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Policy recommendations for public administrators on free and open source software usage

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ABSTRACT

Free and open source software, holding a strategic position in knowledge economy, reaffirms the critical role of governments and regional authorities in establishing strategies for integrating effective and sustainable Information Technology solutions in the public sector towards economic growth and social welfare. Moreover, public services, organisations and territorial administrations collectively represent a major software user with great impact on the software market. In this sense, software selection in the public sector is a highly political and strategic process; various collateral implications and policy aspects should be considered in order to reach the best possible decisions. Within this context, this manuscript provides policy recommendations on issues and challenges pertaining to the use of free and open source software by European public administrations. The recommended policy actions are mainly based on review of the current policy framework. The main goal of this manuscript is to contribute in providing policy orientations and proposing actions that can help governments, public administrations and European institutions fully harvest the benefits of open source.

1. Introduction

Public administrations have the mission of best allocating available resources in a socially responsible, transparent and economically efficient manner. Free and Open Source software (FOSS),[1] being a public resource based on non-rival use rights and allowing for lower entry barriers in software development, offers public stakeholders a set of cost-effective, re-usable tools and resources that can give impetus to innovation, entrepreneurship and economic growth.

Moreover, public organisations play a major role in the software market as mass scale software "consumers" with specialised needs and requirements. In this sense, adopting software environments in public Information Technology (IT)

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[1] Although there are different definitions of FOSS, there are some basic principles on which FOSS relies. These refer to the freedom to run a software program for any purpose, to study and modify a software program by accessing its source code and to distribute copies of a software program, whether modified or not. Despite different approaches or variations, the terms "free" and "open source" software are used interchangeably throughout this manuscript to refer to software that is developed as a public resource, based on non-excludable, non-rival use rights and properties.

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infrastructures sector is not a neutral, "technical" process but a highly political and strategic one with various implications and policy[2] aspects to be considered in decision making.

Regional authorities and public administrations could valorise the FOSS potential on a bottom-up approach by fully integrating FOSS solutions in their regional development planning, internal administrative processes and educational networks. On a local or regional level a faster penetration and sustainable use of FOSS can be achieved by clearly outlining needs and wants through public procurement[3] and by directly engaging local communities in open source environments.

National governments should support public administrations and particularly small and medium size organisations in using FOSS in effective and sustainable ways providing guidance, resources and reusable software tools and components through national reference centers and repositories. They should also establish clear legal and institutional frameworks to eliminate software discrimination in public tenders and monitor the implementation of certain principles and requirements such as openness, reusability and interoperability of data (Almeida et al., 2011), software and systems in full compliance with the European frameworks and guidelines.

On a European Union (EU)-wide level, there should be more straight forward policies for the implementation of defined requirements and specifications on openness, reusability and interoperability combined with the coordination and fine-tuning of the national strategies of the member states. Successful cases of FOSS integration on a regional or national level should be highlighted, communicated and valorised through EU-wide networks such as JOINUP (https://joinup.ec.europa.eu/, former OSOR). European strategies, initiatives and official policy documents relating to software should be constantly updated or revised where needed in order to reflect software market realities, industry driven achievements and public stakeholders' needs. Moreover, research and development policies should leverage Europe's competitive advantage in FOSS development by investing in regional innovation clusters and FOSS-based entrepreneurship.

Within this context, this document outlines the policy framework, describes available options and expected benefits and proposes certain policy actions that can enable policy makers to better assess FOSS as a strategic choice offering competitive advantages for the public sector. It is specifically aimed at: (a) policy makers in governments and public administrations: government officials, elected representatives, senior managers and decision makers in local and regional authorities, (b) IT managers and heads of procurement departments in governments and public administrations and (c) social economy actors and institutions such as non-governmental organisations, policy institutions, professional associations and networks, civil society organisations, FOSS communities and networks, non-profit foundations.

The remainder of this manuscript is structured as follows: in Section 2 the main policy issues and aspects relating to the use of FOSS in the public sector are presented and the need for required measures and actions is analysed. Section 3 provides a review of the current policy framework relating to FOSS within the EU context and defines the FOSS related policy implementation levels and areas. Section 4 proposes certain policy measures and actions in assessing, adopting and further integrating FOSS in public IT infrastructures. Finally, in Section 5 our conclusions and some proposals for future work are drawn up.

2. FOSS policy issues

Either integrated in the operational tasks of businesses and organisations, or embedded in systems and products, software is omnipresent in most economy sectors and is now a driving force for the European Information and Communications Technology (ICT) industry fostering innovation and productivity, supporting growth and creating jobs.

The European software market, including both software products and related services has risen from 228.6 billion € in 2008 to 231 billion € in 2009 and is expected to reach 264.8 billion € by the end of 2012 (Rönkkö et al., 2010; Giron, 2009). It also employs more than 2.75 million people. These figures make Europe (EU27) the second largest software market on a global scale.

FOSS is one of the main drivers of the software market with a remarkable growth and increasing share. According to the UNU-MERIT study in 2006 European firms with 565,000 employees and €263 billion in annual revenue invested an estimated €1.2 billion in FOSS development (Ghosh, 2006). In a more recent study on software's economic impact commissioned by the European Commission, the FOSS share in the European market is estimated on a baseline scenario to exceed 5% in 2013 with an increasing trend up to 2020 (Giron et al., 2009).

FOSS is expected to continue penetrating the market based on both its inherent features and capabilities as well as on current developments in the ICT sector and the market environment. The increasing penetration of FOSS in a changing and expanding software market environment that is driven by rapid technological developments, raise a series of challenges for policy making on an EU-wide level. The growth of FOSS comes as a response to the needs of businesses and the public sector. In the case of public administrations these needs are to be met under certain conditions and requirements that promote economic development and serve social welfare.

[2] The term "FOSS policy" is used in this manuscript to describe policy measures, actions and implementation plans with regard to the assessment, use and adoption of FOSS by governments and public sector organisations. A "FOSS policy" may either refer to an official policy document issued by a government body or to a set of actions and initiatives undertaken by various public stakeholders (e.g. local governments, regional authorities).

[3] Public procurement refers to the process used by governmental bodies, national agencies, regional and local authorities and public administrations to buy products and supplies, services and public works. Having to do with spending of taxpayers' money public procurement has to be conducted under certain rules and specifications.

Within this scope, there is a need for coherent, up-to-date policies, on a regional, national or EU level that address the various aspects of FOSS in the public sector. Policy making and implementation relating to FOSS in the public sector covers a wide range of areas and objectives: open access and e-inclusion requirements, fair market competition and non-discrimination in software procurement, standardisation and interoperability frameworks, research and development funding, IT security. Several national or EU policies relating to these issues have been defined in the last years and are constantly revised and updated to meet current development in the European software market and industry.

2.1. The role of public administrations

Based not only on their institutional status and mission, but also on their position in the software market environment, governments and public administrations have a critical role to play in terms of software supply in general and FOSS use and penetration in particular.

Government bodies and public organisations collectively form a critical, mass-scale software consumer and end-recipient of associated IT services with significant influence on software product specification and licensing agreements. Depending on their scale, the organisational profile and the specialised administrative and operational tasks they have to undertake (e.g. e-government services, tax administration and human resources management), public organisations often seek custom developed IT services and software solutions that can be tailored to their specific needs and that they are often shared and identifiable between different departments and organisations. FOSS, allowing for maximum customisation and re-use, brings certain advantages that need to be assessed on a wider, IT policy level.

Moreover, due to their public service orientation, public agencies and administrations have also to reinforce themselves and comply with certain principles and requirements such as open access and availability of public data, transparency in public funding and spending, fair market competition and accountability to citizens. Due to its features as a public good with non-rival use rights, FOSS directly relates to these policy objectives as a potential enabler pertaining to societal, economic and strategic aspects as described below.

2.2. Social aspects

2.2.1. Public data openness and e-inclusion

Openness and "e-inclusion" refer to the indiscriminate, unhindered access of all citizens to public information and e-government services. Government departments and public administrations are obliged to facilitate the access of citizens to public data and to support information exchange mainly through the adoption of open platforms, standards and technologies. The way that FOSS affects e-government growth is described in Lakka et al. (2012).

Open standards and platforms should be implementable in both open source and proprietary systems and applications. When opting for a specific software environment, however, public administrations also define the level and extent of openness allowed by software features and functionalities. Potential risks and barriers to accessibility such as data lock-ins are critical factors to be considered. FOSS, natively supporting a wide range of open standards and being highly customizable, particularly relates to the requirement of openness and accessibility.

2.2.2. Transparency and accountability

It has been argued that the citizen's right to information goes as far as scrutinising the procedures under which information was generated and processed. In this sense, software should also be well documented in all its technical features and adopted through open and transparent procurement and selection procedures in order to promote competition fairness, public information accessibility and accountability. Software system architectures, features and functionalities should be as visible as possible so they can be benchmarked, evaluated and modified if needed to meet the particular needs of public organisations. FOSS, providing, by definition, access to its source code and allowing public stakeholders to assess specific software modules and features, is central to the openness and transparency priority thus raising a serious challenge for public stakeholders and decision makers.

2.3. Economic aspects

One of the most critical aspects and a strong motivation driver for public administrations when opting for open source is the cost cutting in terms of software licence purchasing. FOSS, based on a free use and distribution licensing model can help public administrations significantly reduce the cost of acquiring software. FOSS, however, should not be considered as cost-free and decision making for public spending should refer to all associated, direct or indirect costs (e.g. service subscriptions and licence agreements, required upgrades and extensions, technical support, training and maintenance fees).

The work (Edwards, 2005) has developed a model for understanding the relationship between a maintainer and one or more user-developers. A maintainer is an agent who is responsible for releasing new versions of a program, and a user-developer is an agent who uses the program and may, depending on the license, decide to make modifications to the program. The model was evaluated for three different types of licenses. Open source also raises the need for wider assessment policies that go beyond a cost analysis basis and include expected benefits and gained advantages on a mid and long term scale such as software reusability and vendor independence.

2.4. Strategic aspects

Avoiding data and vendor lock-ins is a critical strategic priority for any public organisation planning to acquire IT systems and applications. Not heavily relying on external providers for data security and not being tied up to specific software products and vendors, are two key factors for national governments and public administrations wishing to maintain a certain level of independence. Such independence can be achieved in more than one ways combining both open source and proprietary features. FOSS, however, provides a higher level of control and flexibility over software thus offering a potential advantage in terms of technological independence.

From the study (Valimaki and Oksanen, 2005), it seems clear that open source and free software have changed fundamentally the operating system software markets in recent years. The authors argue that FOSS licensing has been one of the most important factors of change in the microcomputer operating system markets in the recent years. However, there has been no single open source strategy; all market players have adopted open source into their operating system strategy in one form or other. Whether governments and public administrations should rely on proprietary software vendors or invest in custom developed, open source solutions that can be maintained by in-house skills and resources, is a complex issue to be analysed within a wider strategic orientation in IT policy.

3. FOSS policy framework

3.1. Policy implementation levels and areas

Legal and institutional frameworks regulating software policies and practices touch upon a wide range of implementation levels and areas. Three main implementation levels are defined and used in this manuscript in order to describe policies and policy makers:

- *Local/regional level*: municipalities, local governments and regional authorities,
- *National level*: national governments, agencies and associations, parliaments, legislative bodies,
- *EU-wide level*: the European Commission, the European Council, the European Parliament, European agencies and observatories.

In the EU context, the principle of subsidiary requires that political decision making is made on the lowest possible administrative and political level. EU legislation can only occur in areas that have not been addressed or have been inadequately addressed by regional or national policies implemented by Member States. Within this framework, there are several national legislative acts, EU Directives, European Commission Communications, government action plans, frameworks and guidelines that regulate software use and acquisition in the public sector (TEIU Codrin-Marius, 2012). Fewer official documents specifically or exclusively address open source as a policy issue.

For the purposes of this document five policy implementation areas that relate to FOSS have been defined, as depicted in Fig. 1:

- *Data openness and reusability*: policies on the openness and accessibility of data and public sector information, strategies for the interoperability of e-government services and the reusability of software solutions and components in the public sector,
- *Licensing, procurement and software market policies*: policies for software licensing and procurement, rules and procedures for public tenders, fair market competition,
- *FOSS adoption, integration and sustainability*: policies on assessing, adopting and integrating open source as a sustainable solution for governments and public administrations,
- *Research & innovation*: policies for investing in open source R&D as a means to support innovation, entrepreneurship and regional development,
- *Training and education*: policies for the educational use of FOSS and its integration in learning environments.

During the last years, Europe has intensively engaged in developing policies and implementing initiatives on open source whether on a regional, national or EU-wide level. According to a recent report on global government open source policies,

Fig. 1. FOSS policy areas.

Europe is the most active open source policy maker in the world with 163 open source initiatives out of a recorded 354 initiatives (46%) (Edwards, 2005) (see Fig. 2). The 126 of the 163 open source initiatives have been approved, 45 of which are research initiatives, 8 mandatory (where the use of open source software is required), 36 preferences (where the use of open source software is given preference, but not mandated) and 37 advisory (where the use of open source software is permitted) (Government Open Source Policies, 2010).

Some of the most recent key policy initiatives that also relate to certain aspects of FOSS are:

- 2003: Public Sector Information Directive (2003/98/EC),
- 2004: Public Procurement Directive (2004/18/EC),
- 2004: European Interoperability Framework, 1st version,
- 2006: Commission Communication on "Interoperability for Pan-European eGovernment Services",
- 2007: Lisbon Ministerial Declaration,
- 2007: i2010 initiative,
- 2010: Commission Communication on the "European Interoperability Strategy" and the "European Interoperability Framework" (final version),
- 2010: Commission Communication: a Digital Agenda for Europe,
- 2010: Europe 2020 Strategy.

With the exception of EU Directives that have been transposed to national legislative acts and therefore acquired a mandatory status, most of these policy documents have an advisory status to national governments and public administrations. Moreover, although acknowledging the potential of open source in meeting the targets of a European software strategy and ICT, most of these policy documents highlight policy objectives and requirements that tend to be technology neutral. Specific policy priorities that have been put forward such as openness of systems or interoperability of e-government services may be associated but do not exclusively refer to open source systems and applications. In this sense, they should be considered rather FOSS-related than open source policies.

The same applies for the National Interoperability Frameworks that have been developed in most Member States as a response to the European Interoperability Framework. According to the 2009 Overview of the National Interoperability Framework Observatory (NIFO), 13 countries out of the EU27 have published their own National Interoperability Frameworks while several others are in progress (IDABC, 2009).

There are, however, cases of national strategies, government action plans and policy documents that specifically refer to open source as a policy issue. Some of the most recent examples are:

- 2009: "Open Source Software and the Public Sector". Denmark (The National IT and Telecom Agency, 2009),
- 2009: "Open Source, Open Standards and ReUse: Government Action Plan". UK (The Cabinet Office, 2009),
- 2008: "Open Source Software for the Development of the Spanish Public Administration. An overview". Spain (National Observatory of Open Source Software, 2008),
- 2007: "The Netherlands in Open Connection. An action plan for the use of open standards and open source software in the public and semi-public sector". The Netherlands (The Ministry of Economic Affairs 2007).

In addition, as reported in JOINUP, some of the most recent cases of FOSS-related initiatives and political statements show a growing acknowledgement of the significant role that FOSS can play in various aspects of the public sector and particularly in public administrations:

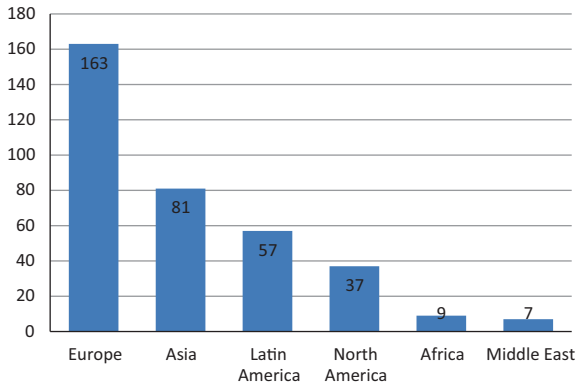

Fig. 2. Open source policy initiatives by world region in the 2000–2009 period. Source: "Government Open Source Policies", Center for Strategic and International Studies, 2010.

- In an opening speech at the Open World Forum (22–24 September 2011, Paris), the French Minister for Industry, Energy and the Digital Economy has acknowledged the "decisive contribution" of open source software (OSS) to the Digital Revolution (JOINUP, 2011a),
- Poland's Deputy Prime Minister and Minister of Economy, acknowledged FOSS as the "greatest success of the 20th century" in a conference talk on 27 September 2011. He commented that FOSS can provide solutions to some of main challenges of the 21st century (JOINUP, 2011b),
- The importance of FOSS is rising among public administrations in the United Kingdom with politicians increasingly acknowledging its impact. Some recent examples of public administrations turning to FOSS include city and county councils (e.g. the Oxfordshire County Council), hospitals and government departments (JOINUP, 2011c).

3.2. Strengths and weaknesses: assessing FOSS policies

Most EU member states have either shaped, revised or have under development software strategies that include open source as a key factor of policy making. There is political will that will be expressed in most countries on a national level to support open standards and adopt open data policies and schemes. This is expected to facilitate a further integration of open source solutions by public administrations.

The European Commission also foresees open source as a critical driving force for strengthening Europe's position in the software industry and as an enabler to the need for openness and interoperability. In this perspective, the strengths of open source or FOSS related policies in the EU context are:

- Political decision making and commitment on a high level (e.g. the European Commission),
- Specification on an EU level of underlying principles and requirements for software features and functionalities (e.g. open standards and platforms, interoperability, reusability) that are also fully implementable by open source software,
- Ongoing public consultation with both public stakeholders and the industry,
- Ongoing development and revision of national software strategies based on defined EU policy schemes such as the European Interoperability Framework,
- Support and monitoring on an EU level through dedicated observatories and networks (e.g. NIFO, JOINUP).

Although being highly active, European policy making on software also suffers from certain weaknesses particularly in putting forward and implementing roadmaps and unified mechanisms to specifically support and further integrate open source in public IT infrastructures as a means towards social inclusion, innovation and development. Some of the policy aspects in which there is still great progress to be made are:

- Most high level (e.g. the European Commission) policy documents do not specifically refer to objectives and priorities for open source,
- Most high level policy documents have not a mandatory but rather an advisory status,
- There is a lack of homogeneity and coordination between national and EU policy frameworks for open standards and open source software,
- Current policies maintain a sporadic open source integration that progresses at different paces. Certain countries or regions seem to lead the way, applying, on some occasions, more advanced or ambitious policy plans than those recommended at the EU level,
- There is a lack of clear institutional frameworks on a national level (e.g. national agencies, monitoring mechanisms) to ensure that requirements, mandatory standards and objectives on open standards and open source are fully implemented by all stakeholders,
- Existing policies have not ensured efficient public procurement monitoring mechanisms to eliminate software discrimination practices in public tenders (Open Forum Europe, 2010),
- Software procurement policies do not fully exploit the collective influence of public administrations in the software market as an extensive base of software "consumers" to benefit from market competition,
- Current policies do not efficiently promote a culture of trust and awareness on open source that is still lacking among public administrations and should be promoted through active policies on training and education,
- Current European policies for software and R&D do not fully reflect the realities of the software industry and Europe's competitive advantage in FOSS development. There is great progress to be made in promoting open source production and entrepreneurship through innovation clusters.

4. FOSS policy recommendations

This section provides policy recommendations on aspects and issues pertaining to the assessment, adoption and integration of FOSS by European Public Administrations. Based on policy review and analysis, 25 recommendations on policy initiatives and actions have been proposed, grouped in five broad policy areas as defined in Section 3. Table 1 presents how the proposed actions/recommendations are distributed per policy area and highlights the policy level (regional, national,

Table 1
Policy level of the recommendations.

Policy area	Recommendation	Policy level		
		Regional	National	EU
Data openness and reusability (3)	Using open standards on a "comply or explain" basis	X	X	
	Fine-tuning interoperability strategies		X	X
	Defining monitoring and support mechanisms for openness and reusability	X	X	X
Licensing, procurement and software market policies (8)	Defining a clear licensing policy	X	X	
	Developing common licensing policies across the public sector	X	X	
	Monitoring tenders for software discrimination practices		X	X
	Updating procurement frameworks and procedures	X	X	
	An "equal consideration" policy: balancing needs and options	X	X	
	Requiring compliance with interoperability frameworks in public tenders	X	X	
	Setting a "re-use instead of re-build" priority in public tenders	X	X	
	Developing joint procurement policies in fulfilment of shared priorities	X	X	
FOSS adoption, integration and sustainability (9)	Developing FOSS adoption plans as part of wider IT strategies	X	X	
	Allowing for diversity in open-standard software environments	X	X	
	Adapting internal processes to open source environments	X	X	
	Clarifying the legal and institutional framework	X	X	
	Providing guidance and support to small and medium size organisations	X	X	
	Involving staff through FOSS training and awareness	X	X	
	Beyond cost analysis: defining a FOSS assessment policy	X	X	
	Integrating FOSS as a vehicle for regional development	X		
	Supporting public organisations as potential FOSS producers	X	X	
Research and innovation (3)	Investing in FOSS research and development	X	X	X
	Revising the EU software standardisation strategy			X
	Investing in innovative software products and solutions	X	X	X
Training and education (2)	Integrating FOSS as a means to increase ICT skills and e-inclusion	X	X	X
	Integrating FOSS in the educational system on a regional/national level	X	X	

EU) that each recommendation may be applied to. The paragraphs that follow Table 1 analyse the recommendations and present the benefits from their adoption.

4.1. Data openness and reusability

4.1.1. Recommendation 1: Using open standards on a "comply or explain" basis

Public administrations are urged to opt for the highest possible level of openness whether using open source or proprietary systems and applications. In cases where required open standards are not available, thus opting for less open alternatives, public administrations should provide sound justification for non-compliance. This approach has been adopted by the Dutch Government as the "comply or explain" policy.

Public administrations willing to implement open standards based on their needs through open source technologies and on a royalty free basis, would meet openness requirements while also being in full compliance with the European Interoperability Framework (Interoperability Framework (EIF) 2010). In any case, a compliance policy for open standards should consider all available platforms and technologies, whether proprietary or open source that could support the implementation of such standards and providing justification for all decisions made. Such a policy would also mean that all peer organisations and involved stakeholders would be expected to implement agreed and clearly defined open platforms and specifications in order to commonly ensure a higher level of interoperability.

By adopting a "comply or explain" policy, governments and public administrations can have practical and long-term benefits on several aspect and levels, such as:

- Reaching higher interoperability and improving information exchange between departments, services and peer stakeholders,
- Speeding-up administrative and decision making processes,
- Improving services provided to citizens,
- Increasing the level of e-inclusion among citizens,
- Facilitating a smooth transition for a potential migration to open source systems and applications.

4.1.2. Recommendation 2: Fine-tuning interoperability strategies

The interoperability of software-based public services through the use of open standards and platforms has been defined as a high level strategic priority in the EU in two key policy documents: the "European Interoperability Strategy" and the

"European Interoperability Framework". Several National Interoperability Frameworks have been developed and published in recent years in response to this European policy objective. However, at the same time, this has posed a risk of fragmentation and lack of homogeneity since not all National Interoperability Frameworks are fully aligned with the revised European Interoperability Framework. This risk needs to be addressed through coordination and monitoring mechanisms on an EU level such as the NIFO in order to compare, analyse and assess national interoperability strategies in Member States and the Community. Policy initiatives should also be undertaken by national governments in order to make sure that National Interoperability Frameworks:

- Refer to all levels of interoperability,
- Reflect the standardisation needs of public stakeholders,
- Are in line with active frameworks in other member states,
- Are fully compliant with the revised European Interoperability Framework.

All applied national strategies on interoperability should be in compliance with the basic principles set by the European Interoperability Framework relating to openness, reusability, transparency, technological neutrality and adaptability. By undertaking joint initiatives and developing common policies on interoperability based on their needs and requirements, public administrations will be able to:

- Put forward their software standardisation needs,
- Identify implementation for open standards and platforms,
- Identify open source solutions that can implement such standards.

4.1.3. Recommendation 3: Defining monitoring and support mechanisms for openness and reusability

Interoperability requirements and re-usability recommendations included in the European Interoperability Framework are not legally binding for Member States (since they are not transposed into national legislative Acts) and therefore their implementation is not perceived as mandatory. Relevant EU legislation such as the Directive 2003/98/EC (Directive 2003/98/EC, 2003) for public sector information re-use, although providing a legal framework does not ensure a full compliance and uniform implementation across Member States.

During the last years there have been some successful examples of monitoring instruments and support centres for openness and reusability on a European level. NIFO has been setup by the IDABC in order to monitor National Interoperability Frameworks on an EU-wide basis. Another successful case is that of JOINUP, which serves both as a repository and support centre for the sharing and re-use of open source solutions. Such EU-wide support and monitoring centers should be used as integral parts of EU policy implementation on openness and reusability.

Similar mechanisms should also be developed or further supported on a national or regional level in order to make sure that open standard and reusability requirements are clearly defined and presented to all stakeholders and are fully implemented across the public sector. National or regional authorities should not simply monitor the implementation of defined requirements but also provide a knowledge basis and support resources for making standards, available options and technologies clear and accessible to all stakeholders.

Adopting a policy for coordination, monitoring and support of software openness and reusability on a national or regional level is expected to:

- Ensure a consistent, homogenous implementation of open standards and reusability requirements across the public sector in compliance with the European Interoperability Framework,
- Guarantee a minimum level of interoperability of e-government services between different departments and organisations on a regional, interregional and national level,
- Maximise the reusability and transferability of software solutions and components among public administration reducing, as a consequence, all relevant costs,
- Facilitate the adoption of trusted and reliable open source software that meets defined criteria, needs and specifications,
- Facilitate the definition of national roadmaps for interoperability,
- Encourage a culture of openness software reusability within public administrations.

4.2. Licensing, procurement and software market policies

4.2.1. Recommendation 4: Defining a clear licensing policy

Auditing licence types and choosing a proper license based on defined needs and requirements, although probably a time-consuming process should be part of the overall IT policy applied by public administrations. Governments and public administrations should define needs, requirements and the desired level of control over software based on which they should specify the conditions, prerequisites and selection criteria of software licences. A software licence adoption policy could be based on a number of criteria some of which may be particularly weighted for governments and public administrations. These criteria include the unlimited access to source code and unlimited usage of the software, the right to reproduce and distribute

an unlimited amount of copies, the right to modify the software and the right to reproduce and distribute an unlimited amount of copies of the modified software version under the same license restrictions.

Reading, reviewing and understanding licensing schemes and conditions of use should be treated as equally important as the acquisition of software itself. Most widely used open source licences, whether open source or proprietary, clearly define terms on the use, integration, modification and redistribution of the software code. Terms of use, warranties and indemnities should be also specified and reviewed, especially throughout the procurement process.

A clearly specified software licensing policy can greatly help public administrations in:

- Selecting software solutions based on desired features and defined criteria,
- Getting suitably licensed software solutions through public tenders,
- Adopting trusted and reliable open source solutions,
- Better serving their needs and requirements regarding software use, re-use, distribution and modification,
- Ensuring compliance with the current legal framework.

4.2.2. Recommendation 5: Developing common licensing policies across the public sector

Public administrations with shared objectives and similar organisational needs should jointly develop ''one to serve all'' licensing policies for software. In this way they could strongly put forward common wants and needs on software and develop a shared knowledge basis on licensing issues as a firm, common ground for selecting best value for money solutions. Adopting shared licensing strategies based on common needs and mutual understanding would help public administrations to:

- Better serve their software requirements based on their operational tasks and organisational needs,
- Maximise the reusability and transferability of acquired software components and applied solutions,
- Reduce the cost of software licence purchasing and updating,
- Promote a uniform software licensing regime across public sector networks or associations (e.g. regional or national associations of municipalities) based on a commonly accepted licence type, such as the European Union Public Licence.

4.2.3. Recommendation 6: Monitoring tenders for software discrimination practices

According to the last OFE procurement monitoring report (Open Forum Europe, 2010), 13% of the monitored public tenders made an explicit reference to a proprietary software trademark, thus excluding open source or proprietary alternatives. In order to ensure fair market competition and transparency in software procurement processes public tenders should be monitored for discrimination factors and practices on both a national and a European level. Public procurement officials and decision-makers have to take a series of measures and initiatives in opening up procurement procedures to all providers. By making sure that public tenders do not discriminate against certain technologies, software delivery models or suppliers, existing entry barriers can be removed. Applying a monitoring policy for software discrimination practices should be considered an effective way of:

- Reducing the risk of vendor lock-ins,
- Ensuring fair market competition and transparency in public tenders,
- Removing barriers for small or medium size open source providers,
- Increasing market competition and software solution offerings.

4.2.4. Recommendation 7: Updating procurement frameworks and procedures

Governments and public administrations should update or adjust, where needed, foreseen requirements and procedures for software procurement and public tenders, in order to both meet changing organisational needs and reflect the dynamics of the rapidly growing software market. By keeping software procurement frameworks and procedures up-to-date, public administrations can make sure that:

- Their current needs and wants are properly reflected,
- Possible entry barriers for emergent technologies or innovative software products are removed,
- No specific technologies or software suppliers, whether open source or proprietary, are excluded.

4.2.5. Recommendation 8: An "equal consideration" policy: balancing needs and options

Governments and public administrations should balance between serving their own wants and needs and discriminating against specific products and alternatives when outlining desired software features or opting for a specific solution. The needs, requirements or specifications should be reflected and could be defined in the form of technical requirements, desired functionalities or additional services. Therefore, public administrations should consider both open source and proprietary solutions on an ''equal footing'', based on competitive advantages and desired features. An ''equal consideration'' policy based on a fair treatment of both open source and proprietary solutions is likely to increase market offerings and available options.

Based on their needs and priorities, public administrations could define various software features and properties as weighted evaluation criteria (e.g. source code availability, right to distribute, reuse and modify, support and security). Adopting an ''equal consideration'' policy can enable public administrations to:

- Increase market competition and offered software solutions,
- Select the most fitting software solutions on a best-value-for money basis,
- Opt for open source solutions if providing added value features or specific benefits,
- Ensure fair market competition and transparency,
- Reduce single vendor dependence and lock-ins.

4.2.6. Recommendation 9: Requiring compliance with interoperability frameworks in public tenders

Public administrations should include open standards and interoperability requirements in tenders in a clear and justified way. A public organisation should specify, for example, that standards, interfaces, protocols or file formats implemented by the supplied solution must meet the open standard requirements. Some basic open standard properties that can be defined are:

- Standards can be delivered by all suppliers and equivalent technologies,
- Standards are developed and documented following open, transparent procedures,
- There are no restrictions regarding the re-use of standards.

Compliance with National Interoperability Frameworks should be included in the procurement criteria where applicable. Setting a policy for including interoperability requirements in public tenders is critical for public administrations since it provides a basis on which to:

- Reduce the risk data and vendor lock-ins,
- Open the field for more software solution providers,
- Equally consider open source solutions,
- Extend the use of open standards and increase interoperability in public administrations,
- Ensure the implementation of National Interoperability Frameworks.

4.2.7. Recommendation 10: Setting a ''re-use instead of re-build'' priority in public tenders

According to the European Interoperability Framework, public administrations ''are encouraged to reuse and share solutions and to cooperate on the development of joint solutions when implementing European public services'' (Interoperability Framework (EIF, 2010). They are also urged to ''develop a component-based service model, allowing the establishment of European public services by reusing, as much as possible, existing service components'' (Interoperability Framework (EIF), 2010). Following the requirement for sharing and reusing software solutions, public administrations should include clear specifications and criteria for the reusability of software components in public tenders. By including reusability criteria in public tenders, public administrations will be able to:

- Maximise the sharing/re-use value of purpose-built software components across the public sector,
- Facilitate collaboration and communication between peer units and organisations,
- Reduce overall software purchasing costs,
- Maximise the effectiveness and transferability of applied software solutions,
- Encourage the development of FOSS solutions tailored to the needs of public administrations.

4.2.8. Recommendation 11: Developing joint procurement policies in fulfilment of shared priorities

Public administrations are strongly urged to form stakeholder networks and develop common procurement policies to fulfil joint needs and priorities (e.g. openness and reusability) and to benefit from fair and increased market competition. Public organisations with similar organisation needs and shared objectives should work together in defining shared procurement requirements and software selection criteria that could increase offering of open source solutions.

Public administrations have a lot to gain from joining forces with peers in procuring open source software. FOSS has not yet reached its full potential in public procurement and therefore national agencies, non-governmental and public organisations should keep providing guidelines and information resources on open source procurement policies through dedicated stakeholder networks, groups and consortia (e.g. JOINUP). The involvement in such communities and networks will not just facilitate software procurement processes but will also help increase the reliability and trust on open source software itself. Adopting such policies on a regional or national level can lead to a series of benefits:

- Increased market competition will lead to better offerings from large-scale software vendors,
- Lower market entry barriers and business opportunities for local or regional developers and providers, SMEs that will be able to provide FOSS solutions,
- A ''large buyer'' effect can lead software supply to more efficient ways to cover public sector needs and requirements,
- Jointly promote shared needs and priorities in software procurement.

4.3. FOSS adoption, integration and sustainability

4.3.1. Recommendation 12: Developing FOSS adoption plans as part of wider IT strategies

Governments and public administrations are urged to develop integrated plans that can facilitate FOSS adoption within their entire infrastructures based on organisational needs and available resources. Planning a wider strategy for FOSS adoption and sustainability should include estimated risks and clearly set objectives, foreseen costs and expected benefits. A FOSS adoption plan should also be adjusted to the scale, IT architecture and organisational profile of the public organisation it is developed for. Offered solutions should be reviewed in the light of available human and technical resources, existing software systems and applications, targeted end-users and overall organisational needs. Small or medium size organisations have significantly different needs and features compared to large organisations or national agencies and institutions that refer to thousands of end-users or stakeholders. Integrating FOSS solutions within a wider IT policy planning framework is expected to:

- Facilitate a smooth migration to open source systems and applications,
- Maximise the effectiveness and sustainability of adopted FOSS solutions.

Such an effective planning can help public administrations leverage the full potential of open source on a long term basis.

4.3.2. Recommendation 13: Allowing for diversity in open-standard software environments

In order to ensure IT sustainability and flexibility, public administrations should allow for diversity in open standard-based software environments (open source or proprietary) in which they can fulfil their needs in terms of operational tasks, software functionalities and interoperable services. Public administration managers and staff should be able to serve internal needs and processes through different software components or environments under a common open standard principle.

By adopting a policy that allows for diversity in open standard-based software environments, governments and public administrations can benefit from a series of enabling factors and advantages:

- Software adoption versatility through diversity of options,
- Ensuring interoperability through an open standard implementation ‘continuum’,
- Avoiding data and vendor lock-ins,
- Public sector data re-usability,
- Sustainability of IT systems and applications,
- Increased readiness for a potential migration to open source environments.

4.3.3. Recommendation 14: Adapting internal processes to open source environments

The integration of open source systems and application in public IT infrastructures often fails due to the fact that public administrations are unable to cope with the features and requirements of open source operating environments. Lack of training and awareness and the incompatibility of internal processes and operational tasks with adopted solutions significantly raise failure risks. Public administrations should be able to integrate not just proprietary but also open source systems in their IT architectures and organisational structure. Internal processes and operational tasks should be adjustable both to the proprietary and open source models for software development and support. By defining a policy for fine-tuning internal processes to meet both open source and proprietary requirements, public administrations can have an advantage in:

- Ensuring a high level of flexibility on selecting the best possible software environment,
- Achieving a high level of independence from specific vendors or technologies,
- Assess and adopt open source solutions based on a clear view of internal needs and processes,
- Smoothly integrate open source systems and applications.

4.3.4. Recommendation 15: Clarifying the legal and institutional framework

When adopting or migrating to open source solutions, public administrations are often involved in time consuming and burdensome bureaucratic processes that can hinder or delay implementation. A large scale open source migration project implemented in the entire IT infrastructure of a government or a public organisation may involve several units, departments or agencies in terms of jurisdiction (e.g. IT departments, public procurement agencies) This raises a need for policies that can significantly simplify processes for integrating open source in public IT infrastructures.

Therefore, national or local governments should provide coherent and updated legal and institutional frameworks for open source development licensing and adoption in the public sector. Moreover, the legal requirements and the institutional roles and responsibilities of all organisations involved in IT policy planning and software procurement should be clearly defined and known to all stakeholders. Having a clear legal and institutional framework on all aspects of open source will be a significant contribution in:

- Speeding up the integration of open source solutions in the public sector,
- Setting up quality assurance and implementation mechanisms for both open standards and FOSS,
- Supporting the quality and sustainability of applied solutions.

4.3.5. Recommendation 16: Providing guidance and support to small and medium size organisations

National governments, central agencies and regional administrative centres should provide guidance and support to small and medium organisations considering FOSS adoption plans and migration projects. Such a support should not restrict to funding but it should also include the specification of standards and requirements, guidelines, documentation and knowledge resources, consensus building and stakeholder motivation.

Joint initiatives and collaborations under an "umbrella" agency can attract more potential adopters and increase the transferability of best practices between small scale organisations. More specifically higher political support and guidance can greatly contribute in:

- Speeding up and encouraging the adoption of FOSS in small and medium public organisations with less staff or technical resources,
- Valorising reusable FOSS components and solutions among small scale organisations,
- Guaranteeing the quality and sustainability of FOSS solutions,
- Ensuring a homogenous integration of open source software on all levels of the public sector.

4.3.6. Recommendation 17: Involving staff through FOSS training and awareness

Open source migration projects often fail due to limited involvement of staff and users. Motivating and involving a large number of staff, an entire department of even an entire organisation in integrating a FOSS solution is the best way to ensure that end-users are going to actively participate, share experiences and keep on using the systems or applications introduced. Therefore, public administrations are urged to plan actions and initiatives for raising awareness and training their staff in open source systems and applications as a critical aspect for the effectiveness of their open source policies. This could constitute an effective mid- and long-term policy for public agencies and administrations in terms of:

- Reducing failure risks in large scale FOSS migration projects,
- Achieving a full integration of adopted FOSS solutions in internal processes and IT infrastructures,
- Maximising the effectiveness and longevity of adopted FOSS solutions,
- Enhancing trust and awareness on open source among staff,
- Advancing staff's ICT skills.

4.3.7. Recommendation 18: Beyond cost analysis: defining a FOSS assessment policy

Governments and public administrations should develop a full assessment policy for adopted open source solutions considering both costs and long-term benefits. Adopting and integrating FOSS systems and applications in an organisation's IT infrastructure is a long process that should be continuously monitored and evaluated in terms of end-user satisfaction, cost-effectiveness and improvement in various operational fields (e.g. productivity and performance, vendor independence, enhancement of IT system security and administration). Evaluating a FOSS project through predefined standards and criteria (e.g. technological maturity and reliability, total amount of cost savings) and by getting both internal feedback and -if possible- external expert opinions is the best way to make sure that all identified risks and weaknesses will be addressed and that benefits will have a long-term impact within the organisation.

By defining a coherent FOSS assessment policy based on clear evaluation criteria that reflect their specific needs and requirements governments and public administrations will be able to:

- Reach informed decisions on opting for the best solutions on a best-value-for-money basis,
- Make sure that adopted open source solutions are technologically mature and reliable,
- Improve and fine-tune their IT and software procurement policies where needed,
- Leverage the full potential of FOSS.

4.3.8. Recommendation 19: Integrating FOSS as a vehicle for regional development

There is a great potential for regional authorities and public administrations aiming to integrate FOSS in their IT infrastructures as a strategic component for regional growth and development. The regional government of Extremadura (Spain) provides a great success story on the potential that FOSS can bring on a regional level. The region of Extremadura has implemented, during the last years, a wide adoption and almost full integration of FOSS solutions in its public services and IT infrastructures, with open source reaching up to 67% of all systems and applications. By adapting open source platforms and applications to local needs through extensive localisation and customisation, Extremadura managed to engage more citizens and age groups (e.g. students, seniors) in e-government services; while, at the same time, it achieved a high level of control over software. According to the ICT Director of the Regional Government, in the case of Extremadura, FOSS has been a vehicle to "sustainable and technologically independent development" (JOINUP, 2011d).

Based on this success story, it is clear that a well planned, large scale migration of public services and IT infrastructures to open source, if combined with motivation drivers for staff, citizens and businesses (e.g. training, localisation of platforms, economic incentives) can prove to be a key factor for regional development. Therefore, local governments and regional authorities are encouraged to assess open source as an enabling factor that can open up opportunities and valorise local strengths as part of wider ICT based strategies for regional development. This could enable local governments and regional authorities to:

- Improve e-inclusion rates and open up opportunities for local businesses,
- Build up trust on the effectiveness and reliability of FOSS among their staff and citizens,
- Gain independence from proprietary vendors and technologies through higher local control over their own software solutions,
- Capitalise on their background and experience by transferring knowledge, support and FOSS-based solutions to more regions with similar problem-solving priorities.

4.3.9. Recommendation 20: Supporting public organisations as potential FOSS producers

As clearly stated in the European Interoperability Framework, European Public Administrations are strongly encouraged to develop component-based service models, and to share and re-use software solutions as much as possible. Based on this recommendation, public administrations should be given support, not only on a policy level but also in terms of legal guidance, funding, resources and practical guidelines in order to be able to become themselves FOSS producers and providers. AS FOSS producers, public administrations can:

- Achieve higher efficiency and independence as producers of own, in-house software solutions,
- Jointly develop, share and re-use software components and solutions with peer organisations,
- Contribute to open source code quality and supply of reliable open source solutions.

4.4. Research and innovation

4.4.1. Recommendation 21: Investing in FOSS research and development

Europe has a wide and active base of open source knowledge centres, SMEs and FOSS developer communities. Nevertheless, it still fails, to a great extent, to turn this advantage to large scale, commercialised FOSS projects and successful FOSS-based business strategies.

The European Union, in close collaboration with Member States and regional stakeholders should orientate R&D policies towards promoting FOSS development and entrepreneurship by investing in public–private partnerships, regional research clusters and innovation hubs. Enabling different developers, IT companies and software firms to compete in FOSS products within innovation ecosystems can not only boost regional economy but also help improve Europe's strategic position in the software industry.

Investing in FOSS R&D centres and innovation hubs could lead to:

- Regional economic growth,
- New business opportunities for European IT companies, SMEs and public–private partnerships,
- Innovating FOSS based tools and applications developed in Europe,
- More open source solutions offerings for European governments and public administrations,
- Increased market penetration and higher innovation status for European businesses and developers.

4.4.2. Recommendation 22: Revising the EU software standardisation strategy

EU policy making in this area should take into account both institutional and industry standard developers and the needs of key European stakeholders. As stated in a recent report on the European software industry, the Commission should: "*recognise the prominent role of industry fora and consortia in developing standards within the software market and take appropriate action*" (The European Commision, 2009). A clear and more detailed mapping of the standardisation needs and areas that are most crucial for public European stakeholders (e.g. standards per market domain or technological domain, interoperability barriers) is also needed.[4]

Therefore, the EU policy on software standardisation should be fine-tuned based on: a clear and detailed mapping of the standardisation needs of public stakeholders (e.g. governments, public administrations), the need for openness of standards in the public sector and an acknowledgement of standards developed by standardisation consortia and the industry. Moreover, it should be revised combined with initiatives for widening the European FOSS development base as a way to improve

[4] It should be noted that the European Commission has recently reached an agreement with the World Wide Web Consortium (W3C) on the sustainability of key specifications to facilitate interoperability between public administrations across borders and sectors. The Asset Description Metadata Schema (ADMS) as well as three Core Vocabularies (Core Person, Core Business, and Core Location) developed by the EU's ISA programme (http://ec.europa.eu/isa) will be contributed to the W3C's Government Linked Data (GLD) Working Group JOINUP (2011e).

and speed up standard adoption mechanisms. Any policy initiative on mapping standardisation needs and updating relevant frameworks should meet certain conditions of openness, technological neutrality and transparency.

A revised software standardisation policy would be more effective in:

- Addressing the software standardisation needs of public stakeholders across Europe,
- Addressing European policy priorities on openness, technological "neutrality" and transparency,
- Promoting FOSS use and development,
- Strengthening the EU software industry.

4.4.3. Recommendation 23: Investing in innovative software products and solutions

Open source is expected to have an increased market penetration in the following years based on its features and on emerging technologies and new software delivery models such as Software-as-a-Service. This trend raises a need of adapting open source policies to the changing software environment. Public administrations, national governments and the EU should meet the challenges raised by this new environment by investing in FOSS as a key enabler of internet based software services. In this way, they could:

- Reap the benefits of the further growth and penetration of FOSS in the software market,
- Develop innovative, cost effective software solutions for public administrations in Europe,
- Facilitate the integration of FOSS-based solutions in public administrations.

4.5. Training and education

4.5.1. Recommendation 24: Integrating FOSS as a means to increase ICT skills and e-inclusion

FOSS, based itself on skill developing, learning and experimentation, has a great potential as a training toolset. The skill setting value of FOSS has been acknowledged long ago by employers that are willing to recruit developers with an open source "exposure" background. Such a training value comes at significantly low cost either to individuals or public organisations and therefore it can be capitalised to increase digital literacy and professional IT skills for both staff and citizens (Ghosh et al., 2002). Governments and public administrations are urged to develop programmes and initiatives on FOSS training for staff and citizens through their capacities and infrastructures. The European Union should also fund and actively support FOSS training as means to address its deficit in ICT skills and digital literacy. These actions can have several benefits on various levels:

- Increasing the level of e-inclusion and digital literacy,
- Increasing the level of professional ICT skills in public organisations,
- Supporting and expand a base of new open source developers,
- Enhancing trust and awareness on FOSS through expert training and certification for staff/citizens,
- Fostering innovation on new internet-based modes for software delivery.

4.5.2. Recommendation 25: Integrating FOSS in the educational system on a regional/national level

Apart from providing itself a training tool for ICT skills, FOSS can offer low cost, stimulating learning environments through educational platforms and applications. On certain occasions FOSS penetration is faster and higher within the IT infrastructures of educational units and departments compared to other public sector sections. Governments and public administrations are urged to introduce or further integrate FOSS-based learning tools and environments in their educational systems and infrastructures. Through a policy for promoting FOSS-based learning, schools, educational units and administrative authorities will be able to:

- Reduce the cost of buying educational software,
- Develop or customise their own learning platforms independently without having to solely rely on proprietary software vendors,
- Provide open and customisable tools and platforms for ICT training and skill developing,
- Provide a basis for an early awareness or adoption of open standards and open source software.

5. Conclusions and Future Work

The use, adoption and integration of FOSS in the IT infrastructures of European governments and public administrations has not always followed the same pace and has not always moved towards the same direction. Legal and institutional frameworks, social, economic and technological aspects are some of the differentiating factors that explain gaps or divides between regions and countries on the awareness and penetration level of open source. Some countries are leading the way of open source integration in public IT infrastructures, either by implementing several migration projects or by having processed clear, FOSS-specific policies, frameworks and support centres.

Local and regional authorities are often better positioned to directly integrate open source systems and applications in their internal processes and IT architectures by clearly defining needs and specifications through public tenders. By adapting FOSS solutions to regional contexts through extensive customisation and localisation, they can also see immediate effects and improvements in administrative tasks or in services delivered to local communities.

Successful cases of innovative FOSS solutions for regions and local communities should be supported and potentially transferred to other regions or replicated in similar contexts and implementation fields. An effective way of disseminating the results and re-distributing the software tools and components of such projects is through national or EU-wide channels and repositories, such as JOINUP (https://joinup.ec.europa.eu/). All European public administrations that are active in FOSS usage and development should be strongly encouraged to use JOINUP as a one-stop point for sharing open source experiences and re-using open source solutions on an EU-wide level.

In order to foster public sector innovation in open source, official, high level policies (e.g. Directives, interoperability frameworks) should be combined with an active support of local/regional FOSS projects and initiatives that could expand and multiply on a shared experience and good practice basis.

Open source can provide new business opportunities, create jobs, save R&D costs, and contribute to the development of ICT skills and e-inclusion in Europe if reaching its full potential. Europe should shape a software strategy that could best capitalise on the open source capacities of its businesses, knowledge institutions and developer communities. The level of openness and the mixture of policies towards a unified European Software Strategy leveraging the full potential and competitive advantages of FOSS are yet to be defined. In any case, such a strategy cannot be effective if not reflecting the needs and experiences of European regions, local communities and public administrations.

Motivated by the fact that procurement procedures take up a great part of a public organisation's budget, operational activities and administrative processes (and they also have to be conducted under certain rules and specifications) our intention as a future work is to provide a concise guide on FOSS procurement for European Public Administrations to be used in addition to any existing national or EU guidelines and regulations. This work will outline the legal context and the main principles of software procurement and highlight good practices and recommended actions for public administrations. The main aspects and guidelines will include: planning and defining a procurement method, estimating costs and benefits, setting interoperability and the use of open standards as a priority, avoiding discriminating practices such as naming trademarks, understanding and assessing licensing schemes, software provision models and suppliers, and establishing fair tendering processes.

Moreover, we plan to provide a literature review on pre-existing comparative studies regarding the technical, social, economic and organisational factors on FOSS in order to propose guidelines that public administrations should follow for the selection between open source and proprietary software. Our goal behind this work is to help public stakeholders understand the technical/social/economic/organisational environment and reach informed decisions when selecting the appropriate software.

References

Almeida, F., Oliveira, J., Cruz, J., 2011. Open standards and open source: enabling interoperability. International Journal of Software Engineering & Applications 2 (1), 111–133.

Edwards, K., 2005. An economic perspective on software licenses-open source, maintainers and user-developers. Telematics and Informatics 22 (1–2), 111–133.

Ghosh, R.A. et al, 2002. Free/Libre and Open Source Software: Survey and Study. Part 2B: Open Source Software in the Public Sector: Policy within the European Union. International Institute of Infonomics University of Maastricht, The Netherlands.

Ghosh, R.A., 2006. Study on the: Economic Impact of Open Source Software on Innovation and the Competitiveness of the Information and Communication Technologies (ICT) Sector in the EU, Final Report (European Commission, November 20, 2006). UNU-MERIT.

Giron, F. et al, 2009. Economic and Social Impact of Software & Software-Based Services. D2. The European Software Industry. Pierre Audoin Consultants (PAC).

IDABC, 2009. Overview of the National Interoperability Frameworks. National Interoperability Framework Observatory, IDABC.

"European Interoperability Framework (EIF) for European public services. Annex 2 to the Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of Regions 'Towards interoperability for European public services'", ISA, the European Commission, 2010.

JOINUP, 2011. FR: Minister of Digital Economy speaks out on open source software and open formats, (Online) Available at: https://joinup.ec.europa.eu/news/fr-minister-digital-economy-speaks-out-open-source-software-and-open-formats..

JOINUP, 2011. PL: Deputy Prime Minister calls FLOSS "the greatest success of the 20th century, (Online) Available at: https://joinup.ec.europa.eu/news/pl-deputy-prime-minister-calls-floss-%E2%80%9C-greatest-success-20th-century%E2%80%9D.

JOINUP, 2011. UK public administration's use of open source growing in importance, (Online) Available at: https://joinup.ec.europa.eu/news/uk-public-administrations-use-open-source-growing-importance.

JOINUP, 2011. ES: CIO Extremadura 'open source key to development', (Online) Available at: http://joinup.ec.europa.eu/news/es-cio-extremadura-open-source-key-development.

JOINUP, 2011. Key specifications for interoperability developed by the EU's Interoperability Solutions for European Public Administration (ISA) Programme to become W3C standards, (Online) Available at: https://joinup.ec.europa.eu/news/key-specifications-interoperability-developed-eu's-interoperability-solutions-european-public-a.

Lakka, S., Stamati, T., Martakos, D., 2012. Does OSS affect e-government growth? An econometric analysis on the impacting factors. IFIP Advances in Information and Communication Technology 378, 292–297.

Open Source Software for the Development of the Spanish Public Administration. An overview, 2008. Cenatic: National Observatory of Open Source Software, Spain.

Directive 2003/98/EC of The European Parliament and of the Council of 17 November 2003 on the re-use of public sector information, Official Journal of the European Union.

Open Forum Europe, 2011. OFE Procurement Monitoring Report: EU Member States practice of referring to specific trademarks when procuring for Computer Software Packages and Information Systems between the months of February and April 2010, Open Forum Europe..
Government Open Source Policies, 2010. Center for Strategic and International Studies.
Rönkkö, M. et al, 2010. Software Industry Survey 2010. Aalto University School of Science and Technology.
Open Source, 2009. Open Standards and ReUse: Government Action Plan. The Cabinet Office, UK.
Open Source Software and the Public Sector, 2009. The National IT and Telecom Agency, Denmark.
TEIU Codrin-Marius, 2012. The politics of open source software – a trend towards liberalization in e-government. Revista Economica, Lucian Blaga University of Sibiu, Faculty of Economic Sciences 65 (6), 107–117.
The European Commision, 2009. Playing to win in the new software market. Software 2.0: winning for Europe. Report of an industry expert group on a European Sotware Strategy, The European Commision.
The Ministry of Economic Affairs, 2007. The Netherlands in Open Connection. An Action Plan for the Use of Open Standards and Open Source Software in the Public and Semi-Public Sector. The Ministry of Economic Affairs, The Netherlands.
Valimaki, M., Oksanen, V., 2005. The impact of free and open source licensing on operating system software markets. Telematics and Informatics 22 (1–2), 97–110.