in increasing familiarity with FLOSS and building of a local skill base. Children and learners who are exposed to FLOSS as a first operating system will develop a proficiency and skill which they will take into the commercial market space on graduation. Not only will they have the necessary skills, but will frequently promote the benefits of FLOSS to their employers and organisations.

Input from the FLOSSInclude partners shows, however, that in order to achieve a greater spread of FLOSS in the target regions, it is necessary to intervene earlier in the educational career. Far from being an end in itself, FLOSS offers an opportunity to improve and modernise general education.

Broadly speaking there are two broad aspects to consider. The first one is a learning culture based on critical thinking and problem solving. The second one technological literacy, meaning the ability to understand and evaluate technology, and to use technological tools naturally, creatively and productively.

FLOSSInclude partners in both Asia and Africa report that the general education system relies far too much on rote learning, while the training of critical thinking and problem-solving is neglected. This leaves much human potential under-utilised. The problems blocking the greater spread of FLOSS reflect this underutilisation.

African learning is frequently guided by example. If a role figure or relative has a good career involving computers, and they use Microsoft Windows, then the youngster will more likely than not aspire to use the same tools .

The average citizen in Africa is introduced to a PC in either their work place, their local internet café or their school. Under almost all of these circumstances, the first exposure is to Microsoft Windows.

As for technological literacy, FLOSSInclude partners from all target regions report that even where computers and connectivity are available in the educational sector, they are often underutilised. This is typically due to teaching staff lacking training in the proper integration of ICT resources into their teaching, as well as corresponding support by school authorities. Users also often lack the necessary sophistication to fully exploit the tools placed in their hands.

Desiderata for the general education curriculum are:

- capabilities of general-purpose computers. In the target regions (especially Africa and Latin America) computers are often underutilised due to users' lack of sophistication.
- an understanding of just how strictly software determines what the user can do ( code is law )
- the importance of open standards
- basic knowledge of programming skills and concepts
- training materials for schools that help develop critical-thinking skills in students, in particular textbooks for FLOSS in local languages that develop these skills

This requires teachers to be aware of FLOSS, and to receive training in the use of FLOSS in educational settings. While training in certain applications may be useful, greater benefits can be expected from instilling in teachers an understanding of FLOSS concepts, which clash with the culture of rote learning that is often found in schools in developing countries.

The broad palette of initiatives required to bring about changes is best illustrated by an example. FLOSSInclude partner Ifc is presently engaged in advocacy efforts on the ICT for education policy front. The organisa-

tion has built a broad coalition of NGOs and educationists to work on the same. Vinay Sreenivasa of ItfC says:

*We are engaged in working with other government departments as well, to push for policy changes. In getting decision makers in the government to move to FLOSS, we sometimes also work with them to make sure that they move their individual systems to FLOSS systems we go ahead and help them install Ubuntu, Open Office etc. We also conduct FLOSS trainings for government officials, to help them make the shift.*

*Requirement: Encourage critical thinking and practice problem-solving skills within the general education system.*

*Requirement: Provide students with at least basic technological literacy.*

*Requirement: Enable teachers to integrate FLOSS knowledge and, perhaps even more importantly, FLOSS methods in their work.*

### **2.1.2 Higher education**

The FLOSSWORLD study (2007) concludes that higher educational institutions (HEI), universities in particular, have a very important role in the use, development and deployment of FLOSS especially in developing countries.

The study shows that participants in FLOSS communities in developing countries are usually young and well educated. This implies that universities offer a prime environment to encourage community formation and participation.

*Universities (and educational institutions more generally) can be both significant contributors to, and beneficiaries from the development of FLOSS. The major educational and research missions of universities give them the potential to be powerful actors in this regard: they can prepare the users and developers of computer software to apply these tools as citizens, consumers, employees and entrepreneurs; they train researchers in scientific and technical fields that are becoming evermore reliant upon advanced digital information processing and retrieval technologies, and they are the institutional hosts for funda-*

*mental and applied research in the mathematical and computational sciences.*<sup>5</sup>

Universities, according to FLOSSWORLD, also offer young people a window to a wider world that they otherwise might have trouble accessing:

*In addition, it must be recognized that HEIs are providers of high-speed internet connections with global sources of information that are likely to be far from ubiquitously available and therefore particularly important in many developing countries. Consequently, beyond questions concerning the extent to which universities and technical training institutes are offering instruction in the skills that would allow students and staff to modify and utilize open source computer code for their own uses, and to participate in collaborative projects on the Internet, one should consider how the policies of universities affect the access that students in developing regions can have to informal, experience-based learning interactions with global software development communities.*<sup>6</sup>

As shown by that study, FLOSS provides a powerful learning environment for technological, managerial and legal skills. If FLOSS activities at universities in the FLOSSInclude target countries can successfully be linked to the global FLOSS community, they enable local individuals and organisations to benefit from innovation and research performed around the world, at only the cost of their own participation in the community. As detailed in the FLOSSImpact study, this can be seen as a form of technology transfer or subsidy *from those who pay for formal training to those who do not (or cannot).*<sup>7</sup>

A precondition for the successful participation in FLOSS communities, whether global or local, is a sufficient level of programming skills. This means that in order to achieve greater use, development and deployment of FLOSS in the target regions, universities should provide better training

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5 David et al. (2007): FLOSSWORLD Final Research Report and Policy Impact, p. 5f

6 David et al. (2007): FLOSSWORLD Final Research Report and Policy Impact, p. 5f

7 Ghosh et al (2006): Study on the economic impact of open source software on innovation and the competitiveness of the European Information and Communication Technologies (ICT) sector (FLOSSImpact), p. 63.

in programming for students of relevant subjects, with a focus on languages used in FLOSS development.

Similarly vocational training should let participants acquire basic skills in setting up, administering, and providing on-site support for FLOSS operating systems, and applications.

More broadly, FLOSS development methodologies and techniques should be spread beyond the ivory towers of prominent research institutes by collaborating e.g. with community development organisations or through fellowship programmes. Such skills might e.g. be taught in the form of a Masters degree.

This could go along with basic training for FLOSS policy work, imparting to students an understanding of the software market, the implications of the use of FLOSS, and enable them to create relationships between the problems that the policy attempts to address and the solutions that FLOSS proposes

*Requirement: University-level courses in relevant subjects should impart a sufficient level of programming skills in languages used in FLOSS development. Students, including those of a broader selection of subjects, will benefit from a working knowledge of FLOSS methodologies and techniques.*

## **2.2 FLOSS training**

Lack of specific FLOSS skills is repeatedly pointed out by the FLOSSInclude partners as one of the principal obstacles to increased FLOSS use, development and deployment in the project's target regions. In particular on the business level, the lack of professional FLOSS support services means that customers perceive a dearth of support, and are consequently reluctant to move to FLOSS.

Beyond the educational sector, trainings are the obvious route to provide access to FLOSS skills for those who want and need them.

Trainings are an extremely flexible avenue to convey skills, as they can be directed towards a wide range of target groups and include a broad array of contents. In order to make FLOSS trainings more widely available, it might be necessary to seed the necessary capabilities through train-the-trainer programmes, which might be backed by governments or, in some cases, development cooperation agencies in partnership with local organisations.<sup>8</sup>

Such programmes need to ensure that they are targeting the right people and organisations, focusing on those who are capable of and interested in taking FLOSS trainings forward on their own, perhaps as an additional revenue stream, after the programme ends.

Trainings in FLOSS can be directed towards many different target groups. Broadly speaking, younger people are usually trained within the educational system (see above), while those who receive FLOSS training beyond university age will mostly do so as part of their professional career.

In the professional segment, trainings may be directed at FLOSS users, e.g. as part of a migration to FLOSS by their employer; or it may be directed towards people who want to make FLOSS their business.

As an expert asked to comment on the implementation of South Africa's FLOSS policy, Aslam Raffee, Chief Information Officer at South Africa's Department of Science and Technology and Chairperson of the South African the Government IT officers Council, OSS and Open standards Steering Committee, highlights how even in a FLOSS-friendly policy environment such as South Africa's, the actual success of such policies hinges on FLOSS skills in various groups:

*The biggest problem is current poor procurement processes. Part of the problem is that lock-in exists not just at the technological level, but as part of the ecosystem. The companies on our tenders, the training providers, the*

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<sup>8</sup> An example of the latter variant is the ict@innovation programme in Eastern and Southern Africa, which is a joint effort of FOSSFA, OSISA and German capacity building agency InWEnt. For this programme, UNU-MERIT and AITI-KACE are preparing training materials and conducting train-the-trainer sessions. <http://ict-innovation.org>

*solution providers and our skills and experience are mainly in proprietary products.<sup>9</sup>*

FLOSS trainings may be directed at the following target groups:

*Training for university graduates:* Graduates from relevant university courses form one of the main target groups for FLOSS trainings. They are likely to have the required skill levels in various fields, while at the same time their working time is not yet as costly as that of an employee. They also have an intense interest in improving their career prospects. If FLOSS skills are perceived as a highly valued asset in the labour market, training programmes and operators should find it relatively easy to attract motivated participants.

*Training for businesses:* Most FLOSS businesses are SMEs, which cannot afford to send their employees to trainings for extended periods of time without significantly affecting the company's operation. It should be noted that e.g. in Africa, SME can frequently refer to a company employing only two or three people. It follows that FLOSS trainings aimed at SME staff have to be designed so as to only require very limited physical attendance. Incentives to participate will often have to be significant enough to motivate people to follow the training on-line in their spare time.

*Training for public sector staff:* as discussed below, the public sector is a very promising target to increase the use, development and deployment of FLOSS in the FLOSSInclude target regions. As a consequence, FLOSS training for public sector staff offers considerable potential for its operators. Within the public sector, at least the following different target groups can be identified:

- IT staff, who need to learn how to build, deploy and manage a FLOSS-based infrastructure
- IT managers, who should be interested in the budgetary advantages of using FLOSS in both the short and the long term. Most IT use in the target regions is very rudimentary: computers are used

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<sup>9</sup> Raffee (2009).

to execute the same tasks that were carried out before their introduction, with little or no added value. There is little understanding about the benefits of integrating and automating processes, which is one of free software's strong points. Training for managers on how integrated systems can make their companies work more efficiently would make free software's value proposition easier to understand and accept.

- Users, who might need training after a migration towards or deployment of FLOSS has taken place, whether on general-purpose or specialised software. Most current office automation users either never received any training, or only got operative training in the use of specific features of specific programs. While power users usually have little trouble changing tools, people who only learned to operate programs at an almost ritual level have serious problems changing their habits.
- procurement staff, who should be informed about how to comply with procurement regulations in regard to FLOSS

There are numerous other target groups at which trainings may be directed. This includes non-governmental organisations (NGOs) which want to reduce their IT costs or gain independence from software vendors, as well as individual users interested in FLOSS.

*Requirement: Explore and highlight ways in which trainings can become a profitable business model for local entrepreneurs.*

*Requirement: Uncover and channel demand for FLOSS trainings in the public and private sector as well as among individuals.*

## **2.3 Certification**

Certification provides individuals and businesses with an easy way to signal their competence to potential customers and employers. A certificate says that the bearer has passed a defined set of tests and examinations in the relevant area.

In this way, certificates make it easier for a customer to trust a person or company to competently fulfil certain tasks. They are of course by no means the only way to communicate skill – there are many other effective tools such as references and recommendations. However, certificates stand out in providing new entrants in a given market with a way to signal their competence. They especially makes sense in a setting such as FLOSS, where most of the actors offering their services in the market will either be SMEs or individuals, both of which will take some time to build a reputation (which, it must be said, certificates can and should not replace).

Setting up or adapting and running certification programmes is far from trivial, whether in Europe and North America or in the FLOSSInclude target regions. Nevertheless, they provide a promising means to promote the growth of a vibrant market for FLOSS services (in the widest sense), especially if programmes are set up in close cooperation with a country's or region's ICT industry.

FLOSS certification programmes that are intended to specifically serve people and companies in developing countries will face different requirements than similar programmes in Europe and North America. The general skill level is often lower, so a balance must be found where a person has sufficient skills to perform a useful function, while the same person can still reasonably expect to be able to obtain the certificate after undergoing widely available training, e.g. a university course in system administration with a practical component. Existing certification programmes such as LPI often have requirements that are extremely hard to fulfil without a quality of training that often is simply not available in particular in Africa. This clearly is a niche to be filled by high-quality training centres.

Existing programmes often are also too costly for the FLOSSInclude target regions. While the definition of acceptable cost for a given certificate will vary with its perceived value, it will clearly have to be considered in relation to the income levels of the programme's target group. On the oth-

er hand, running a certification programme is quite costly, and prices should be sufficient to sustain the programme to avoid dependency on external funding, which might dry up before the certificate has existed for long enough to acquire the sort of reputation that makes it desirable.

Given these considerations, it is worthwhile to discuss the set-up of certification programmes in the target regions. While such effort should be subject to a stringent cost-benefit calculation, they offer the chance of creating or adapting a certificate to become an important currency, enabling greater liquidity in the local FLOSS market.

*Requirement: Provide individuals and companies skilled in FLOSS with an easy way to effectively and efficiently communicate their skills, at an affordable cost.*

## **2.4 Language skills**

Most FLOSS development by global communities is conducted in English. This represents a hurdle to potential community participants from other linguistic backgrounds.

Although English is part of school curriculum in most countries in the target regions, most people's knowledge of the language is barely sufficient to enable them to understand technical texts. Participation in the free software community, however, pretty much requires at least decent written communications skills in English, which makes this skill highly desirable to foster the adoption and development of free software.

There are two basic ways to address this. One is to improve English language skills in particular within the target group of potential developers. The other is to foster the creation of local-language communities of sufficient size to create network effects and eventually economic spillovers.

The right path probably lies somewhere in between. Except in cases of purely local FLOSS development, people and communities in the target regions must balance their reliance on the local language (acting loosely as a proxy for their openness to newcomers) with the need to connect to

larger international communities, where English will usually be the lingua franca. This connection prevents the local community from being limited by the potential of its own members, and lets it absorb outside influences which it can use to shape the software according to local requirements.

In India there is an interesting initiative to allow coding directly in Indian languages, with a lexical mechanism translating input into the keywords of standard computer languages. This allows novice programmers to start working in languages that they are comfortable with, and then change to programming in English, once they have acquired sufficient programming skills. Such a mechanism is relevant to India in particular as the country has an internal language divide to overcome: Indian FLOSS communities interact overwhelmingly in English, while local languages are greatly under-represented.<sup>10</sup> Many regions can start thus being producers of free software rather than consumers, which is important because local developers are better positioned to detect and tackle specific needs of a given region.

*Requirement: find technical and social ways of bridging the gap between communities and individuals developing FLOSS in local languages, and international FLOSS communities where English is the lingua franca.*

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10 David et al. (2007): FLOSSWORLD Final Research Report and Policy Impact, p. 9

### 3 Businesses

As demonstrated in UNU-MERIT's FLOSSImpact study<sup>11</sup>, FLOSS offers great opportunities for businesses. Entry hurdles are low, since little investment is required beyond the acquisition of the necessary technical skills, which in turn is supported by the global FLOSS community as an informal learning environment. This is particularly relevant for developing countries in the target regions.<sup>12</sup>

Since free software allows local businesses to adapt software to local needs, and does not require the payment of royalties to the original author, it allows local businesses to provide deep support which is of higher value than the shallow support provided for proprietary software. When problems arise with proprietary software they can only be fixed by the proprietor, limiting the role of local small businesses. With free software on the other hand, a local business is limited only by its skill levels, not by access to the code or the right to change it. Not only can much more value be generated locally, also it can also lead to wider recognition for local innovators since improvements can be fed back to the global market.

In addition to the clear advantages of retaining a higher share of value-added locally, there is an additional compelling reason for encouraging FLOSS use in developing countries. Any support for the proprietary software requires the payment of licence fees and other royalties for the use of the proprietary software that are rarely retained locally. Free software allows local economies to regain independence from vendors while binding them closely with global developer communities of training and support. Profits both from service and from development remain in the country where they accrue, instead of ending up with a software company in a developed country.

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<sup>11</sup> Ghosh et al. (2007): FLOSSImpact.

<sup>12</sup> Ghosh, Gerloff (2007)

Another interesting point is that Free Software use in enterprises increases the demand for in-house ICT skills. This makes it easier to retain talented people in the country, slowing the "brain drain".

While the above reasons strongly support the greater use, development and deployment of FLOSS in the target regions, there are a number of practical problems. As detailed in the following, these mostly have to do with skill levels and awareness.

In India, the adoption of FLOSS seems likely to be driven by sheer commercial needs, rather than by government policy or by grassroots-efforts on a large scale. Medium to large businesses in India, especially in the IT sector, are enthusiastic adopters of FLOSS. Even large, closed-source companies are moving internally to FLOSS applications--one big example being the gradual replacement of Microsoft Office with OpenOffice--due to reasons of economy. Thus, the time is ripe for the growth of service companies specialising in FLOSS support. We also believe that this will lead to a concomitant rise in innovation centred around FLOSS, signs of which are already apparent in Indian regions specialising in cutting-edge technology.

### **3.1 Availability of qualified staff**

Given the situation discussed in the [Skills](#) chapter, the lack of qualified staff is one of the chief constraints that businesses have to overcome in order to successfully engage with FLOSS. For businesses offering software development as a service, skilled programmers in particular are hard to come by.

The use of FLOSS in the back-end of businesses requires system administration skills that are not widely available in developing countries, deployment is difficult due to this restriction.

Development on FLOSS platforms is hindered by the lack of good programmers, as their training takes too long, due to the lack of the necessary mental structures. In the job training is long and expensive, and the small

size of the programmers pool causes salaries to rise to a level that small businesses may not be able to afford.

### **3.2 *Controversial practices by proprietary software vendors***

In many countries of the target regions, proprietary software companies practice what could be construed as unfair trade practices. In the experience of FLOSSInclude partners, Microsoft for instance appears to have made offers of licenses of Microsoft Windows, at little or no cost to all the public school system in Gujarat<sup>13</sup>, and this appears to be usual in cases where the buyer suggests that they are exploring FLOSS options. This is similar to the dumping of cheap products by western corporations in developing countries, to prevent the formation of local manufacturing capacities. By offering products at low or no cost, these companies capture the market and maintain a stranglehold over the same, which is basically anti-competitive in nature. This practice is more common in the education sector because once students get used to proprietary systems, they are unlikely to shift to FLOSS systems later on.

Microsoft also has entered into agreements with several Indian state governments where they setup 'IT Training Academies' for teachers in the public school system, wherein only Microsoft technologies are allowed to be taught, which is again a restrictive practice and also one that is pedagogically wrong. Similarly in Africa, Microsoft often either provides a free license to Governments for formal education deployments, or heavily discounts its operating system (\$3 to \$5) as well as its productivity suite. (\$2.50) (Per year, per PC).<sup>14</sup> Given these sorts of cost breaks, and coupled with the familiarity with Windows amongst the suppliers, the support staff, the teachers and frequently the learners, governments most frequently choose the option which is easiest in the short term.

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<sup>13</sup> <http://www.indianexpress.com/news/rs-500-cr-for-computers-in-schools/405217/>

<sup>14</sup> Page 23 : Affordable Computing for Schools in Developing Countries, p. 23. Vital Wave Consulting, 8/15/2008

Similarly advertisements from hardware (computer and laptop) vendors often eulogise proprietary software (for e.g. the typical line in almost all such advertisements is 'xxx vendor recommends Windows Vista') and avoid mentioning that their hardware product is available without bundling in the proprietary software. This could qualify as a 'restrictive' and unfair trade practice, which has the effect of persuading customers that there are no options.

Besides the dumping-like practice described above, bundling software with hardware is another strategy used by proprietary vendors which prevents greater FLOSS use in the target regions. When buying a computer, it often comes preloaded with a proprietary operating system. The buyer usually does not have the option to refuse the license for this operating system.

In combination with the fact that special effort is required to find a seller of computers without pre-installed software (let alone with a pre-installed FLOSS operating system), this means that proprietary software is the default for most users, and is not replaced with FLOSS even where this would easily be possible.

This quasi-compulsory bundling practice could be viewed as being anti-competitive by a regulator trying to enable a competitive market for software and services, and certainly deserves scrutiny.

### ***3.3 FLOSS business strategies and community support***

The main difference between software companies which are working with FLOSS and those that are working with proprietary software relates to the way how the company achieves revenues, the way how customers benefit from the company's products and services (FLOSS provides access to the source code and the right to modify it, proprietary software does not), and the cost structure (where FLOSS has some advantages over proprietary software as it is comparably cost-effective however, a proprietary software company can also benefit from FLOSS by integrating it in its propri-

etary software within the terms permitted by the applicable licenses). There are also some differences regarding the core capabilities regarded for the business model to work, as FLOSS business models require FLOSS skills and (at least some) interaction with the community. But there are no necessary differences between FLOSS and proprietary business models regarding the partner network, the markets / customers, the distribution channels and marketing, the relationship to customers and the management of these relationships,

In the most narrow sense, the fact that the source code of FLOSS is open while the source code of proprietary software is closed does not matter directly to the client if he does not want or is not able to check or modify the code. The main business advantages of FLOSS are not so much on the demand side but on the supply side. While a proprietary vendor is always limited to the closed and therefore relatively small community of its developers (i.e. usually its employees and contractors), FLOSS provides potentially a practically unlimited worldwide community of developers and testers. This community provides a powerful test bed and developer pool that allows businesses that manage to interact with this community in a meaningful way to shorten development cycles and time needed for customising software to clients' needs.

To interact with the community in such a meaningful way is however bound to two fundamental conditions: First, the community supporting a company's FLOSS services must be large enough, and it should also show some degree of professionalism, such as the capacity to stick to schedules or the existence of key players in the community that can be contacted to change the software, fix bugs, to organise work within the community and the like. Second, the company must be able to be considered as part of the community by the other community members.

The second point is crucial when FLOSS businesses in many developing countries are considered. Evidently, a company that uses a FLOSS product to sell services on top of it will be able to receive more and better support from the community if it continuously interacts with the com-

munity, participates in communications and events, maybe sponsors some events, sends bug reports or patches to the community etc, than a company which just downloads the software from the FLOSS project's website but remains invisible to the community in other respects. The most extreme form of cutting the company off from the potentials provided by community support is to create a fork of the community software, as forks are usually not supported by the community.

In Europe and North America businesses have all opportunities available to them, ranging from full FLOSS collaboration to forks. Forking a FLOSS project might be a useful strategy for a company if, for instance, the community does not support functionalities the company wants to be integrated in the software, or if the release management does not fit in the company's plans. The disadvantage of forking a FLOSS project – the loss of community support – is less pronounced in niche markets (where communities are small anyway) or in communities that are large enough to split and to provide support for the original FLOSS program as well as for the fork.

However, in many developing countries businesses face a very limited choice of opportunities. Because the communities are often very small, businesses have difficulties to find effective community support. The situation of FLOSS businesses in many developing countries can be compared to a company in an unintended fork situation, they rely on their own capacities to understand and modify the code, to find and fix bugs, to adapt the software to customer needs and so on. As a result, while FLOSS enables firms in Europe and North America to use the community in order to save time they can use for innovations or customer relationship management and advertising their services, firms in developing countries often do not have these opportunities.

### **3.4 Public bodies as clients**

In many countries in the FLOSSInclude target regions (as in Europe), the public sector is the largest potential buyer of FLOSS services and solu-

tions. Much could therefore be gained from setting up platforms and channels that make it easier for public buyers and private sellers of services to find and contact each other.

Some European countries, such as Denmark<sup>15</sup>, have successfully implemented platforms aimed at the that allow private companies to advertise and showcase their services. Through this avenue, public bodies can more easily find FLOSS service providers to suit their needs. These platforms are usually backed by the government for a set of reasons:

- Such platforms provide public bodies with relatively easy access to FLOSS vendors and service providers, thereby raising the chance that public bodies will select FLOSS for a given purpose and thereby profit from the advantages of this type of software
- These platforms also make it easier for local SMEs to win business from the public sector, ensuring that taxpayer's money is spent within the country rather than being channelled abroad by way of license fees. These local SMEs also provide employment, thereby raising tax revenues and lowering social security spending.
- Such platforms provide an easy way of creating a liquid market in FLOSS in an environment where both supply and demand already exist at least latently. They can be set up at relatively little cost, and may greatly contribute to the creation of a lively local scene of FLOSS companies.

### **3.5 Professional support services**

There is a marked lack of Open Source professional services on the African continent. Even large and globally distributed organisations such as Hewlett Packard are not able to provide comprehensive support for Open Source operating systems running on their hardware.

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<sup>15</sup> see Gerloff (2007): The best software for the purpose: softwarebørsen.dk.

When isolated pockets of internal skill are found, in the majority these tend to be individuals who are interested and committed to Open Source from a personal passion, and not from the background of a company professional training or resource offering.

Based on Canonical's experiences in the Gauteng Online Project<sup>16</sup> and the NEPAD eSchools Project<sup>17</sup>, and discussions at the International Conference African Legal Resources<sup>18</sup>, the lack of professional support in Africa is one of the greatest hindrances for greater use, development and deployment of this type of software.

This lack of availability of guaranteed support services presents a serious risk exposure in the commissioning and implementation of deployments based on Open Source platforms. With respect to continuity of service, it often means that FLOSS does not present a prudent business decision.

In our experience, the forerunner in the adoption of Open Source is generally government, and the leading edge in government is generally the education sector.

This is due to the fact that Government has both less commercial risk exposure than private business, and lower budgets for IT spending than private business. The same factors apply again to the public education sector.

In the NEPAD eSchools Project, HP made a commitment to install two out of three e-schools on Open Source in seven African countries. Despite this commitment and willingness to deploy such a ratio, it simply did not prove feasible on a ground level. Despite the direct support of HP Africa, as well as the HP branches and/or distributorships in each territory, the lack of available staff resources proved to be a sticking point.

It simply was not possible to guarantee support availability or commit to a predictable turnaround time for problem diagnosis, or resolution.

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16 <http://www.gautengonline.com/>

17 <http://www.eafricacommission.org/projects/127/nepad-e-schools-initiative>

18 <http://www.parliaments.info/documentation/abuja-conference-march-2007>

Thus, although hardware, finances, and all other elements were in place to support Open Source based school deployments, it was not possible to proceed, and the installations were reverted to Microsoft.

Increasing the availability of the required professional support services is not an easy challenge – it presents a case of the chicken and egg dilemma. Companies are not willing to install critical deployments on an Open Source platform until they are assured of the availability of professional support. On the other hand, companies who provide professional support services are unwilling to train their resources and invest in Open Source skills unless they see a clear market demand for Open Source from clients.

The same applies in India. Due to the relatively small base of people conversant with FLOSS technologies, and due to the lack of a sufficiently large market for support, FLOSS support companies in India have yet to develop on a large scale.

Again the requirement to build a skill base of qualified resources is not an easy challenge. In African countries, there is a clear recognition that education is key to personal security and prosperity, and that computer literacy is not only an accelerator, but a fundamental requirement.

Similarly, due to the relatively small base of people conversant with FLOSS technologies, and due to the lack of a sufficiently large market for support, FLOSS support companies in India have yet to develop on a large scale. There are several community-based efforts to change that, and support for these in terms of advice, and maybe an initial incubation, would help.

### ***3.6 Raising awareness and marketing FLOSS***

Buyers of IT services and solutions in the target regions are scarcely aware of FLOSS. This means that decision makers in those businesses find it harder to account for long-term strategic benefits that may be gained from this type of software.

This presents yet another hurdle for FLOSS businesses to overcome. Case studies of African FLOSS businesses conducted by UNU-MERIT have shown that it is a frequent strategy with solutions providers to avoid mentioning to the client (whether a private business or a public body) that a solution is based on FLOSS until that solution is up and running. This strategy is aimed at avoiding prejudices that clients may hold against this type of software. While it may succeed in the short term by gaining or retaining a customer, it does little to make it easier for the provider to sell FLOSS-based solutions in the long term.

One element of a successful marketing effort is to collect and highlight success stories of businesses using FLOSS as a key part of their daily operations.

*Requirement: Identify approaches to solving the chicken-and-egg problem regarding professional FLOSS support. An option is to provide advice and perhaps incubation to FLOSS support SMEs.*

*Requirement: Raise regulatory awareness to unfair trade practices by proprietary software vendors, as such practices impede the development of a local skill base*

*Requirement: Improve businesses' awareness and perception of FLOSS through multi-strategy marketing efforts. Ensure that businesses perceive FLOSS as safe, reliable and productive.*

*Requirement: Ensure that FLOSS is perceived as an instrument for economic growth*

*Requirement: establish channels and platforms where businesses (as sellers of FLOSS services) and the public sector (as the single largest buyer in many countries) can effectively meet and conduct business.*

## 4 Localisation

Large segments of the population will only be able to benefit from software (FLOSS or otherwise) if it is available in their own language. In this area, FLOSS has a comparative advantage over existing proprietary operating systems and applications, as most FLOSS applications are built on a framework that allows for easy localisation, i.e., the translation of the user interface into a local language. Moreover, the open nature of FLOSS development allows small communities to take up such translation work for languages where the market has not yet developed enough for there to be a commercial incentive for localisation.

The FLOSSWORLD study highlights the importance of localisation for the growth of local developer communities:

*Localisation and internationalisation of existing FLOSS applications is not only a precondition for the usability of these systems in many countries, it is also a precondition for reaching and establishing a critical mass of FLOSS developers in these countries, which again is the most important prerequisite for an independent and sustainable local FLOSS community. Finally, it must be assumed that FLOSS in target countries may have greater significance at the local or regional level than it has in richer regions. As the example of the province of Extremadura in Spain shows, it is not unlikely that FLOSS initiatives in underdeveloped regions develop a specific dynamics that address local needs (of businesses and the labour market, of public administration, of the educational sector) and tend to replace proprietary software systems and standards by FLOSS systems and standards because of the low purchasing power of local authorities and organisations.<sup>19</sup>*

Localisation is the key to gain competitive advantage in the end-user software market of a country. In countries in which proprietary end-user software is not available in the local language, FLOSS software – if distributed with the right strategy, can be used to give access to computers to the local markets (provincial governments, country-wide education), allowing people who have no knowledge of a foreign language use computers,

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<sup>19</sup> FLOSSWORLD D45, p8

which would not be possible with an English or French copy of the software.

A non-English lingua franca such as Hindi in parts of India can play an important role in increasing the reach of FLOSS. Localising software to such languages will make it available to a large number of users with limited effort.



Illustration 1: Cambodia's KhmerOS project advertises a new release.

© Open Institute 2009

The required investment does not have to be large. The Open Institute's experience in Cambodia shows that it is neither complicated nor expensive to set up professional localisation structures in developing countries, and that with clear guidance, management and funding it is possible to complete the localisation of a set of basic FLOSS programs within a year.

In this respect, it should be fruitful to develop products in specific languages as well as to customize tools for specific contexts. For example, in India there is an initiative to create accounting systems and tax-preparation tools aware of Indian regulations and practices, enterprise resource

planning systems adapted to the needs of Indian organizations, mapping and GIS systems to transparently handle Indian language names, etc.

For some minority languages, proprietary software manufacturers tend to perform partial localisation, as a make-up scheme to say that their products exist in this language (Microsoft LIPs are a clear example of this), but only the most frequently used commands are in the local language, anything a little deeper in the software or configuration screens is still in the original English.

Full and high-quality localisation of relevant applications is a must for the public sector use of FLOSS. The public sector, often the largest potential user group for FLOSS in the target regions, is unlikely to make use of applications which are not available in at least the country's main official languages. While this would seem to primarily concern FLOSS use on the desktop, where license costs for proprietary software often provide an important incentive to migrate to FLOSS, the relevance of proper localisation on the server should not be underestimated. System administrators who might not have a working knowledge of technical English terms, but are otherwise fully qualified to work with the systems at hand, are much more likely to push for a migration to FLOSS if they foresee that their work will become easier thanks to their being able to operate programs in their own language.<sup>20</sup>

Significant FLOSS uptake by the public sector is in turn highly relevant for the growth of a healthy ecosystem of FLOSS service providers. Seen from this perspective, government funding of localisation efforts can be a useful policy tool. A European example is the Spanish region of Galicia, where the regional government supports localisation to and software development for the local language, Galego.<sup>21</sup>

A major problem with FLOSS documentation is that although packages are translated into different languages, the translations are usually restric-

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20 UNU-MERIT's experience from numerous case studies conducted for the European Commission's OSOR project is that it is very often the technical staff within a public body that is the origin of an effort to migrate towards FLOSS.

21 See Gerloff (2008): Building networks: The Mancomún project in Galicia, Spain.

ted to the menu items, commands, and user interfaces. Seldom are user manuals, if they exist at all, translated. In addition, while developers often know enough English to write computer programs, some of them cannot write useful end-user documentation, thus reducing the user-friendliness of the applications they develop, no matter how good they are.<sup>22</sup>

All this points to a promising route for promoting FLOSS. If greater insistence on fully localised software among users can be fostered, then FLOSS would find itself in a highly advantageous market position across the target regions. This especially concerns the public sector, where a large number of both users and service providers would stand to profit: users would welcome a higher utility of the software on their computers, while local service providers would be able to take on business that used to go to large proprietary vendors. It is also in the public sector where a case for insisting on software in the local language can most convincingly be made.

FLOSS would further be at an advantage since it can be localised relatively easily and cheaply, while the processes for the localisation of proprietary software tend to be heavy and costly.

Regarding local developer communities, one problem should not be underestimated: If the local community operates only in the local language, it is much less likely to establish links with the global FLOSS scene. This diminishes the advantages of that scene as an informal, free-of-charge training environment for programmers. On the other hand, local-language communities are crucial to recruiting new developers into the scene. A happy balance can be struck if there are individuals acting as connectors to the global scene while at the same time being fully integrated into the local community.<sup>23</sup>

*Requirement: Develop and make accessible templates for FLOSS localisation efforts, based on past experiences. This should include templates for government-funded localisation efforts.*

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<sup>22</sup> Touray (2004).

<sup>23</sup> FLOSSWORLD D45, p15

*Requirement: Raise awareness for the benefits of fully localised software, in particular in the public sector.*

*Requirement: Identify ways in which local developer communities can be fully functional in their own language, while at the same time benefiting from lively connections to the international FLOSS scene.*

*Requirement: Identify priority applications for localisation.*

#### **4.1 Technical aspects**

Particularly in Asia, a crucial issue for localisation efforts is the software's ability to handle non-Western fonts. Above all, this concerns countries that use non-Latin scripts, such as India, Cambodia and China

The next step is to improve the usability of local language desktops. This may involve making font installation and keyboard remapping easier, ensuring that all requisite packages are included in FLOSS operating-system distributions intended for the country in question (e.g. Indian-language fonts packages for India), offering an easy path of migration for content in legacy fonts, etc.

It is also necessary to adapt FLOSS applications to local contexts beyond the technical level. In this respect, it should be fruitful to develop products in specific languages as well as to customize tools for specific contexts. For example, in India there is an initiative to create accounting systems and tax-preparation tools aware of Indian regulations and practices, enterprise resource planning systems adapted to the needs of Indian organisations, mapping and GIS systems to transparently handle Indian language names, etc.

*Requirement: Ensure that FLOSS operating systems and applications are able to handle non-Western fonts.*

*Requirement: Improve the usability of local-language desktops by ensuring that all relevant packages are included in a distribution aimed at local markets, and that there is an easy upgrade path for legacy content.*

*Requirement: Localise applications to conform to local requirements, laws and regulations (e.g. tax and accounting software).*

## **4.2 Regional requirements**

In *English-speaking African countries*, localisation is not much of an issue, since most FLOSS programs are available in English.

On the other hand, English is very often a second or third language for many Africans, even if it is one of their country's official languages. This makes it necessary to not only localise software, but also to develop content in local languages.

A significant share of Africa's population is illiterate or has minimal education. If any kind of technology is to succeed in Africa, it has to rely on local language communication. Several efforts have been made towards localisation and the development of local content. [Translate.org.za](http://Translate.org.za) is a translation effort to make Linux and other FLOSS based applications available in the 11 South African languages. Efforts to localise FLOSS applications to Kiswahili in Kenya are under way. This will greatly increase the availability of FLOSS based ICT solutions to the Africans.<sup>24</sup>

In *Spanish-speaking Latin America*, the number of Spanish speakers is large enough to warrant translations of most FLOSS programs. Though there might not be a fully localised translation for each country, a general Spanish (es\_\*) localisation is usually good enough.

Localisation, and the broader goal of making digital computing in *Indian* languages work smoothly, is probably the most important area for FLOSS activity in India. The need for this is obvious in a country with over 400 languages, including 22 official languages recognised by the constitution. By the best of estimates, less than some 6% of the population speaks English. By contrast, about 60% of the country can converse in a dialect of Hindi, the main Indian language. For most of India, this situation is unlikely to change in the near future.

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<sup>24</sup> Kigai and Kimolo, 2004.

Localisation is considered as an important objective by most major FLOSS projects like GNOME, KDE, Mozilla, and OpenOffice, and there are teams dedicated to the work in at least 18 Indian languages. Such advantages have made Linux, and open-source desktops available in many more languages than proprietary equivalents.

The importance of FLOSS, and of localisation has now been noted by the government of India. The National Knowledge Commission has explicitly made a recommendation for the increased adoption of FLOSS, and the latest five-year plan has significant earmarks for funding localisation. Government-funded agencies like CDAC are also playing an increased role in promoting free software, and in localisation efforts.

In *China*, a few FLOSS community have worked at FLOSS localisation. But the amount is limited. The main service clients of them are technicians. According survey, 80% FLOSS enthusiasts want get detail technical documents in Chinese, 60% of them would like get the support from local communities, and 46% would like get the local product supporting training.

## 5 Policy

In the context of a society in which even relatively inexpensive computers are beyond the possibilities of a large part of the population, free software is a powerful enabler to let people use whatever hardware is available for their own needs. Regional and national governments are probably one of the most powerful (if not the most) driving force for societal change. By designing and implementing the right policies, they can bring about much faster and deeper changes than could be achieved otherwise. But what should policies look like that foster greater use, development and deployment of FLOSS in developing countries?

### 5.1 *FLOSS policy strategies*

Many developing countries have yet to articulate national information and communications technology (ICT) policies on such issues as privacy, strategies, and approaches to ICT development. Lack of policy on FLOSS is a specific aspect of this general problem of lack of ICT policy in many developing countries. For this reason, many developing countries do not have policies on the use of FLOSS by government agencies, and their service providers. In other cases, they have policy environments that at best are neutral, or at worse, hostile to the adoption and use of FLOSS.

This situation is especially debilitating to FLOSS because in many developing countries the government is the largest single buyer of ICT products and services. Furthermore, a favourable government policy on FLOSS is frequently a major boost to the adoption and use of FLOSS, especially if it encourages both public and private spending on FLOSS.

Another adverse policy effect on the adoption and use of FLOSS in developing countries is that many government and donor agencies insist on proprietary software when they invite bids to provide ICT products and services. It is thus not uncommon to find advertisements that specifically ask for computers preloaded with Microsoft Windows and Office, rather

than stipulating the required functionalities of the computers to be provided.

While an increasing number of countries are starting to formulate FOSS policy strategies and draft documents, not many complete them or turn their strategies into actions. A draft report by the Centre for Strategic and International Studies (CSIS) in the United States looked at open source policies of over 45 countries worldwide and found that "slightly more than half of the initiatives never went beyond the proposal stage" and that "there was little tangible action toward migration. There were no stated limitations or requirements to use OSS in over 80% of cases and policies within the mandatory category, had not yet been enforced." The report suggests the majority of policy initiatives have resulted in "technological neutrality", rather than pro-FOSS policy.<sup>25</sup>

Though that report dates from 2005, input from the FLOSSInclude partners indicates that most governments in the target regions have generally not made much progress in this regard. Exceptions are South Africa, which in 2007 adopted a FLOSS support policy of the more stringent type for the public sector, and China, which has put a certain political weight behind the adoption of open standards at the international level.

Some countries, such as *South Africa*, have issued guidelines for their public sector, stipulating a certain degree of attention to FLOSS in e-government and procurement. Unfortunately, implementation is often patchy at best. In South Africa, the policy has led to a higher pace of FLOSS implementation on the back-end and infrastructure side, while desktop migrations remain sluggish. Although the country's pro-FLOSS policy has led to higher awareness among public IT staff, there have been few changes on the procurement side (see below).<sup>26</sup>

In any case, such guidelines do not amount to a full-blown policy strategy, which could use FLOSS as a tool to help a country's population enter the

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<sup>25</sup> Bridges.org 2005.

<sup>26</sup> Raffee (2009).

information society. In the Spanish region of Extremadura<sup>27</sup>, where such a strategy is being implemented, FLOSS is one tool in a large toolbox, but it is a crucial one.

Building such broad policy strategies is difficult, and implementing them even more so. Such efforts require firm political consensus, ideally across party lines, and a willingness to take bold action, as well as a degree of courage. Much is therefore to be gained from cooperation between governments in this matter, making it possible to profit from the experience of others.

In *India*, policy which is supportive of open standards and free software is limited. There are guidelines in some states which recommend (not stipulate) the use of FLOSS for e.g. the IT department of the state of Delhi has recommended that all government offices should use Open Office and should not purchase Microsoft Office<sup>28</sup>. However comprehensive national policy is largely absent and neither do (most) individual states have enabling policies. There is a new draft national policy for open standards in e-Governance<sup>29</sup>, and the main opposition party BJP has released an IT Vision document<sup>30</sup> one month ahead of national elections which endorses FLOSS and open standards. The process needs to be followed to see if the policy comes into effect and if it leads to increased FLOSS adoption.

The country is currently struggling with issues that will have major implications in the longer term, such as software patents, localisation, and a policy on FLOSS. An encouraging aspect of this is that at least some senior policy makers are starting to recognise the importance of a thriving FLOSS community, and reaching out to it. As similar issues have been mooted in Europe and in other regions, a joint examination of the issues

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27 Disseldorp (2003).

28 Government of National Capital Territory of Delhi, India; Department of Information Technology (2005) 'Policy for open Office'. [http://it.delhigovt.nic.in/doit/open\\_office.pdf](http://it.delhigovt.nic.in/doit/open_office.pdf).

29 [http://egovstandards.gov.in/Policy\\_Open\\_Std\\_review](http://egovstandards.gov.in/Policy_Open_Std_review)

30 <http://www.lkadvani.in/eng/images/stories/it-vision.pdf>

involved, and the production of white papers on topical subjects could serve as input to policy makers in India.

Policy changes on a number of front are required to support the adoption of FLOSS in the country's public sector. India's National Knowledge Commission<sup>31</sup> and India's Planning commission have both recommended that India needs to widely adopt FLOSS in order to meet some of its developmental goals. However such recommendations have to get translated into policy for actual adoption to take place.

For such reasons, cooperation should be promoted between European governments and public bodies working engaging with FLOSS and their counterparts in the target regions. Europe, and especially governmental agencies there, are significantly ahead of most of the countries in the target regions in their adoption of FLOSS, and case studies of success stories in Europe would have an influence on policy makers there.

In drawing up policy strategies, whether national or sector-specific, UNDP and UNESCO are also promising partners. They have direct access to government decision-makers, and - especially UNESCO - also in-house expertise of ICT policy-making on education. UNDP has already funded efforts towards national FLOSS policies in a number of developing nations.

*Donor agencies*, either by omission or commission, also frequently hinder the adoption and use of FLOSS in developing countries. Again, the problem emanates from the insistence of many donor agencies on proprietary software, and a failure to adopt a more pro-FLOSS policy in their assistance programs.

This lack of commitment by the donor community to the increased use of FLOSS in developing countries is especially unfortunate because governments in many developed countries are turning to FLOSS and curtailing their use of proprietary software. The UK government, for example, in a

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31 National Knowledge Commission, Government of India (2006): Recommendations on e-governance. <http://www.knowledgecommission.gov.in/recommendations/egovernance.asp>.

2002 published a policy paper that among other things called for using products that support open standards, and avoiding being locked into proprietary IT products and services, while the European Commission has called for promoting the use of FLOSS in government. Given that more and more developed countries are opting for FLOSS, it makes sense for donor agencies (e.g. the Department for International Development (DFID) in the UK) to have a more pro-FLOSS policy in their development assistance programs.

*International development organizations and agencies* have also yet to promulgate and implement pro-FLOSS policies. Despite the fact that a number of UN agencies, such as the UNDP and UNESCO, provide support to the FLOSS community, they have yet to articulate specific guidelines on the use of FLOSS in their assistance programs, or indeed within their organizations themselves. Although UNESCO has a vibrant FLOSS portal<sup>32</sup> and the UNDP actively supports the International Open Source Network<sup>33</sup> (IOSN), there are no indications that they plan to migrate to FLOSS any time soon (Touray, 2004).

There is significant space in the target regions for FLOSS interest groups to lobby their governments. Increasing the capacities of local FLOSS advocacy organisations to inform policy makers about this type of software and its potential as a policy tool is both relatively easy, as the actors in question are already motivated, and cost effective, since usually not much funding is required. Rather, these groups stand to profit from a lively exchange with their counterparts both in the target regions and in Europe and North America, which will enable both sides to better select their objectives and improve their strategies. Helping such groups in the target region to get started is another objective of such cooperation.

Advocacy can take place on several fronts: directly for the use of FLOSS (for cost, security, etc.), on the use of software that is 100% in the local language (when this is an advantage for FLOSS), on the need of using

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32 <http://www.unesco-ci.org/cgi-bin/portals/foss/page.cgi?d=1>

33 <http://www.iosn.net>

legal software in the Education system, to teach ethical use of computers to children from the beginning (when this is an advantage), on the use of Open Standards, on the use of low-power-consumption computers (no need to upgrade for new systems) and any other external factor that might put FLOSS in a better competitive position.

*Requirement: Raise awareness of FLOSS and its strategic potential among policy makers in the target region.*

*Requirement: promote international cooperation and exchange between Europe and the target countries on development and implementation of FLOSS-based policy strategies.*

*Requirement: Work with donor agencies and international development organisations to ensure that they are able to provide support for the development of FLOSS policy strategies.*

*Requirement: Increase the ability of FLOSS advocacy groups to inform policy makers and the general public about FLOSS.*

## **5.2 Education and digital literacy**

ICT related education policies need to change to remove the existing biases for proprietary software. Education policies should actively promote FLOSS. Governments should explore going only for FLOSS in education because using FLOSS in schools will promote educational aims: with FLOSS, students can learn not only how to use software, but also how to create and modify the software applications. Hence students will not just be passive users but will actually construct knowledge. This fits in well with the constructivist approach to learning, which e.g. *India's* National Curriculum Framework calls for.

FLOSS uptake is also harmed where educational boards in the country prescribe proprietary software in their syllabi. Students are not given options to explore FLOSS applications and operating systems, and any hands-on training often involves only such applications.. Once students are indoctrinated into proprietary software systems in their initial educa-

tion, they tend to continue using only proprietary platforms later on. Government education policies need to stipulate that only mentioning proprietary software is avoided and that FLOSS options also need to be provided. As such efforts end up teaching the usage of a specific tool, rather than of a method, e.g., they teach the usage of Microsoft Excel, rather than of a generic spreadsheet, they are counter-productive, and aimed at keeping students tied to these applications.

FVL: The government could also promote FLOSS by distributing free software in its public offices, offering courses on free software concepts, tools and development through its media outlets such as school TV and the educational system at all levels, from primary school to the university.

*Requirement: Ensure that curricula in schools and universities integrate FLOSS, ideally both as a subject and as an inspiration to learning methods.*

*Requirement: Motivate governments to use FLOSS as a tool to increase digital literacy.*

### **5.3 Procurement**

In many developing countries the government is the largest single buyer of ICT products and services. This gives the public sector a huge influence on the development of a country's ICT market. Public procurement rules, policies and practices are a prime factor in defining the business climate for FLOSS-based companies.

Some discretion is in order when arguing for FLOSS in developing countries as a way to lower the costs of using software. While high prices for proprietary software licenses mean that many people are not able to afford such licenses, there is widespread use of unlicensed proprietary software, which can usually be obtained slightly the marginal cost of burning a CD or DVD. This practice often extends to public organisations as well. This means that the cost advantages of FLOSS at the acquisition stage may be small or non-existent in practice. Nevertheless, FLOSS may still offer cost

advantages as seen over the software life cycle. This may be more relevant to the individual user, however, as larger organisations usually face increased scrutiny by software vendors.

Procurement rules of course vary from country to country. Differences between the stated rules and policies and actual practice introduce another layer of complexity to the analysis. (As recently demonstrated, this is in no way particular to the countries of the target regions alone.<sup>34</sup>) As a general principle, procurement policies should be vendor-neutral and should not mention brands of software to be used, instead stating only the software specifications required.

Procurement rules may specify that purchases above a certain sum need to be publicly tendered. Yet in practice, recent research in Europe<sup>35</sup> shows that FLOSS-based offerings are often excluded from this requirement.

Some tendering agencies explicitly specify proprietary programs by name (e.g. licenses for Microsoft Windows Vista ). Others require compatibility with pre-existing proprietary solutions.

A more subtle variant of exclusion are financial stability requirements for the bidder. As FLOSS companies are often SMEs, they have a harder time meeting such demands. At the same time, the risk to the tendering agency of a failure of the bidder's business is much smaller than in the case of proprietary software. Since FLOSS is based on open standards, the customer (in this case, the public body) can easily hire a new contractor to take up work where the first, failed one left off.

These practices do not necessarily reflect any ill will towards FLOSS. More frequently, they are a sign of a lack of awareness, as well as a lack of guidance for public servants on this matter. Therefore, public bodies

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34 Ghosh et al. (2008): OSOR Guidelines. Public Procurement and Open Source Software. (Public draft version v1.0), <http://www.osor.eu/idabc-studies/OSS-procurement-guideline-public-draft-v1%201.pdf>.

35 Ghosh et al. (2008): OSOR Guidelines. Public Procurement and Open Source Software. (Public draft version v1.0), <http://www.osor.eu/idabc-studies/OSS-procurement-guideline-public-draft-v1%201.pdf>.

could be provided with guidelines on how to conduct tenders in a manner that allows and encourages FLOSS-based offerings.

While such guidelines of course would have to be adapted to numerous national legislations in the target regions, they offer the opportunity to make public sector procurement significantly more FLOSS-friendly at a relatively low cost. Actually changing procurement rules would take much more time and effort, without necessarily guaranteeing changes in procurement practices on the ground. On the background of the South African experience, Aslam Raffee argues that IT and procurement staff in public bodies need not only policies, but concrete help in order to change their practices:

*What could help is a directory of evaluated, tested FLOSS solutions indicating the different metrics used, along with companies capable of fully supporting such solutions to help decision makers. Currently there is a lack of know how when it comes to procuring, implementing, deploying and supporting FLOSS amongst some IT managers and C level executives.*

Where public bodies contract software development out to companies, an easy step to take is for the public body to require the contractor to hand over all rights to the software, as well as the source code. This then allows the public body to release the program in question under a FLOSS license. Even under FLOSS-friendly policies, progress is far from guaranteed, as the problems may lie deeper. While such policies may substantially raise FLOSS awareness among senior IT staff in the public sector, they may not reach those responsible for procurement without an additional effort to change procurement practices.<sup>36</sup>

The actual deployment of the software can hinge on details, such as a mismatch between government policies on ICT and FLOSS deployment. In India governments have set restrictions on the fonts that can be used, which are not always implemented in a FLOSS distribution, as it happens

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<sup>36</sup> Raffee (2009).

in the state of Karnataka, where the adoption of FLOSS is being blocked as Nudi fonts are only distributed in certain proprietary products.

Furthermore, the task of increasing FLOSS use in the public sector often presents a problem not only of demand, but also of supply. A number of African Governments have made positive statements towards Open Source and the benefits it offers. Some have set targets for the adoption of Open Source within government; defined usually as a commitment to a percentage of installed computers to be running on Open Source operating systems by a given date.

The problem here is that usually, those making the promises are the politicians who are a long way from the reality on the ground faced by the operational staff. When the operating divisions set up procurement lists, and invite tender applications, there are very few (if any) responses that offer Open Source as an option. The government departments are thus only able to select purchase options from what has been offered. If no local supplier organisation is confident enough in their own degree of internal skill to support an Open Source based client deployment, then quite simply no such offering is usually presented.

This can contribute to the perception that pro-FLOSS policies are failing. It is therefore necessary to provide a sort of catalyst that enables supply of FLOSS services to meet the demand created by such policies.

Making procurement policies technology neutral or aiming for a level playing field for FLOSS is not enough. Proprietary software locks its users in through proprietary file formats and interfaces, combined with extremely high market penetration. If there is to be a truly competitive market for software and services, governments and regulators will need to engage with these network and lock-in effects. In the light of the advantages that FLOSS offers public bodies and the country at large, it is necessary for the public sector to adopt explicitly pro-FLOSS policies in order to realise those benefits.<sup>37</sup>

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<sup>37</sup> see FLOSSImpact (2007), pp. 205-210

*Requirement: FLOSS policies for the public sector should explicitly address procurement, providing concrete guidelines along with strong monitoring and compliance instruments, along with training of IT and procurement officers in public bodies.*

*Requirement: Public bodies could be provided with guidelines on how to conduct tenders in a manner that allows and encourages FLOSS-based offerings.*

*Requirement: Ensure that there exists a supply of FLOSS services that can satisfy the demand created by improved public sector procurement policies and practices.*

*Requirement: Create a fully competitive market for software and services through policies that encourage FLOSS offerings for public bids.*

## **5.4 Interoperability and open standards**

Interoperability and the open standards for data and files that enable it are crucial for FLOSS to make headway in the public sector, and by extension in society at large. This is because they break the lock-in that forces people and organisations to continue using proprietary software.

This makes interoperability and open standards a hotly disputed policy battle ground. Even the definition of an open standard is somewhat contentious. While some definitions are less stringent than others, the authors consider that a demanding definition is the most helpful in order to maximise the usefulness of a given standard. According to the partners in the consortium, a definition that may be suitable is proposed by the Free Software Foundation Europe:<sup>38</sup>

*An Open Standard refers to a format or protocol that is*

- 1. subject to full public assessment and use without constraints in a manner equally available to all parties;*
- 2. without any components or extensions that have dependencies on formats or protocols that do not*

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38 <http://www.fsfeurope.org/projects/os/def.en.html>

*meet the definition of an Open Standard themselves;*

- 3. free from legal or technical clauses that limit its utilisation by any party or in any business model;*
- 4. managed and further developed independently of any single vendor in a process open to the equal participation of competitors and third parties;*
- 5. available in multiple complete implementations by competing vendors, or as a complete implementation equally available to all parties.*

Open standards, and interoperability are a natural fit to FLOSS, and by default FLOSS applications are among the most inter-operable, and adhere most strongly to standards. An insistence on open standards, implementable by all comers, is important as closed, undocumented standards are often used by vendors of proprietary software to create enclosures, and keep users locked to their applications.

#### **5.4.1 Open standards within the public sector**

Open file formats in particular can be a sticking point for organisations wanting to migrate to FLOSS, or even only to an open standards-compliant IT infrastructure. Especially for organisations that already have large amounts of data stored in proprietary formats, there are exit costs when moving to open standards. On the other hand, proprietary formats themselves often undergo changes which necessitate similar conversion efforts. This cost factor of migrating to FLOSS might therefore not be as relevant as it might seem at first, in particular not when the comparison is to an upgrade to a new version of a proprietary format.

In practice, interoperability of common document formats should not present any real practical problems. OpenOffice is able to easily read and save documents, spreadsheets, presentations and drawings in the commonly used proprietary file formats. The training/readjustment is usually a simple once-off lesson.

The Spanish region of *Extremadura* has mandated two formats for the storage and exchange of information within the regional government:

- Open Document Format for Office Applications (OASIS Open Document Format, based on standard ISO/IEC DIS 26300), for working documents and administrative procedures.
- Interchange Document Format PDF(A (Portable Document Format ISO 19005-1:2005), for documents that are not intended to be modified.

At the level of international standardisation efforts, *India* took a principled stand on the recent issue of the ISO approval of the flawed OOXML standard; a stance that was strongly supported by open-source companies, educational institutions, and government advisers. Besides helping support such activities, the broad-based support can be tapped for building a complete FLOSS ecosystem.

In China, the Open Document Format (ODF) has been officially approved as an international ISO standard document format. Soon after, the Chinese government also approved its own national standards for office documents UOF ("Biao Wen Tong" in Chinese). This served to give Chinese producers of office software an advantage over foreign proprietary competitors. Both standards are recommended for use, but not mandatory.

While these examples would seem to hint at a degree of progress in the target regions, a word of caution is in order. Both China and India are notable for their rapid economic growth, particularly in ICT, with growth relying in great measure on domestic companies. For software producers both countries, open standards and interoperability represent an important avenue towards winning market share from the dominant incumbents. It is much easier to persuade potential clients to migrate to a new solution if there are no large exit costs associated with the move.

For countries that do not have such a vibrant domestic software industry, the picture is different. They too stand to benefit from open standards and interoperability, through easier FLOSS use in general and through more competitive market conditions for software and services in particular.

However, bringing about changes from de-facto document standards to open standards is difficult, and requires both commitment and action from governments. Again, widespread change in the tools will also require government intervention. With the benefits being indirect as they are, these changes will not come about without a measure of advice and advocacy, both from local FLOSS groups and businesses and from governments in other parts of the world, in particular Europe, some of which have gathered considerable experience in the use of open standards and the quest for interoperability.

### **5.4.2 eAdministration: Interaction with citizens and businesses**

Interoperability and open standards are relevant not only to the internal workings of the public sector, as discussed above, but also to the interaction between public bodies and those whom they are intended to serve: citizens and businesses.

In numerous countries in the target regions, electronic government services are based on proprietary standards, and only available to users of proprietary software. This presents a massive obstacle to the greater use and deployment of FLOSS, since FLOSS users will occasionally face difficulties in interacting with their administrations.

These problems can be prevented if public bodies ensure that their electronic services, even those which run on proprietary back-ends, comply to the relevant open standards and can be accessed with both FLOSS and proprietary software. This particularly applies to web-based services, which should not require a certain browser to perform their function.

*Requirement: Adoption of open standards by the national standards bodies. For the government to adopt standards, it is often a requirement that these be blessed by the national standards body.*

*Requirement: Increase the use of open standards both within the public sector, and for purposes of interfacing with citizens and businesses.*

*Requirement: International cooperation between governments interested in using and promoting open standards and interoperability.*

## 6 Infrastructure

Another common issue which is holding back the use and deployment of FLOSS in developing countries is the lack of appropriate infrastructure. Computer terminals are scarce and hardware is still too expensive. In this regard, FLOSS helps to save money on license fees, support and integration, and besides it avoids vendor lock-in, thus final users gain strategic control in negotiations. To help with this this, competitive FLOSS consultancy services or repositories of code (Forge) for code integrators could be offered.

Electricity shortages and power cuts are a common problem in several of the target regions, in particular Africa and India. While not specific to FLOSS, this is an issue that should be kept in mind when discussing the need to achieve greater spread and use of computers.

The low power consumption issue becomes very important in education systems of undeveloped countries, as schools cannot afford to pay a lot for electricity. The hardware industry (Intel, VIA, AMD) are now competing on low-power-consumption, coming out with products that use very little electricity, with very competitive prices. Microsoft is bringing into the market computer systems that use more and more computer power, and even new characteristics in the computer boards (as is the case of Vista, versus Windows XP). Proprietary software produces systems that increase, at every step them speed and capacity requirements of computer system, rendering obsolete existing equipment (specially low-power-consumption equipment), while the use of resources on FLOSS-based systems remains constant (or is optimized). The usage of FLOSS allows the use of long-term low-power-consumption facilities in schools, without fearing that the equipment will become obsolete, or that it will not be possible to upgrade to use better versions of the same system or software. Any policy that supports the use of low-power-consumption computers reinforces the need for FLOSS (computer systems that are responsible in their use of resources).

*Requirement: FLOSS solutions for the target regions should aim for low power consumption, and should be able to deal with power cuts. FLOSS should be examined as a solution for extending the lifetime of computers, and extracting more value out of lower-powered computers and computational devices.*

## **6.1 Connectivity**

The lack of affordable broadband connectivity is pervasive in the target regions. This applies even to South Africa, which otherwise boasts relatively extensive infrastructure.

Many FLOSS applications, especially smaller programs, are only available for download. In the absence of sufficient bandwidth to enable the downloading of such applications, alternative approaches for their distribution can help. This includes projects such as Freedom Toaster<sup>39</sup>, which has seen take-up in South Africa and India.

At FLOSSInclude partner UWC, the IT department has set up local mirror servers for the repositories of the Ubuntu GNU/Linux operating system. All client requests to the repositories are automatically redirected to these mirrors. This significantly eases bandwidth requirements, as the data in the repositories has to be retrieved from the Internet only once, and is distributed to users through the local network, where bandwidth restrictions are much less of a problem.

Such mirroring solutions can be set up relatively easily wherever there is an organisation that has the capacity to do so and a group of users of certain applications that is big enough to warrant the effort.

*Requirement: In the long term, network infrastructures of countries in the target regions have to be improved in order to remove limitations not just on FLOSS, but on the development of the ICT sector as a whole.*

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<sup>39</sup> <http://www.freedomtoaster.co.za/>

*Requirement: In the meantime, creative solutions for dealing with scarce bandwidth need to be found, collected and shared between the target regions.*

## **6.2 Hardware**

Another common issue which is holding back the use and deployment of FLOSS in developing countries is the lack of appropriate hardware. Computer terminals are scarce and frequently still too expensive. In this regard, FLOSS helps to save money on license fees, support and integration, and also avoids vendor lock-in, thus final users gain strategic control in negotiations.

The relatively high price of hardware means that users must make do with whatever PC stores carry at a given price, which often consists of whatever was cheapest in Asia at the time, and without any regard for compatibility with free software.

The provision of computers to primary and secondary schools have proved to be a successful initiative because people working in these areas are more inclined to consider FLOSS, due to stringent cost requirements, and are less reluctant to change. On the other hand broadband connectivity is still unreliable or unavailable in many areas, which is specially relevant for FLOSS, in so far as its use requires frequent updates and contact.



*Innovative round tabletops designed by SchoolNet Namibia reduce computer failure rates, as cables are fed through the centre of the table.*

*© Karsten Gerloff 2008, cc-by-sa*

FLOSS can be used to reduce costs for hardware acquisition, deployment and maintenance. One option is offered by affordable low-power thin clients and multi-seat systems. This can include surprisingly simple, but effective advances, such as the table-top design developed and used by SchoolNet Namibia.<sup>40</sup> Throughout rural Namibia, locally purchased shutter-board is cut to size by a local contractor and built into round tabletops, which are then mounted on disused school desks in rural schools. Each of these tables offers space for five PCs and up to ten learners. All cables are run through a central duct in the middle of the circular table, greatly reducing the risk of them being unplugged or damaged. This design has greatly reduced maintenance costs for the schools that use it, in particular as it avoids frequent repair trips to rural areas.

*Requirement: Explore and enhance the ability of FLOSS solutions to work on cheap, low-powered hardware.*

*Requirement: Improve hardware compatibility with FLOSS through adaptation of both software and hardware.*

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<sup>40</sup> <http://www.schoolnet.na/news/stories/tabletops.html>

## 7 Usability

Another challenge is to improve the usability of FLOSS. This includes making the installation easier, ensuring that all required packages are included in specific distributions or providing an easy route for migration. There is also a generalized lack of FLOSS web-enabled applications, such as content management and publishing systems.

It is important to remove some inefficiencies of FLOSS, especially regarding use by non experts. Often there is a mismatch between developers and users. It should be helpful to work on technical issues which might be less appealing for the developer community, such as producing open source software more focused to the final user and paying greater attention to the usability of the products.

To reduce the difficulties associated with moving to FLOSS (or any new software application, for that matter), Extremadura's regional government offers and distributes pre-packaged sets of FLOSS applications for different user groups, such as students, SMEs or municipal administrations. On a CD or DVD, each of these packages includes the local GNU/Linux operating system, a basic set of general-use FLOSS applications (e.g. OpenOffice) and applications for the target group in question, such as educational software for students or accounting software for SMEs.<sup>41</sup>

*Requirement: Improve usability of FLOSS solutions through interface optimisation and pre-packaging for target audiences.*

*Requirement: Provide easy upgrade paths from legacy solutions, file formats and data.*

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41 See e.g. <http://www.gnulinex.net/web-nueva/> for the SME edition of GNU/Linux.

## 8 Conclusions

Though the requirements have turned out to be fairly similar across the target regions, the situations in Asia, Africa, Latin America and Europe are far from homogeneous, leading to different priorities for different sets of requirements. On the whole, Latin America and, to a certain extent, India and Southern Africa profit from a broad availability of FLOSS applications in Spanish and English, respectively. In Africa in general, infrastructure concerns such as power and connectivity are more pressing, while in India and Cambodia the issue of non-western fonts comes to the fore.

Nonetheless, there is significant common ground between the regions. From the report, it becomes clear that raising ICT skill levels and digital literacy is a key requirement across all target regions for the greater spread of FLOSS. Enabling a large number of successful FLOSS-based businesses will be central to the growth of competitive markets for software and services, with FLOSS support companies being a priority. For these businesses to thrive along with citizens, policy makers will need to build the right sort of environment. The public sector and the education system turn out to be the most promising entry vector for efforts to promote FLOSS as a tool for social and economic development.

*The need for higher levels of FLOSS skills* emerges as a key issue across all areas. Taking a broad perspective, programming abilities are only one element in a much larger puzzle.

The partners report that in the general education systems of the target regions, rote learning methods are still dominant. Applied from an early age, they are one reason why fewer young people become interested in the creative use of ICTs in general and FLOSS in particular than would otherwise be possible. General education should be geared towards encouraging *critical thinking*, and let students learn and practice *problem-solving*.

*ing skills*. The education system is also crucial in helping people to acquire at least *basic technological literacy*.<sup>42</sup>

In these endeavours, FLOSS is not so much a goal, but a tool. The working methods of FLOSS communities frequently serve as a template for efforts to improve general education, as they are deemed to encourage just those abilities in critical thinking and problem-solving.<sup>43</sup> FLOSS allows users, including students, to examine and modify the software to any depth they wish, and FLOSS communities present established and usually well-documented examples of collaborative creativity.

Such changes can only come about if *teachers are properly trained* to integrate FLOSS knowledge and, perhaps even more importantly, FLOSS methods in their work. This implies broad changes both in the education system, where the perception of students would have to change, and in the training of teachers, where curricula would have to be adapted.

As with the rest of the requirements listed here, the implementation of such measures and the subsequent success is a matter of degree. Short of achieving sweeping change, local actors will have to identify the best ways to make inroads into presently deficient situations and improve them bit by bit.

At the university level, *courses in subjects relevant to FLOSS should impart a sufficient level of programming skills in languages used in FLOSS development*. All too frequently, graduates from the target regions do not have sufficient skills to participate in international FLOSS developer communities. One way to change this is to set up *mentored internship programs*, where students can complement a theory-oriented education with practical experience in a real working environment with the help of a more experienced person. Students, including those of a broader selection of subjects, will benefit from a working knowledge of FLOSS methodologies and techniques.

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42 complementing the reports by FLOSSInclude partners, see e.g. Tan Wooi Tong (2004), pp. 18 ff.

43 see Meiszner et al. (2008), Hemetsberger (2004).

Beyond the public education system, trainings are the main route for people to achieve FLOSS skills. Likely participant groups include university graduates looking to broaden their career options; employees of FLOSS-based businesses, which are usually SMEs; or public sector employees, whether IT staff implementing and running FLOSS solutions, or general employees working with FLOSS on the desktop. Other target groups include NGOs and individual users.

Capacity building agencies consider trainings an excellent way to stimulate the growth of a vibrant FLOSS ecosystem in the target regions.<sup>44</sup> While funding from such agencies may be able to seed skills in this way, trainings have to be financially and organisationally sustainable if they are to continue after foreign funding runs out.

It is therefore necessary to *explore and highlight ways in which trainings can become a profitable business model for local entrepreneurs, and to uncover and channel demand for FLOSS trainings in the public and private sector as well as among individuals.*

A person who has acquired FLOSS-related skills in this way (or by any other means) will find it much easier to become an economic participant in FLOSS if she has an easy way to effectively and efficiently communicate her skills, at an affordable cost. This purpose can be served by certification, which needs to be both available and affordable. Designing and implementing such *certification schemes* would make it easier for supply and demand in FLOSS services to come together.

On a non-technical level, languages present a challenge. Local communities operate in local languages, which encourages newcomers to join. But to fully participate in international FLOSS communities, sufficient knowledge of English usually is indispensable. It is necessary to *find technical and social ways of bridging the gap between communities and individuals*

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44 One example is the German capacity building organisation InWEnt ([www.inwent.org](http://www.inwent.org)), which conducts train-the-trainer programs on FOSS both in Vietnam and in Eastern and Southern Africa.

*developing FLOSS in local languages, and international FLOSS communities where English is the lingua franca.*

*Businesses* are at the core of the idea that FLOSS can promote social and economic development. If FLOSS is widely recognised as a profitable business opportunity, then this type of software will have reached a tipping point after which efforts to spread FLOSS become much easier.

To get there, a number of requirements must be addressed. It is necessary to identify approaches to solving the chicken-and-egg problem regarding professional FLOSS support. An option is to provide advice and perhaps incubation to FLOSS support SMEs.

In order to create a truly competitive market for software and services, backers of FLOSS should raise regulatory awareness to unfair trade practices by proprietary software vendors. Not only do such practices impede the development of a local skill base, they also harm the development of a vital ecosystem of FLOSS companies.

The public sector can throw its usually considerable weight as a buyer behind the spread of FLOSS, by establishing channels and platforms where businesses (as sellers of FLOSS services) and public bodies can effectively meet and conduct business. Public support for such an effort can be justified on the basis that FLOSS is a tool for economic growth.

Regarding businesses as users, it is necessary to improve their awareness and perception of FLOSS through multi-strategy marketing efforts. They should be helped to perceive FLOSS as safe, reliable and productive.

The possibility to easily translate applications into any language, without relying on the approval of a vendor, is one of the great advantages of FLOSS in the target regions. With a view towards *localisation*, technical and socio-economic issues again have to be considered jointly, as software and services required need to be tailored to the specific local context in which they are going to be used.

As in other instances, the public sector is a potentially massive user of localised software, and should therefore be looked upon as a key actor in localisation efforts. It would be helpful to develop and make accessible models for FLOSS localisation efforts, based on past experiences. This should include guidelines for government-funded localisation efforts. Before such efforts can take place, it is first necessary to convince those public bodies whose backing is sought of the benefits of fully localised software.

Whether institutionally backed or voluntary, resources for localisation efforts are limited. This makes it necessary to identify priority applications for localisation.

Particularly in Cambodia and India, and generally in South-East Asia, localisation goes beyond the mere translation of applications and documentation. There, FLOSS operating systems and applications must be enabled to handle non-Western fonts. In the same vein, efforts should be made to improve the usability of local-language desktops by ensuring that all relevant packages are included in a distribution aimed at local markets, and that there is an easy upgrade path for legacy content.

For some applications, localisation needs go even further. Administrative software as well as tax and accounting programs are examples of programs which have to be adapted to local laws, regulations and practices in order to be useful.

If FLOSS is a tool for social and economic development, then this tool is often most effective when wielded by local, regional and national governments. Integrated into *policy* strategies, FLOSS stands the greatest chances of making a real difference for social and economic development. Both local and international actors should *raise awareness of FLOSS and its strategic potential among policymakers in the target region*.

Designing and implementing policy strategies for the development of the information society is an extremely complex task. Cooperation with experienced partners helps to achieve high-quality results. It should there-

fore be a priority to *promote international cooperation and exchange between Europe and the target countries on development and implementation of FLOSS-based policy strategies.*

In Europe, much could be gained by *working with donor agencies and international development organisations to ensure that they are able to provide support for the development of FLOSS policy strategies.*

In the target regions, a necessary element of such policy strategies must be to *ensure that curricula in schools and universities integrate FLOSS*, ideally both as a subject and as an inspiration to learning methods. This will help to increase digital literacy, greatly raising the ability of students to contribute to economic growth.

While overarching policies may be difficult to design and time-consuming to implement, there are other measures that the public sector can take.

*Procurement* is one such lever which public bodies can pull, and quite an effective one at that. If public bodies could be provided with guidelines on how to conduct tenders in a manner that allows and encourages FLOSS-based offerings, this would help FLOSS-based businesses to grow.

Fixing public procurement is one way to contribute to the creation of a fully competitive market for software and services, through policies that *encourage FLOSS offerings for public bids*. With the demand thus created attracting businesses, government should also consider a broad set of measures as described in the previous and following sections to encourage a supply of FLOSS services that can satisfy the demand created by improved public sector procurement policies and practices.

Policy makers need information to choose a course of action, and it is up to FLOSS advocacy groups to provide it. *Increasing the capacities of local FLOSS advocacy organisations* to inform policy makers about this type of software and its potential as a policy tool is a highly promising and effective route towards a more widespread use of FLOSS as a tool for social and economic development.

*Interoperability and open standards* are key to a fully competitive market in software and services. They are another area that is clearly within the purview of the public sector. In order for open standards to be used throughout the public sector, governments should be made to *push for the adoption of open standards by the national standards bodies*.

*Open standards should also be used to ensure interoperability where the government uses ICTs to communicate with citizens and businesses*. This is necessary not least to avoid the perception that FLOSS applications are somehow deficient because the government's software has trouble interacting with them.

To speed up and broaden the adoption of open standards, it is desirable to *increase international cooperation between governments interested in using and promoting open standards and interoperability*.

While not directly related to FLOSS, *infrastructure* matters. At the most basic level, computers require electricity to run, and an Internet connection to be truly useful. Both these items present problems in parts of the target regions, in particular in Africa. Here, power cuts are frequent, and connectivity is expensive.

FLOSS solutions designed for the target regions should aim for low power consumption, and should be *able to deal with power cuts* or, where necessary, the lack of electricity from the grid. They should work on *affordable, low-powered hardware*.

In the long term, *network infrastructures* of countries in the target regions need to be improved in order to remove limitations not just on FLOSS, but on the development of the ICT sector as a whole. In the meantime, *creative solutions for dealing with scarce bandwidth need to be found, collected and shared* between the target regions.

It is also important to solve some *usability* deficits of FLOSS, optimising applications for their use by non-experts. Local developers in particular could help to *improve the usability of FLOSS solutions*

*through interface optimisation.* In order to make FLOSS easier to deploy, sets of *applications may be prepackaged* for distribution to various target groups. Such solutions should *provide an easy upgrade paths from legacy solutions, file formats and data.*

The *public sector* clearly emerges as a prime vector for increasing the use, development and deployment of FLOSS in the target regions. This is especially true if the sector is defined broadly, so as to also include educational institutions.

As reported in FLOSSWORLD, public sector organisations that already used some FLOSS overwhelmingly said they would like to use more of it (whether in mixed or purely FLOSS systems), while roughly half of those public bodies that were not using FLOSS said they wanted to start doing so.

For advocacy groups, the public sector is a promising, if difficult target. It is relatively well delineated, with hierarchical structures and established lines of communication, so that in theory it might be sufficient to convince a limited number of high-level staff to engage with FLOSS.

On the other hand, innovation in the public sector often happens in bottom-up ways, as the experience from Europe reflected in the case studies<sup>45</sup> for the European Commission's Open Source Observatory and Repository has shown. This means that interacting with high-level staff might not be sufficient to bring about real and lasting change. While such interaction is necessary, backers of FLOSS must at the same time work to get individuals such as system administrators and architects in the public sector interested in this type of software.

Public bodies are likely to be interested in buying FLOSS services not only due to the fact that their IT budgets are usually lower than in the private sector. Public bodies also have a responsibility to spend taxpayers' money wisely; in this case, this can mean paying for the services of a local SME rather than for software licenses of a foreign corporation. In this

<sup>45</sup> Five years' worth of case studies on FLOSS in the European public sector are available at [http://osor.eu/case\\_studies](http://osor.eu/case_studies).

way, public money is likely to stimulate local economic growth, and generate employment (not to mention higher tax revenues).

Policies on ICT for the use of FLOSS within the public sector should be fruitful in those regions where there is a reliable state of governance and a durable democratic basis, whereas in other regions bottom-up strategies and initiatives regarding technical and socio-economic requirements are likely to be more successful and sustainable.

Public bodies in particular may benefit from the set-up of FLOSS *re-source and competence centres* which provide information that helps them switch over to FLOSS and helps them deal with the challenges of FLOSS implementation. Such centres serve to develop and exchange best practices in the use and development of FLOSS, and to share success stories. They can be set up and run with relatively limited resources, and lead to lower public sector IT costs by helping and encouraging public bodies to reduce their dependence on proprietary software.

An example in the target regions is the online resource portal [www.public-software.in](http://www.public-software.in), set up by FLOSSInclude partner IT for Change. The goal is to collect and share information on conceptual aspects related to FLOSS and also practical details. The resource portal will explain the concept of FLOSS and the advantages of going for FLOSS. It will also provide details of organizations which support, develop and train on FLOSS systems; case-studies of governments which have gone for FLOSS; a user FAQ for users who have recently switched over to FLOSS; discussion forums for FLOSS users in governments and also guides to using FLOSS for documenting in local languages.

While this portal will meet some needs of governments across the country, it will however not serve to meet all the needs of states all across the country. Each state should ideally have its own such portal. We will be suggesting to governments/various FLOSS coalitions to have such portals in other states in the country.

While skills are an important limitation for the greater spread of FLOSS in the target regions, the lack of *awareness* is an even greater hurdle to widespread FLOSS adoption. This could be addressed in part by an effective dissemination of FLOSS success stories throughout the world, in particular in the public sector.

Efforts to raise awareness of FLOSS in the public sector should aim both to inform about alternatives to proprietary software applications, and about FLOSS as a highly effective policy tool.

In relation to the former, the matter of cost usually comes to the fore. Here, the fact that FLOSS users incur no license fees offers a significant advantage. A less well known factor in the calculations for a migration should be the exit costs from both a proprietary and a FLOSS-based solutions. The former is likely to be significant, the latter will be close to zero.

Like people, public bodies take inspiration from their peers. Showcasing *successful instances of FLOSS use in the public sector* is therefore a promising route to move such organisations to consider FLOSS.

Clearly, greater use of FLOSS in the target regions is not an end in itself. Rather, FLOSS should be considered as an important tool in a whole toolkit to enable and promote social and economic development.

The fact that ICTs have become so central not only to peoples' lives, but to the economy as a whole means that FLOSS as a social and economic issue cannot be discussed in isolation. The requirements identified in this report show that FLOSS touches upon number of questions of policy and governance which go far beyond what would commonly be associated with software from a technology-centered point of view. Indeed, technical and socio-economic requirements have turned out to be so closely intertwined as to make it impossible to clearly separate the two categories.

FLOSS is clearly not a silver bullet for the world's ills; no tool is. But this tool, used with wisdom, creativity and courage, can make great contributions to a country's or region's social and economic development.

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