

## National Free and Open Source Software (FOSS) Strategy

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## **A Word by**

### **The Minister of Communications and Information Technology**

Dear Readers,

The leveraging of Information and Communication Technologies in socio- economic development has become a necessity in Egypt. The development of the Open Source Software industry in Egypt will contribute to the achievement of technology independence and knowledge economy benefitting from a balanced ecosystem of IT-producing and IT-using sectors, promoting prosperity, freedom and social equity.

The formulation of the open source software strategy is meant to boost the establishment of a well-developed open source software ecosystem, which will co-exist and compete within the local ICT market with proprietary software. This is to provide space for new businesses that bring efficiency, innovation and maximize the benefits for the public and private ICT communities and consumers in Egypt.

Many challenges may face Egypt in terms of implementing the national open source strategy. As FOSS is still in its preliminary phase of development in the country, the most pressing challenges will touch on the market's uptake, awareness, education, training and business know-how for FOSS start-up companies.

While we are committed to adopt proactive steps and a number of pilot projects for the development and promotion of high quality open source software solutions and services as one fundamental pillar of the knowledge economy, the role of industry and consumers, as well as the educational system ~~is~~ are essential to sustain this new technology on the long run.

Finally, the FOSS strategy is a key component and a step in the Ministry of Communications and Information Technology's mandate to extending the reach of ICT tools to all societal segments, marginalized communities and youth in particular. This is in addition to unleashing the innovative potential of young people and encouraging a transformative and empowering ICT industry, as well as fostering digital citizenship, equity and expanding the role of ICT as a main tool for development and growth. We hope that this document, written in a multi stakeholder spirit- will be a concrete step towards the achievement of these objectives.

## **Acknowledgements**

The Ministry of Communications and Information Technology (MCIT) presents its sincere appreciation and gratitude to the FOSS committee members for the time and effort given to produce the FOSS strategy. The committee members who comprised representatives from academia, civil society and some of the affiliated entities to the ministry have exerted a very special effort in laying down the foundations of the strategy, in conducting discussion sessions, presenting different views, working on reaching compromises and producing the current version of the document which reconciles different interests in view of the national interest of Egypt and its promising ICT sector.

The document comes as a response to the PM assignment to study the adoption of an open source strategy in Egypt for the national benefit of the country. It is also a result of a deep conviction that Egypt, similarly to other developed and developing countries, needs to open to different types of software especially those encouraging easy uptake, innovation and creativity through a well thought strategy and proactive steps in this direction.

MCIT wishes to acknowledge the work performed by Dr Nagla Rizk, (Professor of Economics & Founding Director, Access to Knowledge for Development Centre AUC), and the committee's professional consultant and her team. Dr Rizk and her team have provided valuable insight and support to the committee members and have reflected that on the drafting and redrafting of the document.

The opinions and views expressed in the strategy have resulted from the different rounds of discussions of committee members, as well as from the multiple phases of consultations which included:

- Formation of the multi stakeholder committee
- Formation of MCIT task force
- Identification of the professional consultancy team
- Consultations with civil society
- Consultations with the private sector

Hence, the views expressed in this document do not necessarily represent the personal opinions of the drafting team members.

MCIT wishes to thank members of the internal task force of the ministry and its affiliates for their feedback, ideas and thoughts to enrich the strategy and ensure its feasibility including: the Information Infrastructure Division; the Telecommunications and Resources Division; the Human Development Division, the International Relations Division, Egypt's ICT Trust Fund, the Information Technology Development Authority (ITIDA), the Software Engineering Competence Centre (SECC), the Technology Innovation and Entrepreneurship Centre (TIEC) and the Information Technology Institute (ITI).

Special thanks go to the experts and representatives of civil society, the media and the private sector who contributed by guiding us at various stages of the project.

Finally, we hope that we have succeeded in presenting a clear road map for the uptake of FOSS in Egypt in a transparent and clear manner. We recognize that this document is the first step in a long journey and we hope to have paved the way for that through concrete, practical and effective steps in order to boost the potential of ICTs in Egypt for the benefit of its promising youth.

## **Executive Summary**

Free and Open Source Software (FOSS) is software whose underlying programming source code is freely available to access, modify, and redistribute. This is different from proprietary software where the copyright-holder sets restrictions on its use, copying and distribution.

Although the success to deploy and reap the benefits from FOSS has varied from one country to another, vast experiences have demonstrated that adopting FOSS has potential for strong economic and developmental benefits. The impacts are clearer for developing countries. For example, Malaysia was very successful at one time in reducing costs (80% in licensing fees, 58% in development and consultancy efforts, and 7% in software support services totaling an overall cost reduction of 30.5%).

Targeting these impacts, MCIT has decided to develop the underlying FOSS strategy to support and promote the usage and utilization of FOSS. The strategy has been developed in collaboration with all relevant stakeholders (e.g. NGOs, private ICT companies and other governmental entities).

Adopting open source technologies on the large scale will not compete with the current ICT industry ecosystem based on the proprietary software. On the contrary, it will contribute to the growth of the overall ICT industry and establish a new developmental FOSS ecosystem, which will co-exist within the local ICT market. This will provide space for new businesses that bring efficiency, innovation and maximize the benefit for the public and private communities in Egypt. The gradual migration of existing ICT services to Free and Open Source Software in coexistence within the current ICT market is recommended as the power of integrating multiple ecosystems in the local ICT market will create a new hybrid ICT models which will reflect positively on the Egyptian ICT market and directly promote GDP growth and overall development.

Based on this, it should be emphasized that the ultimate target is not to replace proprietary software by FOSS, but to incubate the growing FOSS-based industry in Egypt and to achieve mutual coexistence, align, and compliment usage of both FOSS and proprietary software so as to raise productivity, improve competitiveness, and enhance the overall economic and social wellbeing of citizens in Egypt.

The projected vision of the proposed FOSS strategy is to build a well-developed knowledge society that benefits from a healthy ecosystem of IT-producing and IT-using sectors. The mission is to promote the development and adoption of high-quality open-source software solutions and services as one fundamental pillar of the knowledge society. The expected benefits are classified into four areas: human development (e.g. decentralization and democratization of Knowledge, maximizing the potential for self-development and learning), economic growth (e.g. equalizing market competition and reducing total cost of ownership), social development (e.g. localization and Arabization) and national security.

There are eight strategic objectives: ensure access to knowledge to all citizens; improve efficiency and transparency of the public sector; harness the development of the ICT sector and foster a competitive environment; ensure efficient budgeting and reduce unjustified pending on IT solutions; technology independence; build a sustainable FOSS community encompassing both users and developers; encourage and support ICT small and medium enterprises (SMEs) in FOSS utilization; and finally, raise public awareness about FOSS and promote an open-culture concept to different sectors in the society.

Achieving the strategy objectives requires eight enablers: ensure high level of leadership coordination; construct policies that support FOSS use and development as part of the broader ICT strategy; promote FOSS use in public sector agencies; conduct and expand educational and training activities to build competitive FOSS supply capacity; develop a capable infrastructure for FOSS adoption; secure a proper, sufficient and continual funding; empower ICT SMEs; and collaborate with civil society.

The underlying FOSS strategy is intended to support and promote the ICT industry in Egypt. It includes the identification of significant quantified targets for the stated objectives, to be subject to annual revision. It also sets

the stage for further elaboration and regular update and expansion. Meanwhile, the strategy sets quantified achievements for its performance indicators, which includes identifying Egypt's governmental single point of reference for FOSS, establishing Egypt's web-based FOSS assets library, five-year doubling of the size of the FOSS ecosystem including the number of ICT SMEs utilizing FOSS technologies, training a minimum of 1000 professional trainees per year, executing a minimum of 3 three yearly national public procurements targeting development of FOSS-based solutions and services based on market need, and establishing a minimum of two yearly national programmes to assist and advise the ICT industry on FOSS development.

# **1. Free and Open Source (FOSS): A Shift in Philosophical Paradigms**

## **1.1. What is FOSS?**

Free and Open Source Software (FOSS) is a software whose underlying programming source code is freely available to access, modify, and redistribute. This is different from proprietary software where the copyright-holder sets restrictions on its use, copying and distribution. Whereas proprietary software is outlined in a licensing agreement that typically does not allow the free distribution, modification or inspection of the software. FOSS is a product that is developed and improved through the collaborative efforts of volunteers within a network. Hence, it offers an additional form of knowledge production based on peer collaboration and community-based innovation. The next paragraphs highlight the pillars behind the philosophy of FOSS as a technological, economic and political paradigm to be encouraged alongside existing proprietary software models to foster a healthy ecosystem in the software market in Egypt.

## **1.2. Why FOSS**

In general, adopting FOSS has strong economic and developmental benefits. These become apparent in the case of developing countries. Below is an overview of the benefits pertaining to FOSS in terms of human development, economic, and social impact. This reflects the philosophy behind promoting FOSS in Egypt.

### **1.2.1. Human Capital Development and the Potential for Self-Development and Learning**

FOSS can have a prodigious potential of spearheading human capital development. Software developers engaging in open source development enhance their own capacity as they simultaneously develop their professional skills. This is especially useful for developing countries, as funds for training are limited, hence open source programmers can concurrently work freely on varied projects, gain multitude of skills and build experience through networking, learning and motivation.

Learning from FOSS can be extended from self-learning of the core group of software developers to entrepreneurs developing businesses around FOSS, as well as to the ultimate end user who learns to use an additional tool.

### **1.2.2. Decentralization and Democratization of Knowledge**

One of the foremost benefits of FOSS is its platform as a source of knowledge liberalization and democratization. At the heart of FOSS is the concept of building new ideas through knowledge sharing. The participatory aspect of FOSS allows the democratization of knowledge, as more users are given the opportunity to equally contribute to knowledge production. In this way, FOSS provides the potential for developing local businesses built around this pool of shared knowledge to generate revenue in return for value added through services such as customization. FOSS also has the potential of eliminating software piracy as it offers an affordable legal alternative, providing prevention as means of saving resources directed to fighting piracy. Moreover, FOSS provides a strong potential for control over data ownership and management, which provides national users better control over their own knowledge.

### **1.2.3. Localization and Arabization**

On another level, FOSS provides potential for localization, offering opportunities for customizing applications to suit the local business culture. Such localization will be beneficial for local capacity building and establishing a knowledge base grounded in indigenous resources that address local needs.

Along with the benefits of localization are advantages that come from widening the scope for the creation and use of Arabic software. From an economic point of view, localization would expand

the market for Egyptian software designers who would be able to sell and produce Arabized products not only to the local, Egyptian, markets but also to the overall Arab region. From a social perspective, expanding the use of specialized Arabic content software would allow for a greater margin of knowledge accessibility to the region with implications on the educational, creative and human capital development. Such software would allow for the cataloguing and organization of Arab based knowledge structures, creation and history that would allow the Arab region, and most importantly Egypt, to harness its own creative abilities for change and development.

#### **1.2.4. National Security**

Openness is essential for the security of software systems. This is particularly true from the point of view of users of technology who are allowed the ability to perform independent examination of each and every software system they use. In such circumstances, open source systems offer an unparalleled opportunity for collaborating on scrutinizing systems and improving their security and quality. Furthermore, when adopting open-source software, an organization is more able to comprehend software-related security aspects and to participate in the maintenance of its security by incorporating its own security processes

The above holds despite the concern that scrutiny enabled by openness might be abused by malicious users, as they would have the opportunity to find and exploit weaknesses in such an open system. However, many experts have observed that the long-term effect of public scrutiny, offered by open source systems, results in improved security.

#### **1.2.5. Equalizing Market Competition**

FOSS offers a paradigm shift as it sets different intellectual property rules that provide an alternate open source licenses model which enhance the innovation & and enables the improvement of software production. FOSS presents an alternative business model, one that depends more on identifying the differentiating factors for companies, and collaborating on the non-differentiating ones. Profit remuneration comes through the technology that differentiates the company and hence sets a certain product apart. In the case of FOSS, this would be the customized product. As such, FOSS opens the door for new players to engage and proliferate, widening the market pie rather than taking over the slice of existing businesses. This allows for a larger software market and a broad based economic growth possibilities.

Adopting open source technologies on the large scale will not compete with the current ICT industry ecosystem based on the proprietary software. On the contrary, it will contribute to the growth of the overall ICT industry and establish a new developmental FOSS ecosystem, which will co-exist within the local ICT market. This will provide space for new businesses that bring efficiency, innovation and maximize the benefit for the public and private communities in Egypt. The gradual migration of existing ICT services to Free and Open source software in co-existence within the current ICT market is recommended as the power of integrating multiple ecosystems in the local ICT market will create a new hybrid ICT models which will reflect positively on the Egyptian ICT market and directly promote GDP growth and overall development.

A balanced ecosystem of a software industry, therefore, will involve the diversity of both open source and proprietary models. In acting as a catalyst, the government will ensure leveling the playing field for all product types that would encourage healthy competition and promote overall growth.

#### **1.2.6. Total Cost of Ownership (TCO)**

Arguments exist for and against TCO being lower in the case of FOSS than it is for other options. This holds especially as the cost of and benefit from investing in software extend beyond the direct acquisition costs and financial returns to include factors such as non-acquisition related

costs, training costs, and assessment of long term versus short term benefits, as well as individual, firm and societal returns. The components of costs and returns of investment in software vary depending on the type of software, the nature of the cost and the type and term of return.

Regardless of the net effect, the fact remains that FOSS allows savings from what would otherwise be payments for licenses and outsourced customization and problem solving services. Moreover, FOSS entails higher retention and internal distribution of funds. Returns on FOSS investments are also high in terms of self-learning and human capital development; only they are reaped in the long term, are hard to measure and do escape basic quantitative calculation of the total cost of ownership if seen as direct acquisition costs.

### **1.2.7. FOSS and Economic Development**

In light of the above, FOSS promises a positive contribution to the software ecosystem of developing countries who are keen on expanding their markets, diversifying their technology base and developing their indigenous capacity and local human capital. The human development, economic growth and social development promised by FOSS would greatly benefit a developing country like Egypt in both its short terms goals (such as its national security and cost efficiency aims) while at same time help it reach its longer-term aim: economic growth and development. Developing a healthy eco-system for software allows the use of both FOSS and proprietary software in the market to ensure healthy competition and positive contribution of all products.

### **1.2.8. Success Stories from other Countries**

There are lessons to be learned from the experience of other developing countries that have promoted FOSS in their respective software ecosystems and managed to achieve success stories.

For example, through promoting FOSS, Malaysia was able to reduce costs significantly by 80% on licensing fees, 58% in development and consultancy efforts and 7% on software support services totaling an overall cost reduction of 30.5% in 2006. It was also able to proliferate a knowledge society on a large scale through engaging with civil society, providing training and support that was not only technical but also business oriented, carefully choosing pilot projects to hedge the community and mobilize its forces for larger scale production.

Other countries with successes include India, where the localization of IT solutions and programs brought knowledge and general education platforms to the disenfranchised poor in the country's 22 different languages. There have also been successes realized by developed countries such as the United States of America (USA), the United Kingdom (UK) and Australia.

Nevertheless, implementing FOSS has not gone without challenges, and successes of countries like Brazil and South Africa were not as pronounced. Details on the experience of selected developed and developing countries - the successes and the challenges - are provided in the Annex.

## 2. **Vision, Mission, and Strategic Objectives**

The above philosophy is behind the **vision** of the current FOSS strategy:

“Building a well-developed knowledge society that benefits from a balanced ecosystem of IT-producing and IT-using sectors, and promotes prosperity, freedom and social equity”.

Within that, our **mission** is:

“To promote the development and adoption of high-quality open-source software-based solutions and services as one fundamental pillar of the knowledge society so as to raise productivity, improve competitiveness, and enhance the overall economic and social well-being of citizens in Egypt.”

Within this framework, the following **objectives** and **enablers** were drafted to highlight the most vital factors to promote the FOSS strategy.

The suggested objectives are identified based on different sources: (i) information collected specific to the national context; (ii) FOSS initiatives of a number of developed and developing countries; and (iii) generic research in Information and Communication Technology (ICT) with a special focus on FOSS adoption.

Furthermore, these objectives are congruent with those of Egypt’s ICT strategy of 2013-2017, especially concerning:

- Supporting a democratic transition
- Promoting digital citizenship and information society
- Promoting sustainable development
- Strengthening the national economy

FOSS adoption aims to reach the following eight objectives:

### 2.1. **Ensure Access to Knowledge to all Citizens**

FOSS movement empowers masses. This is because it facilitates access to sharing of a variety of local and global knowledge (cultural, political and scientific) in a convenient manner through the use of portable devices, such as, mobiles, tablets and laptops. It is also affordable as it does not necessitate payment of licence fees. In addition, FOSS enables knowledge management and building low cost sustainable institutional repositories. Every individual hence has the right to acquire tools, resources, and services for accessing, disseminating and developing knowledge and insight. Knowledge liberalization would ensure the inclusion of the poor and illiterate in the transition to a knowledge society, which in turn bridges the digital divide within Egyptian local communities. Accordingly, FOSS adoption enables shared ownership of intellectual resources, which in turn accelerates learning, innovation, entrepreneurship, as well as social and economic development.

### 2.2. **Improve Efficiency and Transparency of the Public Sector**

Promoting FOSS in the public sector enables the creation of effective service delivery platform and allows for universal access to a single window that provides online government services through various media. Citizens would be able to have the option of accessing public services through alternative platforms, while the government would be able to provide such services in an efficient and cost effective manner. Furthermore, the availability of the source code expedites the process of detecting and eliminating security risks, bugs and errors, and increases confidence in the trustworthiness of such software. In addition, better safety of public and personal data is guaranteed, as well as operational security of information systems in state administration bodies.

In this context, adopting open standards will enable interoperability, which in turn facilitates knowledge exchange and information sharing, and ensures coherent and sustainable IT solutions.

FOSS, therefore, would be useful in decreasing the barriers of digitization across public sector agencies. This would increase the efficiency and quality of business processes in the public sector as it ensures reliable information and support for decision-making and better-targeted public policy.

Moreover, open public data is an important digital resource since it creates better and smarter public sector information and services. Ensuring free and reliable access to complete and timely public information content would strengthen the collaborative governance model, where building trust resonates with the multi-stakeholder approach to policy development; an essential act reflecting a transparent and democratic government.

### **2.3. Harness the Development of the ICT Sector and Foster a Competitive Environment**

Since there is room for growth of the software industry in Egypt, FOSS development could present an opportunity to stimulate this sector. Introducing open source software to the market as an additional player would increase the competitive landscape of the entire software industry in Egypt. This improves quality and gives customers a better position in negotiating contractual terms.

The growing expertise of Egyptian software firms could also open opportunities to boost software exports and position Egypt's software industry as a foreign exchange earner. Moreover, since Egypt is among the countries that attract IT outsourcing, further revenues could be generated from open-source related services.

Introducing FOSS as alternative software systems would therefore increase efficiency and foster competitiveness of Egypt's software industry.

### **2.4. Ensure Efficient Budgeting and Reduce Unjustified Spending on IT Solutions**

As mentioned earlier, software acquisition is not the only cost item required for the implementation of any system; other issues should be equally considered, such as training, hardware, customer support, maintenance, future expansion, etc. In the case of FOSS, the financial resources saved as a result of the reduction of replication costs of IT solutions could be directed towards other projects, such as training IT staff in open source support and development. Further costs could also be saved as many FOSS programmes now depend on migrating to cloud computing. Therefore, the objective of FOSS adoption should not be to use FOSS because "it is cheaper"; rather, the aim is to ensure that budgeting and spending decisions are taken and executed in the most efficient and cost-minimizing way.

To conclude, public and private sector agencies should rationalize their resources and provide a proper explanation of why they chose to adopt a certain type of software. Particular attention, subsequently, should be given to: (i) the cost of maintenance, support, and training; (ii) the cost of needed storage, infrastructure, and deployment model (e.g., cloud, server based, etc.); and (iii) the cost of future expansion.

### **2.5. Achieve Technology Independence**

Moving towards open standards and FOSS will alleviate the problem of vendor lock-in. Allowing for alternative forms of software platform provides a robust business environment. It offers users the flexibility to switch at any time to another supplier or service provider without worrying about changing the software currently being used. Avoiding vendor lock-in would increase freedom of choice regarding software usage; companies would possess the freedom to select and compare between different systems and choose the one that best fits their necessities and requirements. They would ensure that their data and software can be accessed across different platforms.

In addition, users could have a wider support options from the FOSS community, where many people are willing to help and assist at any implementation stage. Furthermore, the availability of the source code enables developers to customize the software as desired to ensure its compatibility with laws,

regulations, business processes and procedures specific to each business or to the entire national context: a key move towards content localization.

## **2.6. Build a Sustainable FOSS Community Encompassing FOSS Users and Developers**

Human resource development through FOSS would narrow the gap between Egypt's industry development and that of more advanced countries. Self-learning and local IT skills development could be further enhanced through sharing ideas and mutual experiences with international developers. Building and sustaining a local FOSS community would also expand the horizon for mutual benefits with African and Middle East countries with regards to sharing and collaborating in FOSS initiatives and research. The open nature of the FOSS movement would also foster collaboration among firms, improve further human capital building and enhance project management skills.

## **2.7. Encourage and Support Small and Medium Enterprises (SMEs) in ICT Utilization**

It is important to build an FOSS ecosystem to maintain comprehensive exchange of information and best practices in business and entrepreneurship. FOSS could be of special interest to entrepreneurs and small businesses, particularly those that have limited capital. This would contribute to the strengthening of the national economy and sustainable development in two ways: it would support SMEs to increasingly rely on information in conducting their business processes, and it would create a nascent infant industry that serves local needs and is able to export its products. Promoting SME's based on FOSS is seen as part of a national commitment to promote entrepreneurship and SMEs in the ICT sector, and indeed in the whole country.

## **2.8. Raise Public Awareness about Open Source Solutions, and Promote an Open Culture Concept to Different Sectors in the Society**

Raising awareness about the benefits and uses of FOSS is seen as part of furthering the understanding about ICTs, knowledge and development, and creating a culture of flexibility and openness to alternatives. This includes raising awareness about issues related to intellectual property, types of license agreements, digital content, scientific and media publishing, among others. This would specifically target resistance to change, and acceptance of a wider pool of options open to the market and to society.

The government will play a pivotal role in facilitating this process, in partnership with the civil society, academia, the public sector, computer software organizations, FOSS advocates, the private sector, and development partners. Promoting FOSS practices could also take place through frequent reports on FOSS-related material in formal government publications, as well as through conducting relevant meetings and conferences on local, regional and international levels.

### **3. Strategic Enablers**

There is an increasing interest in outlining and setting a conducive environment for FOSS. After a thorough review of FOSS strategies in a number of developed and developing countries, the following insights were concluded:

- Developing countries focus on establishing an enabling foundation that includes: building an FOSS-oriented human capacity and shaping relevant legal policies; whereas developed countries - being relatively more developed in this regard - shift their attention to further advanced issues such as, migration strategies, and new procurement and coexistence issues.
- In some cases (e.g., Malaysia, Saudi Arabia, and Vietnam), forming a responsible body is highly acknowledged since the early phases of FOSS adoption projects. This would ensure a single point of reference for coordinating and facilitating FOSS development and implementation.

The enablers identified below are based on case studies in the mentioned countries, the initial national FOSS strategy draft, and interviews conducted with key players in software adoption in Egypt in both private and public sectors. These enablers attempt to address both demand and supply in FOSS adoption in Egypt.

It is essential to identify a leadership body to act as “Egypt's Governmental Single Point of Reference for FOSS”. This body would play an active role especially at the early stages of fostering FOSS adoption in order to create an ecosystem that advocates open source culture.

#### **3.1. Ensure High Level of Leadership and Coordination**

The adoption of the strategy should have a key leadership role, not only in acting as a focal point for the plan, but also in orchestrating the strategy among all stakeholders and ensuring its smooth implementation.

An Egypt's Governmental Single Point of Reference for FOSS (ESPF) would be in charge of a number of tasks required in FOSS projects. These include:

- Ensuring consistency and standardization among all initiatives;
- Creating and managing a center of excellence to provide consultation and support;
- Developing and promoting a set of key performance indicators (KPIs) for FOSS adoption;
- Shaping public-private partnership strategies based on win-win business models;
- Addressing challenges that could arise at any stage of implementation;
- Conducting regular monitoring and evaluation of the strategy application;
- Performing updates and corrections whenever and wherever it is required;
- Documenting and disseminating best practices.

Most importantly, ESPF will ensure that all FOSS initiatives and stakeholders are directed towards a common goal. Further roles could be to coordinate initiatives and activities with governments and NGOs in the Arab and African regions as well as internationally.

#### **3.2. Construct Policies that Support FOSS Use and Development as Part of the Broader Information and Communication Technology (ICT) Strategy, and Ensure its Linkage with the Overall Development Agenda of Egypt**

An enabling business environment is essential for all players in the market, requiring. Vision of current regulations and policies affecting ICT pinpoint in overlaps, and contradictions among different regulations. Reviews are to involve laws related to software adoption, procurement, usage and development. This necessitates a revision of some laws such as those concerning public bidding and auction, communication, freedom of information, intellectual property rights, and investments laws.

Hence, it is crucial to conduct a study investigating the effect of the current laws on implementing the current strategy. Such study would also define the areas where new laws/policies are needed and

whether amendments of some of the existing laws need to be made. As an example, it is recommended to incorporate clear procedures regarding software procurement in the procurement and auction law number 89 for the year 1998, and to include a specific section related to ICT acquisition. In addition, it is important to develop a system that provides no procedural barriers to the adoption of open source products and that considers different business models and supply chain relationships prevalent in the open source sector.

As well, the guidelines for FOSS implementation policies are to be clearly stated and published to foster competition and to facilitate leapfrogging into open-standard technologies.

### **3.3. Promote FOSS Use in Public Sector Agencies**

As a step towards diversification, the government could act as a consumer to drive demand for open source solutions. This could take place through a large-scale public procurement plan targeting the inclusion of FOSS-based solutions and services within the government choices. The selection of these solutions is to be based on the fulfilment of a number of predefined measures (e.g., functionality, total cost of ownership, risks, reuse, flexibility, stability, etc.). In-depth study of the different options – FOSS and otherwise, would result in well-informed choices. The selection of the new FOSS systems should also ensure their interoperability with existing proprietary systems, and consider the required changes in procedures and business processes paying particular regard to the different business models, as well as the relationships throughout the entire supply chain.

Managing change in the bureaucratic and static public sector atmosphere constitutes one of the main challenges in adopting open systems. Public agencies must be committed in educating and re-training their personnel to improve their FOSS competency. It is also vital to ensure that the Arabic language is used whenever and wherever possible in the software applications to guarantee ease of usage and communication for government personnel and the public at large.

Promoting open source practices to different sectors and agencies could be achieved through a careful selection of pilot projects to try out FOSS policy, and the introduction of FOSS to users who would likely be enthusiastic about trying new products. Other important factors in this vein are developing, publishing, and circulating FOSS implementation/migrations guidelines. This is in addition to hosting a number of workshops for government CIOs and FOSS civil society to discuss the FOSS strategy, implementation/migration guidelines, the national projects, infrastructure problems and others.

Embedding an open source culture of sharing, reuse and collaborative development across the government and its suppliers would definitely strengthen FOSS diffusion throughout governmental agencies. A Web-based FOSS assets library(Knowledge Bank) should be built for agencies implementing FOSS to register their initiatives, and for management to record predefined reuse policies and processes. The knowledge bank would also serve in providing technical and administrative guidance to governmental agencies that consider FOSS implementation, and in diffusing good practices throughout public administrations. In parallel, the government can build teams of interested personnel to play as advocates for any FOSS project, and encourage them to open collaboration channels with NGOs involved in FOSS practices in Egypt and in the regions to guarantee growth and sustainability of the sector.

### **3.4. Conduct and Expand Educational and Training Activities to Build Competitive FOSS Supply Capacity**

In order to encourage the adoption of FOSS in the public and private sectors, the government recommends paying more attention and allocating resources for FOSS R&D activities, as well as FOSS business entrepreneurs. Research centres could contribute to developing nascent scientific and expert skills capable of creating domestic software - especially with regards to the youth - and expanding educational dimensions through Training of Trainers (TOT) workshops and courses (including educators of learning institutions that cover all educational levels). Intensive training

sessions on FOSS business models could also be provided to ensure that trainers and developers attract additional capacity-building partners.

In addition, it is recommended to introduce structured FOSS programmes in school IT labs, equipped with various electronic media for relevant subjects and grades. This would be done for primary, secondary and tertiary education levels. The IT course of study needs to be implemented at a much more intense level avoiding lifelong vendor lock-in by teaching skills to students rather than limitation to specific applications.

For universities, it is important to include open source software in the curricula at the undergraduate and post-graduate levels. It will also be vital to establish an open source section in faculties of computers and information sciences & engineering. Graduates could have necessary qualifications that meet market needs, emphasizing practical industry experience through organizing internships, sponsoring graduation projects and incubating some of them. Additional support could also be provided to rely on open source software products as tools for teaching/learning and research, and to encourage the exchange and sharing of materials and experiences among schools, universities and other educational institutions.

Furthermore, an educational action plan should identify the part that will be played by different categories of stakeholders, i.e. users, developers, researchers, trainers, education institutions, research centre managers, and consultants. FOSS training could further expand to be embedded in the working environment of other professions in the society (journalists, public sector employees, medical experts, developers, management experts and others).

### **3.5. Develop a Capable Infrastructure for the Adoption of FOSS**

As mentioned in the 2012 UNCTAD report: “(An) important general (FOSS implementation) enabler (is) the widespread use and adoption of the Internet and increasing bandwidth opportunities, coupled with the transition towards knowledge -based economies.”

It is important to evaluate the current status of IT and other related infrastructure capabilities in different public and private sectors, especially SMEs. Such assessment would take into account the volume and pattern of use, evaluate their readiness for the adoption of FOSS and identify gaps and needs. IT Infrastructure assessment encompasses different technology aspects, such as servers, operating systems, databases, software applications, and networking systems. A primary step in this regard is to investigate opportunities for the widespread use and adoption of the Internet and the increase of bandwidth and broadband services, coupled with the transition towards knowledge-based economies. Moreover, the possibility for content and software localization (Arabization, compatibility with Egyptian laws and business processes, etc.) could be researched as well.

Further studies are also to be conducted to investigate the possibility of allocating one of the infrastructure running governmental cloud computing to be based on FOSS technologies over the three cloud service levels: Software as a Service (SaaS), Platform as a Service (PaaS) and Infrastructure as a Service (IaaS). Undoubtedly, in case of migration to cloud computing, information security should be a pivotal factor that requires specific considerations.

Aligning broadband, cloud, and FOSS strategies would evidently increase the opportunities for the widespread use and adoption of FOSS.

### **3.6. Secure a Proper, Sufficient, and Continual Funding in Place to Support the Strategy**

Implementing FOSS strategy requires the shaping of a suitable funding plan. For the primary phase of implementation sufficient funding should be secured and appropriated for at least the first five years so that it adequately covers its many activities which include training, coordination, awareness raising, sponsoring national projects in the public sector, and monitoring and evaluation activities.

Furthermore, funding schemes would then need to be researched and discovered for the strategy's sustainability.

Besides the main budget allocated from the government as well as from possible special MCIT programs provided by Information Technology Industry Development Agency (ITIDA), funds could also be obtained from: (i) gifts, economic, scientific and cultural endowments; (ii) contribution and support from the private sector including multinational companies such as IBM, Google, Oracle, Intel, HP, etc.; and (iii) support from regional and international organizations (e.g., European Commission, United Nations, International Development Research Centre (IDRC), etc.). Other sources could also be considered from providers of FOSS sales and support services, and revenues that could be generated from early FOSS adoption projects.

### **3.7. Empower Small and Medium Enterprises (SMEs) Operating in ICT Industry**

Some Egyptian software companies rely on FOSS components especially applications related to Web development. Nonetheless, such activities are still scattered and individually driven, which threatens their continuity and limits their expansion as a consistent industrial mainstream.

Therefore, in order to reach a sustainable development and use of FOSS on a national scale, it is very important to provide a motivating environment for SMEs that provides ICT solutions to offer their customers services based on open standards. A number of activities could be performed in this regard, e.g. provide a private sector and community registry platform, raise awareness about several FOSS aspects (e.g., value, possible business models that fit the Egyptian context, success stories, legal property rights and various licenses), stimulate SMEs to communicate and take part into the international movement of FOSS development, offer tax breaks, investigate the possibility of including SMEs FOSS providers in government procurement contracts, provide assistance and advisory in FOSS-related national projects, conduct competition with valuable rewards and build incubators for FOSS related development. The government will play a moderating role through building committees that link entities in charge of ICT development with SMEs to initiate their support. Publishing periodic publications directed to SMEs could serve to inform SMEs of the different FOSS support services and motivating policies.

Special interest is to be directed towards young Egyptian entrepreneurs, who are increasingly penetrating the market. These represent a promising opportunity for growing FOSS industry since they possess the knowledge and access to information, as well as the flexibility to change their business practices. It is important to include FOSS entrepreneurs within the activities of MCIT programs provided by Technology Innovation and Entrepreneurship Centre (TIEC), Information Technology Industry Development Agency (ITIDA) and Information Technology Institution (ITI).

### **3.8. Collaborate with Civil Society**

Collaborating with civil society can take shape in two forms. First, there are few groups and NGOs that are already working in projects utilizing FOSS and promoting its adoption in Egypt. A case in point is "Open Egypt" NGO that brings together FOSS community in Egypt. Moreover, the Arab Digital Expression Foundation has been active in promoting FOSS applications, especially among youth. Other groups such as the Association for Freedom of Thought and Expression (AFTE) and the Egyptian Initiative for Personal Rights (EIPR), among others, have been promoting freedom of information and access to knowledge in general, which naturally includes advocacy for FOSS adoption.

Second, civil society groups can serve as a source of demand for FOSS. Working in other fields of advocacy and not necessarily access to knowledge, civil society represents an important market for businesses built around FOSS.

#### **4. Key Performance Indicators for Enablers**

The following metrics are some of the suggested KPIs for measuring the enablers that ensure a proper implementation of the national FOSS strategy.

<b>Enabler</b>	<b>KPI</b>	<b>Target</b>
<b>Enabler 1: Ensure High Level of Leadership Coordination</b>		
	Identification Egypt's governmental Single Point of Reference for FOSS	Identification declared
	Number of FOSS advocacy/awareness event/meeting	3 per year
	Number of FOSS strategy implementation reports	4 per year
	Number of partnerships/relationships with reputable, worldwide FOSS entities	2 in the first year with 1 more every year
<b>Enabler 2: Construct Policies that Support FOSS Use and Development as Part of the Broader Information and Communication Technology (ICT) Strategy, and Ensure its Linkage with the Overall Development Agenda of Egypt</b>		
	Number of FOSS implementation/migrations guidelines/best practices to be circulated in the Egyptian ICT Community	One new version released every year
<b>Enabler 3: Promote FOSS Use in Public Sector Agencies</b>		
	Number of national public procurements targeting development of FOSS-based solutions and services based on market needs	Minimum of 3 per year
	Size of Egypt's web-based FOSS assets library	Established & maintained
	Number of workshops for government CIOs and FOSS civil society to discuss the FOSS strategy, the national projects, infrastructure problems, etc.	2 workshops / Year
<b>Enabler 4: Conduct and Expand Educational and Training Activities to Build Competitive FOSS Supply Capacity</b>		
	Number of institutes/training providers delivering FOSS-related educational/training courses	Increase by 20% per year
	Number of FOSS-related educational/training courses/tracks	Increase by 20% per year
	Number of FOSS trainees	Minimum of 1000 trainees per year
<b>Enabler 5: Develop a Capable Infrastructure for the Adoption of FOSS</b>		
	Size of governmental IT infrastructure dedicated to running FOSS	As needed
	Number of running FOSS enterprise application software	One of the infrastructure running cloud computing sponsored by MCIT will be based on FOSS
<b>Enabler 6: Secure a Proper, Sufficient and Continual Funding in Place to Support the strategy</b>		
	Budget size	enough to achieve the other targets
	Number of sponsors	enough to achieve the other targets
<b>Enabler 7: Empower Small and Medium Enterprises (SMEs) Operating in ICT Industry</b>		
	Number of SMEs utilizing FOSS	Increase by 20% per year
	Number of national programmes to assist and advise the ICT industry on the development of FOSS-based solutions and services based on market needs	Minimum of 2 per year
<b>Enabler 8: Collaborate with Civil Society</b>		
	Number of NGOs involved in FOSS	All software-related NGOs by end of second year
	Number of NGOs collaborations	Minimum of 2 per year

## 5.High-Level Action Plan

The action plan should comprise short, medium, and long-term phases. It is recommended to develop a complete FOSS strategy ahead of setting the final action plan, notwithstanding the direct approaches hereunder could be employed in parallel with the preparation of the strategy. Once such strategy is finalized, amendments on short-term steps as well as development of a medium and long term action plans should be considered and embraced. The specified tasks and expected completion times are preliminary estimates; further discussions are to be conducted to reach a more accurate and final conception.

It is worth noting that the tasks - or direct approaches - stated below should not lead to a narrow scope limiting FOSS implementation to specific pilot projects; to the contrary, the aim is to view them as initial building blocks in a broader FOSS adoption over a national scale.

Action Plan for FOSS Strategy												
Short term												
Action	Mth. 1	Mth. 2	Mth. 3	Mth. 4	Mth. 5	Mth. 6	Mth. 7	Mth. 8	Mth. 9	Mth. 10	Mth. 11	Mth. 12
<b>Enabler 1: Ensure High Level of Leadership Coordination</b>												
Identify “Egypt’s Governmental Single Point of Reference for FOSS”												
Determine the main responsibilities of each, and specific goals related to time, communication and reporting protocols												
Organize events/meetings with government, public, and private stakeholders to advocate for FOSS strategy												
Develop a quarterly status report about FOSS strategy implementation												
Establish and maintain partnerships/relationships with reputable worldwide FOSS entities experienced												

in the identified FOSS potential areas in Egypt												
<b>Enabler 2: Construct Policies that Support FOSS Use and Development as Part of the Broader Information and Communication Technology (ICT) Strategy, and Ensure its Linkage with the Overall Development Agenda of Egypt</b>												
Revise current ICT policies and related law articles relevant to FOSS adoption (e.g., laws related to competition, IP, state bidding and acquisition)												
Identify laws and policies to be changed and determine their expected implications												
Develop a guiding FOSS policy												
Formulate a final version of the revamped laws and policies												
Create and publish FOSS implementation/migrations guidelines/best practices to be circulated in the Egyptian ICT Community												
<b>Enabler 3: Promote FOSS Use in Public Sector Agencies</b>												
Issue and supervise the implementation of national public procurements targeting the development of FOSS-based solutions and services based on market needs												
Establish and maintain Egypt's web-based FOSS assets library												
Conduct an assessment of the goals of pre-selected pilot projects and the resources required for												

reaching them. Based on this assessment, further decisions are to be taken (e.g., project's budget and scope, software and hardware selection, people involved, possibility of Arabic language content, etc.)													
Publicize piloted projects													
Develop a clear plan for each pilot project													
Conduct a periodic evaluation on each project's progress													
<b>Enabler 4: Conduct and Expand Educational and Training Activities to Build Competitive FOSS Supply Capacity</b>													
Investigate institutions that could provide different FOSS courses													
Determine courses to be offered in schools, universities, and other sectors													
Perform a study to conclude capacity and quality of training courses, and to match courses with institutions according to pre-set policies													
Decide on the business models to be shaped with industries to promote FOSS use in graduation projects													

<b>Enabler 5: Develop a Capable Infrastructure for the Adoption of FOSS</b>													
Evaluate the current status													

of IT infrastructure in Egypt to assess readiness for the adoption of FOSS in the public and private sectors as well as for individuals													
Investigate opportunities for the widespread use and adoption of the Internet and increasing bandwidth													
Identify infrastructure requirements for FOSS implementation													
Research the possibility for content and software localization (Arabization, compatibility with Egyptian laws and business processes, etc.)													
Study the ability to develop FOSS through Cloud computing over the three cloud service levels: Software as a Service (SaaS), Platform as a Service (PaaS), and Infrastructure as a Service (IaaS)													
In case of migration to cloud computing, investigate and research information security and decide on specific considerations													

<b>Enabler 6: Secure a Proper, Sufficient and Continual Funding in Place to Support the strategy</b>													
Conduct a study to													

estimate the budget for the primary phase of implementation												
Research other funding opportunities from different resources (consider expected amounts and preferable projects)												
Write proposals for funding opportunities from international donors												
Analyze ways for joining regional and international initiatives and projects												
Participate in regional and international forums and conferences												
<b>Enabler 7: Empower Small and Medium Enterprises (SMEs) Operating in ICT Industry</b>												
Determine the number of ICT SMEs utilizing FOSS												
Establish national programmes to assist and advise the ICT industry on the development of FOSS-based solutions and services based on market needs												
Develop periodic publications directed to SMEs to inform them about different FOSS support services and motivating policies												
Identify market needs in the Egyptian ICT market where FOSS-based solutions and services can be leveraged												

<b>Enabler 8: Collaborate with Civil Society</b>												
Identify NGOs involved in FOSS practices in Egypt, regionally and internationally												
Indicate means of collaboration with them and shed light on promoting and building on their successful initiatives												

## **6. Challenges and Means to Address Them**

There are many challenges that face Egypt in terms of FOSS implementation. As FOSS is still in its preliminary phase of development, the most pressing challenges have to do with the market, awareness, education, training and business know-how for FOSS start-up companies.

### **6.1. The Market**

One of the challenges that the FOSS industry has had to face in Egypt is the need for a more enabling business environment that provides stronger market presence within the existing eco-system. As FOSS in Egypt is at its infancy with most FOSS-based companies tending to be SMEs, there is a need to provide incentives for the FOSS firms, perhaps even affirmative action (reverse discrimination; preferential treatment), e.g. when it comes to procurement, exhibits, etc. FOSS businesses would also benefit from incentives and other benefits such as tax breaks and cost reducing packages, all of which would allow this underdeveloped sector a chance to grow beyond its infancy and help firms overcome challenges in cost and human capital that are intrinsic of all SMEs.

### **6.2. Awareness**

Another prominent challenge concerning FOSS in Egypt is the lack of overall awareness of the existence of FOSS as an alternative within a healthy software eco-system. There are various means to address this issue in Egypt. The most obvious is to instigate public awareness campaigns that are targeted towards various audiences. These campaigns would concisely outline the benefits of including FOSS in the eco-system, not only on the national level but also on the business and personal levels as well. Moreover, the integration of FOSS within the national primary and secondary curriculum will ensure that they are embraced by future generations. Lastly, this challenge can be addressed through fostering stronger links between FOSS companies, universities, IT and non-IT companies and civil society to ensure maximum awareness building through networking.

### **6.3. Human Capital**

Another setback facing FOSS implementation in Egypt arises in the limited pool of adequate FOSS developers with the necessary skill level to harness the potential that FOSS has to offer as a catalyst for development. Even within the limited number of FOSS developers and firms, a few are actually original contributors to the development of these systems.

To a large extent, the absence of such critical mass is attributed to the limited presence of FOSS in Egypt's educational system. There is an overwhelming consensus among experts and the community that there needs to be an expansion of the exposure of FOSS within the entire local educational system at all levels so as to initiate FOSS awareness and interest for the long term. An introduction and maintenance of FOSS software in the national curricula is necessary to ensure that there is a long-term growth of FOSS developers in the country. This educational backbone would ideally start in primary education and continue through tertiary through use and training on several FOSS platforms. This would ensure students' awareness of FOSS and become comfortable with its use and application as an additional tool.

Moreover, some FOSS companies have limited business experience and are on the most part untested in the market. Their human capital suffer from lack of business know-how, inadequate business training, and limited ability to truly market their products and themselves. Many of the contributions appear to be “one-off” where a project is made once for the preference of the client so a business model is driven directly by customer demand. Hence there are fewer still companies that establish long-term investments and planning driven by the development and maintenance of single original products. In this way, the benefits of specialization cannot be realized in many current FOSS business initiatives.

Training programmes that target business know-how and planning will be of high benefit to FOSS businesses in Egypt. This would focus on training FOSS developers on new forms of business models and help them develop their marketing skills to properly position themselves, and hence the entire sector, not only in local markets but also in regional and international spheres.

Additionally, in terms of human capital development there is also a challenge in instituting continuous and pertinent FOSS training to employees in non-IT companies. Some companies do provide some form of training for clients’ employees, however, it is usually not more than a basic training concerning the usage of the product. If intense training is given, it is only provided to the clients’ IT specialist, which is not sufficient to develop the overall capacity.

The challenge, therefore, lies in an overall shortage of skills: poor quality of education, and large numbers of graduates who, even though are formally educated have no hands-on training and have never developed source codes. Even so, they are in need of business skills. Addressing this challenge would help bolster new FOSS developers so that the labour market bottleneck can be relieved. Extending FOSS usage to non IT specialists in FOSS using companies would further enhance capacity building as users learn to new software tools and applications.

#### **6.4. Migration Resistance**

The challenges that FOSS companies face in regards to their potential customers are threefold: the switching cost, psychological barriers and infrastructure challenges, all associated with migration. There is an associated initial cost with moving from one system to another. In regards to FOSS this cost is associated more with training not just IT personals, but all other employees in a firm to understand and use the FOSS platforms and/or new system that is put in place.

There is also a psychological barrier when it comes to FOSS implementation. Several countries (like Australia) have pointed out this phenomenon, which has also been noted in Egypt which already suffers from a lower rate of IT know-how in companies.

Lastly, FOSS companies may also face an infrastructural barrier in terms of the ability to get their software to align with other software, whether proprietary or FOSS. This is due to the coding used or the age of files or programmes that may no longer be able to be read. Furthermore, all software types face the problem of reading older versions of stored files due to inventions and changes in code writing. This can cause major archiving problems if not taken into account in advance. Ideally, the international common standard platform should be utilized, and perhaps later on own standardisation

kit would be instigated for all software development in order to diminish interoperability problems.

## **7. Lessons Learned from other Countries**

The following is a list summarizing lessons learned from the experience of other countries as provided in the attached Annex:

- Orchestrating a successful strategic plan involves three stages: planning, trial (pilot phase); and realization
- Gradual implementation of strategic plan to iron out any mishaps or loose ends before full implementation phase
- Lower success rates in countries like South Africa can be attested to inadequate planning and lack of preparedness with a detailed implementation plan, as employees found many things left unanswered and were thus unsure of how to go about doing that
- Creation of a virtual “Knowledge Sharing Bank” by which different institutions, departments and ministerial branches can share their experiences dealing with FOSS and proprietary platforms so as to have an governmental based archive and reference for future procurement instances
- Clarity in procurement procedures is a must<sup>1</sup>
- Publishing detailed brochures and documents explaining reasons and benefits behind FOSS acquisition creating well-informed employees and reducing—uncertainty and confusion
- Transparency regarding acceptance of contracts, as opaqueness, blocks the ability to assess contract fairness and cost reduction impact
- The “re-use” policy of licensing is a practical principal
- Establishment of “open standards” as a necessary means of ensuring interoperability-
- Ensuring adequate coordination between relevant institutions is important to minimize problems
- Harboring an open and competitive market will allow FOSS to thrive
- Emphasizing the philosophy of using ICT to empower and uplift the marginalized is important for a developing country like Egypt

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<sup>1</sup>Experience of the United Kingdom. See Annex for details.

## Annex

### FOSS Experiences of other Countries

#### **A.1. Malaysia**

The Malaysian Government launched its OSS master plan in 2004. This launch came after their decision to endorse FOSS as a development tool in 2002. The OSS plan and initiative is are part of a larger government lead economic development programme that strove to propel the overall political- social and economic position if the country were to be a first world nation by 2020 through providing efficient and quality service. In order to achieve this more open and developed nation, decision makers suggest that, “FOSS helps pave the road towards moving the economy to a technology driven, knowledge-based one. Allowing one to ‘peek under the hood’ and learn how some piece of software works, is crucial to a nation where skills are still being developed. It allows a nation to play a part in the international software community, and not be dependent on 100% foreign built proprietary software”. The objectives set were to:

- Reduce total cost of ownership
- Increase freedom of choice of software usage
- Increase interoperability among systems
- Increase growth of ICT industry
- Increase growth of OSS industry
- Increase growth of OSS user and developer community
- Increase growth of knowledge based society
- Reduce digital divide

Along with the objectives, the Master Plan of 2004 identified seven strategic “thrusts” as an outline to propel a later developed action long with eight policy areas. The plan outlines several key goals that the government wishes to achieve and breaks them down into short-medium and long-term stages. At the forefront of the document is the reiteration of setting up various research initiatives to orchestrate in depth research and analysis if the current situation of different aspects of FOSS implementation and hitherto suggest the best solutions to achieve these pre-set goals. To monitor and implement the overall project, the government established the Open Source Competency Centre (OSCC) that same year. In 2007 the Malaysian government publicized its Open Source Software (OSS) Implementation Guidelines document which not only served as a guide to OSS implementation in the areas outlined in 2004, but also served to increase awareness in the public and to provide a consistent approach and common framework to the overall OSS project. These were made in different phases of implementation.

By the end of the first phase, there were quiet some measurable success, although they fell short of the initial goals. However, Malaysia is considered an international case of a success story of FOSS implementation. By the end of phase 1, 60 percent of all IT personnel were trained in OSS. One percent of web servers were OSS based, and 42 percent of web operating systems were likewise OSS based. The estimated costs of savings were (2006):

- 80% of savings in overall licensing cost
- 58% reduction in development & consultancy efforts
- 7% savings in software support services
- 30.5% savings in overall cost

In 2008, more figures were shared by the Malaysian government that indicate the extent of their success:

- 3000 government employees trained on various OSS products
- About 200 state agencies using OSS on both the server and the client side
- OSS applications are mainly developed by the local community or the OSCC
- By March 2008 an estimated 120 state agencies have fully migrated desktop users to OSS

PhaseII will attempt to perpetuate the success of phase 1 and has re-adjusted goals for the upcoming time frame. Hence, FOSS has had measurable success in Malaysia.

The major factors that have allowed for the success of the Malaysia project are argued to be the careful planning and research of the best solutions that would target the main objectives the government seeks to achieve. This is followed by clear implementation and careful monitoring and evaluation of results over a specified period. This has allowed for accountability and steady progress of the overall initiative concerning FOSS. Furthermore, the government did not simply decree rules to be made but engaged with civil society at a great deal and started to install the use of FOSS at all levels of the education system in order to ensure long term sustainability. In the elaboration of their eight plan scopes: adoption, procurement, ownership, technology, implementation, knowledge sharing, education and training, there are various key interesting and beneficial concepts that should be considered. One of which is an OSS maturity model that determines OSS feasibility for implementation, determined by the software's functionality, usability, quality, security, performance scalability, architecture, support, documentation, adoption, community and professionalism.

Another factor contributing to Malaysian success is the careful selection of pilot projects to try out policies as well as introducing FOSS to users who would likely be enthusiastic about trying new products and could eventually spread the use of these products to those in their circles that might be more wary. In terms of procurement, a gradual plan is to cover all aspects of the procurement process of the software from outlining needs of the agency to adopting an open and transparent bidding system and final careful review and acquisition. Different licensing models are also stipulated serving as a guideline and kind of a unifying system by which software acquired must fall under to be considered an FOSS and hence in line with the overall objectives. Licensing stipulations cover copying and distribution, modification, licensing and warranties. Furthermore, there is an interest in creating a "Knowledge Sharing Bank" made of documents shared by different agencies about their experiences with different FOSS products for public agencies to have a reference archive of FOSS in order to determine which products work or are most useful. Finally, further to the education factor that is beneficial, it should also be noted that training does not only involve technical aspects but also the soft business skills necessary for software companies to be successful business ventures.

## **A.2. South Africa**

The South African government has long been developing and implementing an FOSS based plan as a backbone to its developmental plans. It conducted a study between 2001

and 2003 on the viability of FOSS as an alternative to proprietary software. The study took into consideration the total cost of ownership, FOSS benefits, and alternative applications to determine its viability. The government, since then, implemented a three-phase plan on how departments can start to implement FOSS. This was gradually done by different departments starting 2002 when the OSS strategy was developed.

The document itself does not outline a detailed plan of exactly how to conduct this implementation. It reads more as a guideline of the implementation process with certain objectives and concepts to be aware of in the creation of a detailed implementation plan by each ministry. This plan entitled “Open Software and Open Standards in South Africa: A Critical Issue for Addressing the Digital Divide introduced to Cabinet by The National Advisory Council on Innovation (NACI)” was conducted to, “promote interoperability and to promote universal access to online government services without prohibitive costs, license restrictions or similar barriers; to minimise the risk of lock-in to specific vendors of ICT products and services; and to lower the entry barriers for local developers who can offer ICT solutions for use in the public sector”. In 2005, a conference was held engaging all members of the society concerned with FOSS in SA, i.e. government, civil society, and the private sector, where a decision was reached that the 2002 policy needed to be redrafted to include Open Content (OC). Along with the benefits of FOSS, this document comprises benefits of OC where it highlights accountability and open society as well as lower TCO, high return on investment, technical performance levels, security, among others that display FOSS competency if not superiority to proprietary software solutions. The revised policy includes five main pillars:

1. “The South African Government will implement FOSS unless proprietary software is demonstrated to be significantly superior. Whenever the advantages of FOSS and proprietary software are comparable, FOSS will be implemented when choosing a software solution for a new project. Whenever FOSS is not implemented, then reasons must be provided in order to justify the implementation of proprietary software
2. The South African Government will migrate current proprietary software to FOSS whenever comparable software exists
3. All new software developed for or by the South African Government will be based on open standards, adherent to FOSS principles, and licensed using a FOSS license where possible
4. The South African Government will ensure all government content and developed content using governmental resources is made Open Content, unless analysis on specific content shows that proprietary licensing or confidentiality is substantially beneficial
5. The South African Government will encourage the use of Open Content and Open Standards within South Africa

The South African government then outlines 10 different initiation projects and entrusts them to different ministries.

In terms of the South African governments, we see some data that indicate the level of use of FOSS in the public sector, which shows limited success. 23 out of 31 government agencies specified that they are using OSS in part or whole of their operation according to a study done by Mtsweni. However, this number is misleading as 97 percent of the users surveyed indicated that on the desktop side, Microsoft operating system was still being used. Only 12 departments of 31 were using OpenOffice.org. The research shows that the main pitfalls observed are that OSS lacks some compatibility with the currently used

proprietary solutions used by the SA government (this is indicated by 83% of those surveyed). This is attested to the fact that most departments use custom made proprietary applications which deal with things like taxation, statistics and data calculation, causing a large challenge in finding an OSS product compatible to this specific closed source base. Other challenges indicated as hampering OSS implementation are lack of support (26%), Migration costs (17%), Lack of approved standards (17%) and User resistance (35%).

The lower success level found in this country can be attested to inadequate planning and the preparedness of a detailed implementation strategy. In a way, too much is left unanswered which has allowed less accountability in accomplishing the objectives stated. The authors of the SA study suggest that there needs to be three stages to plan development: planning and trial (pilot cases), realization (overall successful solution deployment in the overall government) and development (further tweaking of plan).

### **A.3. United Kingdom**

The United Kingdom has had a policy regarding open source since 2004 which was later updated in February 2009. The reasoning behind adopting Open Source has to do with the government's desire to offer the best, efficient and most value for service to its citizens. Oftentimes in the last few years, the government has found that OSS has been better able to help in reaching this overall goal. the government has used it in the National Health Care Service, websites etc. The government also strives to increase innovation within and without its halls in the country through its OSS use. Some of the benefits that have been seen through the use of the strategy since 2004 are:

- Over 25% of secondary schools use the Linux operating system on at least one computer
- The NHS "Spine" uses an open-sourced operating system meaning that 35% of NHS organizations (300,000 users) are supported on Linux infrastructure
- Birmingham City Council has been rolling out open source software across their library services since 2005. All staff and public PCs in their library services now have a mixture of open source and proprietary software

More so, the IT industry has started to embrace FOSS at a larger level, with the growth of more robust and sustainable SME's appearing as well as the increase use of FOSS in larger enterprises and more government departments.

Indeed, the government has been a major player in the introduction and proliferation of FOSS in the country. It has created within its folds an open source profession and recruits talent for the post. It has also established a "CIO Council" with the mandate of sharing information about good IT solutions and different experiences within the department. Agreements between the government and its major IT suppliers have allowed certain closed software to be opened which has led to the sharing and re-using of common software components between different lines of business. However, there has been a

certain level of problems that have arisen during the implementation phase of the strategy. One of the main problems is that the government can still be treated as one large component rather than different entities. This is in addition to—the continued lack of transparency on some contracts which has forestalled the cost reduction that might have been possible. The government however established a site that has allowed citizens and other stakeholders to comment on the strategy and illuminate pitfalls. In 2009, taking into account the comments made the government "refreshed" the strategy, which placed more

emphasis on suppliers providing evidence that show FOSS had been considered in their plans. Furthermore, where proprietary licenses had to be bought, the government now requires that a study is undertaken showing a “shadow” price that takes into consideration a comparison to the total cost of ownership. Moreover, another stipulation made was that when a licence is paid for by the government, it will comprise the purpose of reuse to be used within any sector in the government and hence will not be rebought for different departments. Furthermore, there have been studies that suggested existing problems with adopting FOSS, as in the case of NHS, where the use of various solutions has created problems in interoperability causing the loss of millions of sterling pounds. Therefore, it was suggested by the government that a standardization kit be drafted in order to ensure that this does not happen in the future. Keeping this in mind, the UK government has redrafted its strategy in February 2009 so that it provides a more even ground between the two types of software’s wherein it will focus on increasing skill levels and being more aggressive in adopting FOSS where it offers more value for money. The new formed policy identified six goals and nine policy points, all of which focus on the following 10 action plans:

- Clarity in Procurement
- Increasing Government Capability
- “Re-Use as a Practical Principle
- Achieving Maturity and Sustainability
- Challenging Suppliers to Actively Consider FOSS
- International Examples and Policies, and Keeping Up to Date with Developments
- Industry/Government Joint Working
- Establishing Open Standards
- Open Source Techniques and Re-Use within Government, and Appropriate Release of Code
- Maintaining Communication, Consultation and Review

These 10 points to address the pitfalls of the early FOSS implementation stage.

#### **A.4. Australia**

The Australian government’s decision to adopt FOSS stems from the desire to provide its citizens with a more open, better-informed, interactive and efficient government service practice. The current strategy extends from 2012-2015. The government, however, has been adopting a policy of “informed neutrality” and “value for money” since 2005. In 2010, ICT Strategy Board of Trustees approved a memo on December 21 that instructed all governmental departments to consider FOSS solutions in their procurement of new ICT products and to provide a detailed explanation of why a department chose to opt out of FOSS if that situation should occur. This same board then released a general FOSS strategy for Australia in the following year as specified above. Along with this strategy, the board also produced literature on open source, regarding its philosophy, structure, benefits and comparison to proprietary software. This went along with another piece of literature with instructions of how to execute the strategy for top-level management. This additive covers aspects in detail such as the current state of the FOSS sector, and development of SME’s, general concerns regarding licenses and support, sourcing, preparing a procurement plan, risk management and mitigation, and the legalities concerned with FOSS procurement. This way, the Australian government went from a more decentralized agency lead approach to open source procurement to a much more centralized and stream-lined manner due to an ICT reform programme that aims at improving integration, cooperation and transparency. Along with its desire to improve

government services, the Australian government has found - after conducting studies - that the FOSS use in ICT directly leads to GDP growth and decreases leakage from licensing agreements with proprietary corporations. Below are some of the advantages brought by FOSS since 2008 prior to the release of the newest one have been:

- Delivered improved agency capability to manage large ICT-enabled programs
- Focused on ICT sustainability and realized \$1 billion in efficiencies from agency ICT business-as-usual operations
- Accelerated a coordinated, whole-of-government approach to data centres, which will avoid \$1 billion in costs over the next 10 to 15 years
- Coordinated ICT procurement and associated efficiencies in high volume, high cost areas such as Microsoft licensing, telecommunications, desktops and data centres
- Provided better information on agency ICT costs

Within the national strategy, there are three large based priority areas: a) delivering better service, b) improving the efficiency of government operations, c) engaging openly. Although the strategy is detailed with enablers on how to go about reaching the three general objectives, the final results are qualitative (as are the enablers) leaving room for further study and more precise estimations for the implementers. The success of this last strategy plan is yet to be determined, as it has only just begun. Yet, once more we see the aggressive progression of FOSS taken by the government hand in hand with civil society in order to create a more open and knowledge based society for the greater good.

#### **A.5. Brazil**

Brazil is one of the most active countries in the development and use of FOSS. It has developed its own version of Linux, named Conectiva and many of its vital software systems are run by FOSS; it also has the largest number of FOSS developers and contributors. It has developed laws and allocated funds to promote the use of FOSS. Brazil was described by Jonathan Schwartz, Chief Executive Officer and President of Sun Microsystems in 2006 as being one of the most progressive nations in the world when it comes to the use FOSS.

The ultimate goal behind the Brazilian policy to promote FOSS is to ensure that citizens have the right to access public services without requiring them to use specific platforms.

The reasoning behind this policy and its subsequent activities to promote the use of FOSS are: (1) Economic reasons (the government estimates savings from the switch to open source to be about \$120 million a year); (2) Developmental reasons (to decrease the digital divide, create initiatives and opportunities to bring technology to the poor and other reasons related to the implications of intellectual property systems in the developing world); and (3) Ideological reasons (the freedom to borrow from available ideas and then adjust them into something new and original).

In addition to the above mentioned reasons, it is believed that the Brazilian open source policy is an expression of national notions related to anti-Americanism, anti-globalization or anti-capitalism. It is also an alternative to Microsoft systems and policies.

Brazil has developed the world's first bank ATM network operated on open source software. The army has adopted free software as well as the main data processing entity at the government. There are also many other public systems and institutions which are now

operated via open source software, such as: the voting system in Brazil, State-owned Banco do Brasil SA, the postal service, the state oil company, the national statistics agency etc. In 2004, the government embarked on a project to convert 80% of departments' computers from Windows to Linux. The project proved to be successful. As of 2005, about 60% of state departments were already using FOSS solutions.

Moreover, a presidential decree was drafted in 2005 calling for making FOSS compulsory for all Brazilian federal departments to switch to open source software. In the state of Ceara, a law was passed in April 2008 requiring the state public administrations to give preference to FOSS systems and programs. Furthermore, Brazil has allocated funds for FOSS research and training. For example, the Ministry of Science and Technology had allocated funding of \$2.1 million in 2003 for open source software research and in 2004, the government provided training for about 2,100 municipal, state and federal public employees in the implementation and management of open source platforms for government administration.

The profile of FOSS Brazilian developers is comparable to the profile of European developers with highly professional developers, and diversified portfolio that consists of systems managers, network technicians, entrepreneurs, researchers and college students. As for FOSS development companies, there is a prevalence of smaller sized companies. The profile of FOSS users is different where large organizations prevail such as communication and information technology sectors, government, commerce, and education. Their main drives in adopting FOSS are economic (to reduce costs) and technical (to develop new skills). The role of the local government was vital in the Brazilian experience as it supported FOSS activities and was able to link the efforts of universities, companies and individuals in the Free Software Project.

The policy of adopting FOSS into the government bodies was strongly supported and projects to implement it were put in place promptly in several cities and municipalities. Some of the cities have approved laws making the adoption of Free Software Solutions the preferred one, and requiring technical evaluations of proprietary solutions if they were the ones recommended. For example, in the city of São Carlos, in the state of São Paulo, a "Free Software" law has been approved in October 2001. The city has installed eight free software based labs in public school libraries and a couple of "telecenters" in the poor areas of the city, where they are also providing training to the population, facilitating the citizens' access to technology and helping them finding jobs.

The role of research and support from universities is also a highlight in the Brazilian experience. One of the universities in Brazil, UNIVATES hosts a portal of FOSS (now co-hosted by UNICAMP, the State University of Campinas, in São Paulo, Código Livre), which serves like a bank where developers and users contribute to its funding stash. UNIVATES has been producing FOSS since 2000, and has reported that their savings from using FOSS was sufficient to pay the salaries of FOSS developers.

The Brazilian experience in adopting open source has been successful; however, some researches have highlighted some weak points in the experience such as (a) poor coordination of the implementation of the policy between the relevant institutions charged with its execution. For example, while the congress of Brazil tried to impose a time frame on the proprietary software use by announcing in August 2003 that proprietary software once expired will not be upgraded and shall be replaced by open source, the government

institutions in charge of software policy argued that migration should not be compulsory. Another example of weakness point lies in (b) the resistance of implementing the law in practice. This was the case in some states where employees were not convinced by the efficiency of open source software. In addition, researchers also highlighted problems with the (c) influence of proprietary software industry in Brazil which is a barrier to the adoption of open source policy; (d) lack for government funding for migration to FOSS and (e) poor provision for language translation of FOSS which has caused delays in some projects. An example is the Ministry of Education which purchased 12,000 computers for schools, using Linux and Open Office. The project was delayed because of lack of Brazilian Portuguese versions of the software. (F) Some critiques pointed out the poor quality of FOSS where it has been implemented including non-compliance to the traditional open license policies because it does not include the source code.

Furthermore, the role of the government and state is very active in the Brazilian experience where it provided the legal framework support, funds, initiated projects and coordinated efforts among various research and NGO institutions.

The role of ICT centers, NGOs and special committees such as the committee for Democracy in Information Technology (CDI) was very vital in the Brazilian experience as well. There have been a number of projects initiated in Brazil in the last decade that aims at decreasing the digital divide and facilitating poor household access to ICT, most of the project gives special attention to youth.

The essence of the experience lies in the comprehensiveness of implementation of the policy (laws, funds, support, projects, R&D and access to the poor). The most important factors in this experience are in the leading role of the government along with the coordination with R&D centers in different universities. Brazil also paid attention to hosting international forums for the use of FOSS and for sharing experience with other countries. For instance, the state of Rio Grande do Sul hosts the International Free Software Forum. Many projects were implemented to facilitate the migration to FOSS in different states and municipalities and NGOs were active in implementing projects that facilitate access of ICT to the poor. One of the main challenges in the Brazilian experience was user resistance, but the government has implemented some initiatives to face the challenges such as providing tax incentives for companies that use ICT OSS systems.

#### **A.6. India**

India is one of the few low-income countries that has built significant software competences on a large scale with a strong related R&D sector. At the same time, it is one of the developing countries that has a policy in place to promote or encourage use of FOSS. A lot of software companies have been established in India since 2001. As of December 2010, 58 Indian companies were certified to the level 5 (highest level) of Capability Maturity Model Integration (CMMI), which is a challenging quality certification in the software industry. In 2008/09, the software and related engineering services reached \$9.6 billion.

The focus of FOSS policy in India was on fostering a software industry as a foreign exchange earner. The government supports the use of FOSS in general, the IT Secretary issued a circular recommending the use of Linux in the government sector. In October 2011, a draft of ICT policy was issued by the government; however, there is no specific legislations in India regarding FOSS though there were some trials to do so. Nevertheless,

FOSS has been able to make significant development in the innovation of many application and tools in the country. Some state governments entered into agreements with private companies to foster FOSS development and facilitate the understanding of FOSS through training.

The Indian experience in promoting FOSS relied on the active involvement of the Government, universities, technology institutes and the private sector including a leading role by the National Association of Software and Services Companies (NASSCOM) and the establishment of software related R&D. The government implemented many initiatives to promote FOSS, for example it has distributed millions of free CDs with Tamil and Hindi language OSS.

Some Indian states have successful experience in adopting FOSS, such as (1) State of Kerala, which has identified FOSS as a major strategic component in its efforts to build an inclusive information society; (2) the state government of Madhya Pradesh has decided to use Linux software in its official IT program, which includes its e-governance (Gyandoot) and computer-enabled school education (Headstart); (3) the Government of Maharashtra (GoM) has introduced OSS for e-governance in 2003 in areas like treasury management, citizen facilitation centers, document journey management system and the land records management system; (4) The state of Uttaranchal signed an e-governance Memorandum of Understanding (MoU) with IBM in February 2004 to focus on OSS technology, as well as a university program MoU to develop local IT talents.

Some leading Indian characters are supporters of FOSS including the former President of India, Dr Abdul Kalam Azad who has been calling for the use of non-proprietary software, especially in the military sections for security reasons.

The success of the Indian case can be attributed to the role of the state in India. The state was very proactive over the years in relation to software development and ICT in general where they have issued number of ICT related policies but not specific to FOSS and has developed the higher education system in engineering and technical disciplines. Many centers have been created to foster software and computing industry including centers of excellence and numerous other institutions for technology development along with the private sector.

FOSS has been developed in all 22 Indian languages, which has facilitated innovations in hardware. For example, one could look at the innovation of “simputer” (simple computer) which addresses illiteracy and affordability problem facing many Indians and that was developed by the Indian Institute of Science in Bangalore. Another innovation was developed using Linux operating system and Open Office, is Aakash, which is a cheap touch screen tablet that costs \$50. About 110 million Indian schoolchildren are expected to benefit from the invented tablet. The wide range of tools and projects that are available online have enabled developers and contributors to connect online from across the world and form groups and communities of learning and practice to share their contributions and build software.

Most of the Indian companies have also realized that there is a high level of cost effectiveness in FOSS. In this way, companies do not have to spend money on training their employees to decipher foreign code, and the end customer can get access to cheaper software and updates. The role of the government is especially prominent in developing an educational system that fosters ICT and software. The various state agreements with FOSS

companies and other centres to boost its use was also an important factor in the success of the project.

The role of excellence and research centers is also very important as well as the role of ICT centers and private companies. For example Indlinux.org, which is an organization of software technicians, has collaborated in localizing Linux to Indian languages; IBM has signed agreements with some Indian states for training and application of FOSS in certain sectors including state records (birth, death, property tax, water tax, food and civil supplies cards, health services and application); *Shiksha* India Trust, an initiative of Confederation of Indian Industry (CII) has recently signed a MoU with Red Hat Inc., the world's leading provider of OSS solutions to develop the Indian education system.

The main purpose of FOSS adoption and usage in this experience on the local level is to facilitate easier and more accessible services to the poor. India hasn't developed an FOSS strategy or laws but it fostered it as part of a greater effort to boost ICT sector and increase its deployment in all sectors. R&D in ICT in general and in FOSS is very important. The decentralization of decision making and implementation of projects within the Indian state is noticeable and could be considered a by lessons learnt in this case. Another lesson learnt is innovation and creating a supply of FOSS products that meet the need of the target population.

#### **A.7. United States of America**

The United States of America (USA) is one of the pioneer countries in the development and use of FOSS since 1980s. In 1990, NASA Ames became one of the first two customers to purchase commercial support for free software. The USA has also hosted many FOSS events, some of which were sponsored by the US Army.

Many policies were released in USA on the state level since the 2000s. There has also been adoption of FOSS by some leading companies in the market, for example, in 2000 IBM announced allocating \$1 billion investment in Linux.

On the federal level, there are a few example to be mentioned. In 2003, the first Federal open source policy was issued which permitted FOSS acquisition, development and use as long as it complies with COTS or GOTS policies. The Consumer Financial Protection Bureau (CFPB) announced its open source policy in 2012.

On the state level in 2009, the City of Portland, Oregon released the first US municipal government open source policy. The policy favours the acquisition of open source. California in 2010 released an open source policy stating that OSS is to be considered when procuring software. In the same year, San Francisco released an open source policy as well mandating evaluation of open source in software procurement for purchases over \$100,000. Recently in 2012, New Hampshire passed open source/open data legislation that requires state agencies to consider open source software and promotes the use of it by state agencies.

On the federal departmental level, the US Department of Defence (DoD) issued a memo in 2009 reiterating that open source software is commercial software and encouraging the various branches of DOD to consider open source when selecting and procuring software.

There are several factors, which have enabled FOSS proliferation in the USA, i.e. the nature of the US open and competitive market, which provides a space for FOSS to grow;

the adoption of FOSS by big companies and government departments such as Department of Defence; strong R&D and big investments in FOSS such as IBM investments in Linux.

Although policies and memos released were not explicitly promoting FOSS but rather encouraging organizations to consider its use in a competitive way, FOSS was adopted by some states/cities (such as Portland and San Francisco), state departments (NASA and DOD) and big companies (IBM). The essence of this experience is that policies are not the most important factor, other factors including demand (state departments and organizations that have precise demands about software) and supply (strong FOSS developers and companies) were more dominant in this experience.

Successful experiences based on FOSS should be publicized to encourage other institutions to use it. If this approach is adopted, it is vital to be transparent about challenges countered.

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## References

- Australian Government, Department of Finance and Administration. Australian Government Information Management Office. (2005). *A Guide to Open Source Software for Australian Government Agencies, Developing and Executing an ICT Sourcing Strategy*. Retrieved May 2013, from:  
[http://agimo.gov.au/files/2012/04/A\\_Guide\\_to\\_Open\\_Source\\_Software.pdf](http://agimo.gov.au/files/2012/04/A_Guide_to_Open_Source_Software.pdf)
- Australian Government Department of Finance and Deregulation, Australian Government Information Management Office (2012). *Australian Public Service Information and Communications Technology Strategy 2012-2015*. Retrieved May 2013, from: [http://agimo.gov.au/files/2013/01/APS\\_ICT\\_Strategy.pdf](http://agimo.gov.au/files/2013/01/APS_ICT_Strategy.pdf)
- Brazil Government Portal. (2013). [WWW] *Science and Technology, Open source software*. Retrieved May 2013, from:  
[http://www.brasil.gov.br/sobre/science-and-technology/open-source-software/open-source-software/br\\_model1?set\\_language=en](http://www.brasil.gov.br/sobre/science-and-technology/open-source-software/open-source-software/br_model1?set_language=en)
- Center for Strategic and International Studies. (2013). [WWW] *Government open source policies*. Retrieved June 2013, from: <http://csis.org/publication/government-open-source-policies-0>
- Danish Agency for Governmental Management. (2012). *Denmark Open Government Partnership National Action Plan 2012*. Retrieved May 2013,  
from:[http://www.opengovpartnership.org/sites/www.opengovpartnership.org/files/country\\_action\\_plans/Denmark%20-%20Open%20Government%20Partnership%20-%20National%20Action%20Plan%202012%20-%20FINAL%20-%202013-04-2012.pdf](http://www.opengovpartnership.org/sites/www.opengovpartnership.org/files/country_action_plans/Denmark%20-%20Open%20Government%20Partnership%20-%20National%20Action%20Plan%202012%20-%20FINAL%20-%202013-04-2012.pdf)
- Fontana R, Kuhn BM, Moglen E, Norwood M, Ravicher DB, Sandler K, Vasile J and Williamson A (2008). *A Legal Issues Primer for Open Source and Free Software Projects*. Available at <http://www.softwarefreedom.org/resources/2008/foss-primer.pdf>.
- Garrido, María, ed. (2008). *Information and Communication Technology (ICTs) Training, Employment and Youth: The case of Brazil, Colombia and Mexico*. CIS, Center for Information & Society. First edition 2008. Peru. Retrieved June 2013, from: [http://lanic.utexas.edu/project/laoap/iep/ddtlibro39\\_eng.pdf](http://lanic.utexas.edu/project/laoap/iep/ddtlibro39_eng.pdf)
- Hoe, Nah Soo. The potential of freedom and open source software for sustainable human development: a compilation of case studies from across the world. UNDP-APDIP. (Bangkok: 2006). Retrieved from  
<http://www.ifap.ru/library/book136.pdf> .
- Indian E-Government Standards, Standards for E-Government applications (2013) [WWW]. Retrieved June 2013, from:  
<https://egovstandards.gov.in/>
- Interoperable Delivery of European eGovernment Services to Public Administrations, Business and Citizens (IDABC) (2007). OSS: Open Source Software. Retrieved July 2013, from:  
<http://ec.europa.eu/idabc/en/document/2627/5644.html>
- Rizk, Nagla, and Sherif El Kassas. "The Software Industry in Egypt: What Role for Open-Source?" In *Access to Knowledge in Egypt, New Research on Intellectual Property, Innovation and Development*, edited by Lea Shaver and Nagla Rizk. Bloomsbury Academic, 2010.
- Liming, Cai, Tetsuo Noda, and Terutaka Tansho. "Development Style of Open Source Software and Innovation of Business Enterprise." *International Proceedings of Economic Development and Research*. 2012.  
<http://www.ipedr.com/vol39/004-ICITE2012-B00013.pdf> (accessed July 03, 2013).

- Moyle, Kathryn. (2004). *Total Cost of Ownership and Open Source Software*. Department of Education and Children's Services. South Australia. Retrieved August 2013, from:  
[http://www.mceecdy.edu.au/verve/\\_resources/total\\_cost\\_op.pdf](http://www.mceecdy.edu.au/verve/_resources/total_cost_op.pdf)
- Open Source Competency Center. *The Malaysian Open Source Software Master Plan*. (Kuala Lumpur: 2004) Retrieved in August 2013 from [http://knowledge.oscc.org.my/oscc-1/oscc-documents/master-plan/master-plan-phase-i-jan-2005-hot/at\\_download/file](http://knowledge.oscc.org.my/oscc-1/oscc-documents/master-plan/master-plan-phase-i-jan-2005-hot/at_download/file)
- Policy on Free and Open Source Software use for South African Government*. Department of public Service and Administration. (Johannesburg: August 2006). Retrieved August 2013 from [www.info.gov.za/view/DownloadFileAction?id=94490](http://www.info.gov.za/view/DownloadFileAction?id=94490).
- Ramanujam, Padmanbha. "How Open Source and Closed Source Business Structures Can Mutually Exist." *Social Science Research Network*. 21 January 2008. [http://papers.ssrn.com/sol3/papers.cfm?abstract\\_id=1102466](http://papers.ssrn.com/sol3/papers.cfm?abstract_id=1102466) (accessed July 03, 2013).
- Rizk, Nagla. "Free and Open Source Software (FOSS) as a Vehicle for Human Development in Egypt: Some Evidence and Insights." *International Journal of Technological Learning, Innovation and Development* 5, no. 3 (2012): 221-236.
- Shaikh, Maha and Cornford, Tony. (2011). *Total Cost of ownership of Open Source Software: A report for the UK Cabinet Office Supported by OpenForum Europe*. London: Queen's Printer and Controller. Retrieved August 2013 from:  
[http://eprints.lse.ac.uk/39826/1/Total\\_cost\\_of\\_ownership\\_of\\_open\\_source\\_software\\_%28LSERO%29.pdf](http://eprints.lse.ac.uk/39826/1/Total_cost_of_ownership_of_open_source_software_%28LSERO%29.pdf)
- Smith, A., Minister of State for the Cabinet Office. (2010). *Open Source, Open Standards and Re-Use: Government Action Plan*. Retrieved June 2013 from:  
[https://www.gov.uk/government/uploads/system/uploads/attachment\\_data/file/61962/open\\_source.pdf](https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/61962/open_source.pdf)
- Smith, Angela. *Open Source, Open Standards and Re-Use: Government Action Plan*. Minister of State for the Cabinet Office. (London: 2010). Retrieved in August 2013 from  
[https://www.gov.uk/government/uploads/system/uploads/attachment\\_data/file/61962/open\\_source.pdf](https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/61962/open_source.pdf).
- Smith, R.E., *A Contemporary Look at Saltzer and Schroeder's 1975 Design Principles*, Security & Privacy, IEEE , vol.10, no.6, pp.20,25, Nov.-Dec. 2012.
- Souphavanh, Anousak, and Theppitak Karoonboonyanan. "Free/Open Source Software Localization." *iosn.net*. United Nations Development Programme- Asia Pacific Development Information Programme (UNDP-ADIP). 2005.  
<http://www.iosn.net/110n/foss-localization-primer/foss-localization-primer.pdf> (accessed July 03, 2013).
- South Africa Government Online. (2013). Retrieved June 2013, from: <http://www.gov.za/>
- Thailand Ministry of Information and Communication Technology and National Electronics and Computer Technology Center. (2009). *The Second Thailand Information and Communication Technology (ICT) Master Plan (2009-2013)*. First edition 2009. Thailand. Retrieved May 2013, from:[http://www.mict.go.th/download/Master\\_Plan.pdf](http://www.mict.go.th/download/Master_Plan.pdf)
- United Nations Conference on Trade and Development (UNCTAD). (2012). *Information Economy Report 2012, The Software Industry and Developing Countries*. United Nations. New York and Geneva 2012.
- United Nations Development Programme Kingdom of Saudi Arabia (UNDP Saudi Arabia). (2013). Retrieved July 2013, from: [http://www.undp.org/sa/sa/index.php?option=com\\_content&view=article&id=65&Itemid=127](http://www.undp.org/sa/sa/index.php?option=com_content&view=article&id=65&Itemid=127)
- Vietnam Free and Open Source Software Association (2012). *Free and open source software in Vietnam*. Retrieved May 2013, from:<http://ubuntuone.com/6a4NYZh3rFBbNnBkxlpn>
- Wheeler, David A. "Secure Programming for Linux and Unix HOWTO." 2003. <http://www.dwheeler.com/secure-programs/Secure-Programs-HOWTO.pdf> (accessed July 01, 2013).
- Wilson, Rowen. *Open Standards and Open Source*. OSS Watch (Oxford: March 11, 2013). Retrieved in August 2013 from <http://www.oss-watch.ac.uk/resources/openstandardsopensource>

Wire, James. *COMESA Regional FOSS Framework-Final Report*. Regional information and Communication technology. (Kampala: 2009). Retrieved August 2013 from [http://programmes.comesa.int/attachments/article/78/COMESA\\_FOSS\\_Report-Final.pdf](http://programmes.comesa.int/attachments/article/78/COMESA_FOSS_Report-Final.pdf)

Wong, Kenneth. "Free/Open Source Software: Government Policy." *sita.co.za*. United Nations Development Programme-Asia Pacific Development Information Programme (UNDP-APDIP). 2004. [http://www.sita.co.za/FOSS/Gov-OSS\\_Guide-04.pdf](http://www.sita.co.za/FOSS/Gov-OSS_Guide-04.pdf) (accessed July 03, 2013).