Free/Libre and Open Source Software (FLOSS) and the Public Sector

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1 Introduction

While the Free/Libre and Open Source Software (FLOSS) is not a new phenomenon, it gained momentum with the advent of the Linux operating system in the 1990s. Today, the market shares of FLOSS applications, such as web servers, server operating systems, desktop operating systems, web browsers, databases, e-mail and other ICT infrastructure systems, often outcompete proprietary counterparts (Ghosh 2006). While the proprietary software market is dominated by US vendors, FLOSS provides an area in which Europe shows considerable strengths. This applies, particularly, to FLOSS market penetration in the public sector. The share of public organisations using FLOSS is higher in Europe than in North America (Ghosh 2006). As Ghosh et al. (2004) point out, "FLOSS has received much attention from public administrations (PAs) for two reasons: the software itself may be cheaper to use and support than proprietary software applications; and free software may be a novel, cost effective and highly responsive way to develop applications specific to PA needs. The second point takes advantage of the modifiable nature of free software, which makes it suitable for adaptation to PA needs."

When FLOSS is considered from the viewpoint of the individual developer, developer communities, or a company, it is usually viewed with regard to the advantages it provides to these developers or companies. Though spill-over effects, such as the foundation of new companies through skilled FLOSS developers or increased demand of businesses for FLOSS-related services are recognised, they are considered as a secondary effect that just accompanies the increase of FLOSS activities in Web-based communities and in the private sector. However, when FLOSS is considered from the viewpoint of the public sector, FLOSS appears as inherently interwoven with strong common welfare and political effects. For instance, Varian & Shapiro (2003) expected that public sector investments and engagement in FLOSS do not only advance the public sector itself but will have a significant effect on the (local) ICT industry.

Another reason why the relationship between public sector and FLOSS is considered to be special or, in other words, strategic (Wong 2004), is that the ways in which the potential of FLOSS can be tapped and the degree to which it can be deployed in an economy, and particularly in the public sector, depends on political regulation, which is defined by public sector institutions. Public sector entities create policies that have a strong impact on the use, access to, development and spread of FLOSS within the economy. Such policies exist on any jurisdictional level, i.e. the

local level of municipalities that may support the use of FLOSS within their administration, at a regional level of e.g., a province, at the federal level, and at the supra-national level, such as the European Interoperability Framework (EIF) (European Commission 2004). The Open World Forum (2008) specified the reasons for why FLOSS became an integral component of public authorities' strategies as follows: "Today, FLOSS is not only recognized as a way to reduce the digital divide and sustain education by giving everyone access to free IT software and knowledge. It is also starting to be widely recognized as a decisive lever for innovation and economic growth. According to surveys, FLOSS could account for 4% of the European GDP in 2012. It is also recognized as a way of ensuring independence from monopolies, whether corporate (liberation from the dominance of some IT giants) or geostrategic (enabling the development of local IT industries), and of preserving the sovereignty of nations." The impact that policies have on the spread and economic effects of FLOSS within economy and society has been illustrated by the FLOSSIMPACT report (Ghosh 2006). The report shows that FLOSS is already contributing significantly to European growth and employment but that the realisation of the socio-economic potential of FLOSS in the future is highly dependant on the fundamental policy scenario in which FLOSS can evolve.

Public procurement (of software) is at the intersection of policies and FLOSS usage in the public sector. Public procurement is usually highly regulated by laws, legally binding administrative rules and policies or guidelines in order to prohibit public sector institutions from discriminating certain vendors against others and to spend taxpayers' money in a reasonable and legitimate way. [1] The interplay of strategic, economic and social benefits of FLOSS provides a legitimate ground for the development of a multitude of government policies towards FLOSS, which can focus on FLOSS directly or indirectly (Wong 2004; Comino, Manenti & Rossi 2006; Baker, Noonan, Seavey & Moon 2008).

Finally, the public sector plays also a role as producer of FLOSS. Public authorities develop FLOSS either directly, through the staff of their IT departments, or they contract a company or developer (or a developer team) for this task. The European Commission's Open Source Observatory and Repository (OSOR.eu) contains a number of examples of such initiatives. The rationale behind developing and releasing FLOSS by public authorities is that this strategy can facilitate the re-usage, adaptation and modification of software developed by other public organisations (and other actors as well), thus making software and software usage more effective and achieving substantial cost savings and, last but not least, control over the software (Ghosh et al. 2007).

In the following sections, the role of FLOSS for the public sector and, vice versa, the role of the public sector for FLOSS are discussed along three dimensions. Firstly, the public sector is considered as a user of FLOSS. How FLOSS deployment evolved in the public sector and which factors have influenced this trend are the

[1] For instance, the European Commission has created a number of documents for the regulation of public procurement within the EU. See http://ec.europa.eu/internal_market/publicprocurement/key-docs_en.htm.

main questions addressed. Next, the role of the public sector as a direct or indirect producer of FLOSS is examined. The third dimension is provided by the public sector as creator of policies that directly and indirectly affect the development and deployment of FLOSS in an economy. Thereafter, aggregated data on the role of FLOSS in the public sector are presented and factors that are expected to affect FLOSS trends within the next decade are briefly discussed. Finally, conclusions are drawn on the relationship between FLOSS and the public sector in general, especially with regard to factors that either support or hinder FLOSS within or through the public sector.

The data used in this chapter mainly derives from EU-funded research projects on the use and production of FLOSS in the European public sector that were carried out by the authors of this paper, a review of literature on the three topics investigated in this paper, and data collected by the Linux distributor Red Hat[2] and the Georgia Institute of Technology's Open Source Software Potential Index (OSPI) project (Noonan, Baker & Moon 2008).

2 The Public Sector as a FLOSS User

In 2005, the EU-funded FLOSSPOLS project, which has surveyed 955 government institutions in 13 European countries, found that 80% of these public sector institutions used some sort of FLOSS in their infrastructure or on their dektop PCs or laptops (Ghosh & Glott 2005). Today, FLOSS has become commonplace, and public sector institutions that do not use any FLOSS can hardly be found. This applies especially to Europe, where, in the recent past, the share of FLOSS in the public sector was higher than in North America and Asia (Ghosh 2006). Thus, the prediction of the Open World Forum (2008) that FLOSS will become mainstream by 2020 appears more than reasonable.

An important hurdle with regard to the adoption of FLOSS in the public sector was taken around the beginning of the new millennium, when FLOSS had achieved a 'critical mass' that signalled to users that it will be permanently available and improved in the future. Reaching this stage was a necessary prerequisite for the public sector (as well as for the private sector) to invest in FLOSS (Varian & Shapiro 2003). There is a wide range of factors that have fueled the general demand for and the deployment of FLOSS. The most important of these factors are cost-effectiveness, increased flexibility, ease of maintenance and support, increased interoperability, vendor independence, higher security and higher reliability (Robert Francis Group 2002, Varian & Shapiro 2003, Winslow 2004, Wheeler 2007).

With regard to the specifics of the public sector, Wichmann (2002) has identified a demand for higher stability and cost savings (on operation and administration costs) as the main drivers of corporate IT managers to opt for FLOSS. Other authors, namely Varian & Shapiro (2003), saw a much greater potential of FLOSS for the

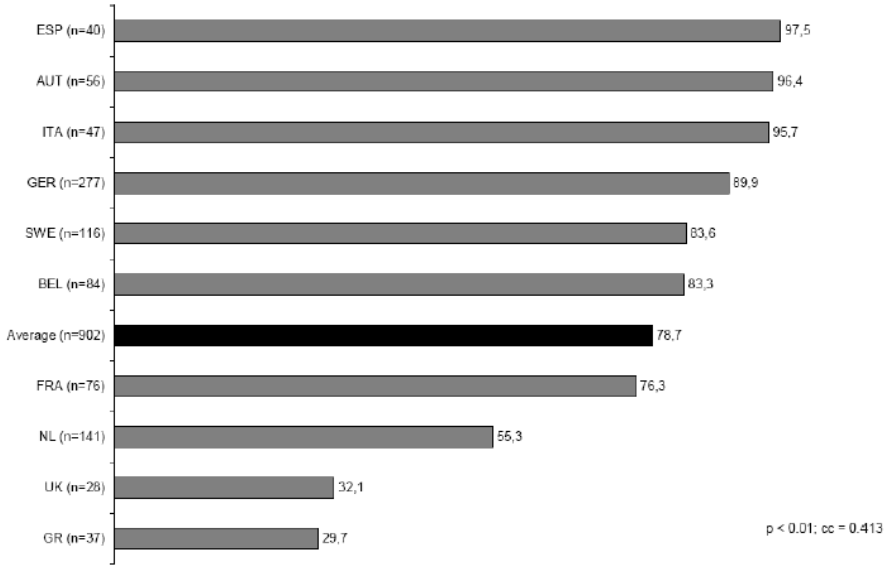
[2] See http://www.redhat.com/about/where-is-open-source/activity/

public sector. By adopting Linux new training demands and opportunities are created, which would enable software engineers in the public sector to build an open platform on which commercial or open source applications can build upon. Overall Varian & Shapiro believes this should initiate and reinforce the development of a robust domestic industry.

Thus, right from its outset, the debate about FLOSS in the public sector was characterised by an interplay of business-economic arguments that aimed at the institutional level, and general economic arguments aimed at the economy in general. Increased application of FLOSS in the public sector was not only expected to make public sector institutions more effective and flexible, it was also expected to have a strong positive impact on the local, regional and national economy in general. The openness and interoperability of FLOSS made it particularly interesting for the development of e-government applications, which is illustrated by the fact that the European Interoperability Framework (EIF) (European Commission 2004), though focussing on the use of open standards, explicitly refers to FLOSS as a means in order to meet interoperability requirements for public sector services. As a consequence, the penetration of the public sector with FLOSS increased continuously, mainly driven by operating systems (Linux, Apache) and databases (MySQL), but also including desk-top suites (OpenOffice) and specific software for public sector tasks (Ghosh & Glott 2005).

It must be noted, however, that, in the first half of the current decade, a considerable part of the FLOSS implementations within the European public sector had been installed unintentionally. As Ghosh & Glott (2005) discovered, 80% out of a total of 955 local governments in Europe used FLOSS in 2005 – but 30% (of the total of 955 public authorities) did not know that they were using it. Back then, the scope of FLOSS implementations within public sector institutions was also quite limited, as only 3.8% of the local governments used FLOSS (almost) completely on their servers and only 1.6% used it (almost) completely on their PCs (Ghosh & Glott 2005). From today's point of view it appears very unlikely that a considerable share of “unaware” FLOSS usage can be found in the European public sector. The ongoing public debate about FLOSS, the continuous spread and diversification FLOSS products and the manifold national and European eGovernment strategies must have had quite an impact on the attention of IT managers in the public sector (Ghosh et al. 2008).

In 2005, there were significant differences between EU Member States with regard to the use of FLOSS in the public sector. Some countries, especially, Spain, Austria, Italy, and Germany, turned out to be heavy users, whereas the usage of FLOSS in the public sector appeared comparably low in the Netherlands, UK and Greece (Ghosh & Glott 2005). In 2005, Belgium ranged in the midfield but slightly above the average, as Figure 1 illustrates.



Source: MERIT 2005 (FLOSSPOLS LocGov Survey)

Figure 1: FLOSS usage in European local governments, by country (2005)

These differences relate to distinct national patterns and practices in the usage and administration of software by IT managers of local governments. Significant differences were found with regard to whether an increase of the share of open source software would be useful: local governments in Spain, Italy, and Greece, but also many respondents from France and the Netherlands showed a high demand for increasing usage of FLOSS in their organisations. Since FLOSS is usually not the standard software in European local governments, such strong demand could be a result of starting from a low base, as most of the organisations that do use FLOSS - even in countries where many organisations use it - do not use it extensively. In these cases, positive experiences with open source software result in an interest in deploying it on a larger scale Ghosh & Glott 2005).

Thus, a main finding of the FLOSSPOLS Survey (Ghosh & Glott 2005) probably still holding today is that the observed wide spread of FLOSS in the European public sector does not at all indicate that FLOSS has become a standard within European local governments overcoming the dominance of proprietary operating systems and desktop publishing suites. As in 2005, it appears that a majority of government authorities use some FLOSS applications somewhere on their servers or PCs, but widespread usage of FLOSS within public sector organisations is still an exception.

The driving forces behind the trend towards FLOSS in the public sector were FLOSS's capacities to be customised easily, as compared to proprietary software, and its combinability with other software, be it FLOSS or proprietary. Usability and reliability, though recognised and acknowledged by European local governments, did not play an equally motivating role, mainly because many respondents found proprietary software usable and reliable, too. In addition, access to the source code

alone was considered to be important only in combination with inexpensiveness. Since it is the same licensing terms that provide both source code access and low costs for FLOSS, the two can of course not be disassociated. Nevertheless, this finding indicates that non-FLOSS methods of providing limited access to source code – such as Microsoft's Shared Source Initiative1 – may[3] not be seen as an advantage for public sector institutions, at least as long as they are not offered together with low cost for the software (Ghosh & Glott 2005).

The main obstacles public authorities encountered when considering FLOSS were difficulties in finding technical support for FLOSS systems and the fear of large investments in time and money in order to teach people how to use FLOSS (Ghosh & Glott 2005).

Key issues with regard to software and software purchases are vendor independence and interoperability. The capacity of FLOSS to be interoperable with other software systems (for instance because of the usage of open standards) is one of its biggest advantages. Even when a FLOSS application is not a standard, it is still quite straightforward for a producer of a software application to enable interoperability with a data format used by this application – e.g. by examining or simply using the FLOSS application's source code. However, unless a truly open standard is used, it is much more difficult for a software producer to enable interoperability with a data format used by another proprietary software vendor. Consequently, software buyers often try to achieve “vendor-independence”, which is to retain the ability to change software products or producers in future without loss of data or significant loss of functionality (Ghosh & Glott 2005). Indeed, public sector institutions showing a high degree of FLOSS awareness (in 2005) usually bought their software from more than four vendors, whereas more unaware FLOSS users in the public sector bought their software usually from one to four vendors (Ghosh & Glott 2005).

However, software purchasers often find themselves in a conflict with implicit or explicit criteria for software purchasing. They might either prefer new software that is compatible with the same product family they already use (= "compatibility") or they might prefer software that is compatible with software from other producers and product product families (= "interoperability"). Buyers who prefer compatibility rather than a general requirement for open standards or vendor-independent interoperability in effect remain locked in to their previously purchased software and dependent on their vendors, even if they see the benefits of open standards and believe in interoperability (Ghosh & Glott 2005). The FLOSSPOLS Local Governments Survey has examined this relationship and found that three fifths of the respondents opted for interoperability while one third preferred compatibility (while 8% said they did not know). There was a strong correlation between the public sector institution's degree of awareness of FLOSS and the preference for interoperability. The latter finding indicates that, in organisations where the IT department truly wants interoperability and is aware of the conflict between interoperability and proprietary software applications, limitations to interoperability set by proprietary

[3] See: http://www.microsoft.com/resources/sharedsource/default.mspx

software in fact help to increase a demand for FLOSS in the organisation (Ghosh & Glott 2005).

Another factor that is usually considered to be a driver of FLOSS in local governments is closely related to the organisation's need to customise software. As the FLOSSPOLS Local Governments Survey has shown, those local governments stating that they never have to customise software indeed show the largest shares of non-users of FLOSS, whereas those that often have to customise software show the largest shares of aware FLOSS users (Ghosh & Glott 2005). Given the limited capacity of proprietary software to enable users to customise it according to their specific needs, it must be expected that non-users rely much more on external maintenance services than FLOSS users. Indeed, the FLOSSPOLS Survey confirmed this hypothesis (Ghosh & Glott 2005).

Since cost-effectiveness plays an important role for public sector institutions when software purchases are considered, the IT budget of a public institution and the share of this budget consumed by software licenses are supposed to be strong determinants of FLOSS usage. In other words, one can expect that the smaller the IT budget or the larger the share of software license fees in the IT budget, the stronger the inclination of an organisation to purchase FLOSS. However, for IT budget data related to 2004, the FLOSSPOLS Local Governments Survey found large annual IT budgets rather aligned with larger shares than with smaller shares of FLOSS, and that there was no statistically significant difference between users and non-users with regard to the IT budget and FLOSS usage (Ghosh & Glott 2005).

The same holds for the basic assumption that a high share of software license fees in an organisation's IT budget works to the benefit of FLOSS. Though this argument is always present when costs and benefits of FLOSS are considered, it turned out in the FLOSSPOLS Survey that license fees appear to be relatively unimportant for IT managers in European local governments. On average (median), the share of software license fees in European local governments IT budget in 2004 was 20%, but there are no significant differences between FLOSS users and non-users (Ghosh & Glott 2009). Rather than the actual cost of license fees for software the subjective perception of these shares is decisive for a public sector institution's decision to purchase FLOSS. Overall, 46% of the respondents of the FLOSSPOLS Local Government Survey said they find the share of license fees in their annual IT budget (for 2004) too high, 6% found it reasonable and another 23% found it too low (26% answered "I don't know"). Indeed, those who find the share of software licenses in their IT budget too high provided the largest group within FLOSS users and the lowest shares within the non-users. Ghosh & Glott (2005) concluded from this observation that "high software licenses produce a stronger willingness to use FLOSS, with the reservation that this applies only to the subjective perception of these shares but not to their actual amount."

The professional background of IT managers in the public sector also seems to have an impact on attitudes towards open source software, as IT managers who are experienced in programming value access to source code significantly higher than IT managers with no or only limited programming experience (Ghosh & Glott 2005).

Overall, the results of the FLOSSPOLS Local Governments Survey allowed to systematically differentiate the use of FLOSS between countries. These differences can be characterised as 'FLOSS adoption profiles', based on the assumption that the observed differences reflect to some degree underlying differences in work organisation, regulation, contractual issues, professional profiles, and other constraints that determine the use of open source software in European local governments (Ghosh & Glott 2005). These adoption profiles are distinguished by the usage of FLOSS, the share of unaware usage, and the attitudes (motivating factors and fears) of IT departments in local governments. Though the further differentiation and dissemination of FLOSS and political initiatives to increase the usage of FLOSS in the public sector have surely changed the 2005 picture, especially with regard to "unaware" FLOSS usage, which presumably does not play the same role today as in 2005, it must be assumed that there are still differences between IT managers and between government organisations with regard to the degree of knowledge of FLOSS. Though their impact might be subtler than the ones observed in 2005, these differences might still have an impact on FLOSS adoption patterns (Ghosh et al. 2008).

The first adoption profile was characterised by a high degree of FLOSS use in combination with an extremely large share of unaware FLOSS usage. Ease of customisation and combinability (with other software) are equally strongly valued as fear of lack of technical support and to be isolated from technical support when migrating towards FLOSS. Fear of cost and time efforts related to training were also considered to be a strong factor working against FLOSS. This ambivalent attitude, which went in line with low demand for an increase of FLOSS and interoperable software, was labeled "uninformed and reluctant FLOSS adoption". In 2005, this adoption profile was likely to appear in small organisations. Given the changes the market for FLOSS in the public sector has undergone since 2005, it is not very likely that this adoption profile can still be found often.

The second adoption profile shows an average degree of FLOSS usage and a comparatively high share of unaware users. Though advantages of FLOSS are noticed more than the disadvantages, the wish to increase its share and for interoperable software is around the average. This adoption profile can be called "interested but reserved use". It seems to be typical for quite large organisations.

An average degree of FLOSS usage and a very small share of unaware users characterises the third adoption profile. Local governments falling into this category value advantages of FLOSS higher than the disadvantages. This attitude appears together with a strong demand for increasing the share of FLOSS and interoperable software. This FLOSS adoption profile, which appears to be typical for medium-sized organisations, can be called "informed FLOSS demand".

The fourth adoption profile features a very low degree of FLOSS usage and a high degree of aware FLOSS usage. Though attitudes towards advantages and disadvantages of FLOSS are not very pronounced, there is a very high demand for an increase of FLOSS. However, this demand is apparently not driven by a need for interoperable software. Since this sort of attitude towards FLOSS appears to be

determined by negative experiences with proprietary software more than by practical experience with FLOSS and by a wish for an alternative to the software that is already in use, this adoption profile can be called "uninformed alternative seeking".
Large shares of FLOSS users and a very low degree of unaware FLOSS usage characterises the fifth adoption profile, which seems to be mainly driven by ease of customisation provided by FLOSS. Disadvantages of FLOSS, in contrast, are hardly pointed out by local governments that fall in this adoption profile. The demand for an increase of FLOSS and for interoperable software is clearly above average. It appears that this type is correlated to IT managers who are skilled in programming and wish to adjust their IT systems to the specific needs of their organisation, which usually is medium-sized. Therefore, this type can be called "software customisation".
The sixth adoption profile, which also seems to be found among medium sized organisations, features relatively low shares of FLOSS and also a low degree of unaware usage. Attitudes towards pros and cons of FLOSS are not distinctive from other adoption profiles. Nevertheless, the demand for FLOSS and for interoperable software is very high. This type can be called "informed interoperability demand".

What characterises the seventh adoption profile is a very high degree of FLOSS usage, whereby the share of unaware users is comparably small. The attitudes towards pro and cons of FLOSS are balanced, as combinability with proprietary software appears to be the main driver of FLOSS usage while fear of a lack of technical support for FLOSS as well as fear of training costs are distinct. Though despite these fears, the demand for an increase of FLOSS within the organisation is high . This FLOSS adoption profile can be called "risk-taking open source software adoption" because despite some pronounced risks associated with FLOSS these public sector institutions use it extensively and still want to increase its use. This adoption profile appears to be typical for small organisations.

The eighth adoption profile features an average degree of FLOSS usage and of unaware FLOSS users. IT managers from local governments that fall into this category rather supported disadvantages than advantages of FLOSS, particularly fear of training costs. As a consequence, the demand for an increase of FLOSS in these organisations is low. However, there is a strong need for interoperable software. Overall, this type seems to be determined by IT managers that hesitate to use FLOSS because of the negative aspects sometimes associated with FLOSS, therefore it can be called "fearful reluctance". It can typically be found in very large organisations.
Low shares of FLOSS users together with an absence of unaware users characterise the ninth FLOSS adoption profile. The respondents are quite neutral with regard to pros and cons of FLOSS and also with regard to the demand for an increase of FLOSS or interoperable software. This type, which seems to be found in medium-sized organisations, can be called "indifferent reluctance".

The main commonality of these adoption profiles is that indifference and lack of awareness lead to fear of possible disadvantages and a reluctance to adopt FLOSS, while awareness of and experience with FLOSS drive FLOSS usage, the demand for customisation of software, the demand for interoperability, and a certain amount of willingness to take risks especially in relation to support and training.

Finally, the FLOSSPOLS Local Governments Survey revealed that the use of FLOSS is stronger in large organisations than in small organisations, and it increases with increasing PC-per-administrator ratios. In order to examine the impact of these two factors on the FLOSS-usage more deeply, four different types of organisations were compared:
small organisations with a low PC-per-administrator ratio
small organisations with a high PC-per-administrator ratio
large organisations with a low PC-per-administrator ratio
large organisations with a high PC-per-administrator ratio[4]

It could be shown (see Table 1, which differentiates between aware users and unaware users of FLOSS, as it was necessary in Europe in 2005 and might still be necessary in other World regions) that the use of FLOSS is more present among large organisations with a low PC-per-administrator ratio than in large organisations with a high workload of the IT administrators. Moreover, in large organisations, a low PC-per-administrator ratio of the IT administrators is correlated with usage of FLOSS whereas the share of FLOSS users among large organisations with a high PC-per administrator ratio is slightly lower. However, in small organisations the relationship tends in the opposite direction, and the difference is stark: small organisations with a high PC-per-administrator ratio have a 50% share of FLOSS users and small organisations with a low PC-per-administrator ratio have only a 21% share of FLOSS users (but as much as 57% unaware users). Thus, a high PC-per-administrator ratio is correlated with FLOSS use overall, but its effect on large organisations is ambivalent and in small organisations it is very strongly related to FLOSS use.

	Workload by size of organisation & IT Dept.				
	small size - low workload	small size - high workload	large size - low workload	large size - high workload	**Average**
aware FLOSS users	21.1	50.0	69.0	64.9	**42.8**
unaware FLOSS users	57.0	38.2	17.2	19.1	**39.1**
non-users	21.8	11.8	13.8	16.0	**18.1**
Total	100.0	100.0	100.0	100.0	**100.0**

p < 0.01 Contingency Coefficient: 0.405 n = 299

Table 1: Size and workload effects on the usage of FLOSS in European local governments

[4] Small organisations with low workload are defined as organisations with less than 3 IT administrators, not more than 70 PCs and laptops, and a maximum average PCs per head ratio of 30.0. These figures determine the boundaries of the lowest third of the respondents in these three categories. Small organisations with a high workload are defined as organisations with less than 3 IT administrators, not more than 70 PCs and laptops, and a minimum average PCs per head ratio of 55.0 (the boundary of the upper third of the respondents in the workload category). Accordingly, large organisations with a small workload are defined as organisations with more than 6 IT administrators, more than 287 PCs and laptops (which are the boundaries of the upper third of the respondents in these two categories), and a maximum average PCs per head ratio of 30.0. Large organisations with a high workload are defined as organisations with more than 6 IT administrators, more than 287 PCs and laptops, and a minimum average PCs per head ratio of 55.0.

3 The Public Sector as a FLOSS Provider

It is not unusual that public sector institutions need specific software, e.g. for an eGovernment portal. If the institution does not have the development capacities in-house necessary to create the desired software, it can commission this task to a company or freelancer. In both cases, in-house development and buy-in, the produced software can be owned by the public sector institution and thus be released by this institution under any software license, including FLOSS licenses.

A study that was carried out on behalf of the European Commission (Ghosh et al. 2007) and that has carried out case studies and a survey of 220 local governments in Europe revealed that only 10% of the public sector institutions in Europe did or do plan to release own software as FLOSS. There are mainly two motivators for public sector organisations to release software under FLOSS license. The first is identification with the FLOSS community. This motivation is largely rooted in personal ties of IT department employees to the FLOSS community, e.g. in form of their participation in FLOSS development projects or community events. The second motivator for public sector institutions to release FLOSS is the wish to increase the service quality of the organisation, which is a reason that shows no obvious association with FLOSS.

Interestingly, though one would expect that these very diverse driving forces would not occur together, in many cases these two answering options were checked simultaneously. The case studies that were examined in the same study clarified the relationship between the two motivators. It turned out that the IT staff, especially the decision-makers, of all organisations that had released FLOSS in the past was familiar with FLOSS, its ideas and principles. This fact alone explains why public institutions may opt for FLOSS because they identify with it. In addition, the decision-makers in the IT departments of these organisations were usually also familiar with the implementation of services into software (Ghosh et al. 2007). Hence, specific knowledge of FLOSS in public institutions' IT departments often appears together with specific knowledge of service design, provision, and quality. Under these conditions it seems feasible for the IT decision-makers to convince the superior management to opt for FLOSS.

The strength of the influence of familiarity with FLOSS on a public institutions' capacity and willingness to release own software under a FLOSS license is also evident when the "non-releasers" are considered, i.e. local governments that did not release FLOSS in the past and do not plan to do so in the future. These non-releasers name only one relevant reason for not distributing own software as FLOSS, and that is that they do not have the necessary capacities and skills within their organisation to realise such a project (Ghosh et al. 2007).

The reason why only a small minority of the public sector institutions are able and willing to release their own software as FLOSS was also illuminated by Ghosh et al. They found a dominant attitude within public bodies that is characterised by a combination of a strong emphasis of their role as a provider of public services and an equally strong refusal to consider software as an integral and significant component of these services (Ghosh et al. 2007). Apparently, when the role of software for public services is considered by IT managers, most public bodies tend to regard

software as something that only translates service processes into algorithms but not as a means that can refine existing services or even define new services, thus improving service quality and quality of work. This observation is confirmed by other studies (Diederen et al. 2008) that report an even hostile attitude of public sector workers when their work processes and the services they deliver become fundamentally challenged through the introduction of eGovernment solutions.

4 The Public Sector and FLOSS Policies

FLOSS has its origins in developer-driven activities and communities, it was produced and distributed outside the sphere of salaried work or political regulation. It is therefore not surprising that only a few EU Member States have explicit FLOSS policies. Many of these policy initiatives are rather driven by more or less informal local groups or individual regional or local governments than by the central government (Ghosh et al. 2008). As Comino et al. (2006) point out, FLOSS-related government policies appear at different administrative levels, in various forms, and for diverse motivations and purposes.

According to the i2010 Mid-term Review (Commission of the European Communities 2008), Portugal is the only EU Member State that refers explicitly to FLOSS in its eGovernment strategy. However, as Ghosh et al. (2008) point out, this does not imply that FLOSS plays no role in the IT strategies of other EU countries, as references to FLOSS are often made in other documents, such as interoperability guidelines or policies, drawing on or similar to the European Interoperability Framework (EIF) [5]. Though these frameworks may not refer explicitly to FLOSS they may support it, as using FLOSS is strongly correlated with interest in and awareness of open standards.

It is apparent that the majority of FLOSS policies is formulated and implemented on the regional and local level. For the period between 2001 and 2007, the Center for Strategic and International Studies (CSIS) counted a total of 268 governmental FLOSS initiatives in the world, of which 131 pertained Europe (CSIS 2007).

A survey of country-specific characteristics with regard to FLOSS-related policies (Ghosh et al. 2008), illustrating the situation around 2007, revealed that most of the younger EU Member States (such as Bulgaria, Cyprus, Poland, or Romania) are in a process of catching up to the old EU Member states in terms of modernising their public sector's IT infrastructure, while other new Member States, such as Estonia, quickly achieved a leading position with regard to some eGovernment aspects. Overall, the Nordic countries (Denmark, Finland, Norway, Sweden) marked the threshold for the other EU Member States regarding the state of the public sector IT infrastructure and the provision of eGovernment services between public administrations (PAs) and between PAs and citizens and PAs and businesses. Regarding the role of FLOSS for eGovernment strategies, strong differences existed between countries with a low attention towards FLOSS and countries that put

[5] See: http://ec.europa.eu/idabc/en/document/3473

emphasis on FLOSS as a means to improve public services. To the former group of countries belong Austria, Bulgaria, Cyprus, Estonia, Greece, Hungary, Ireland, Latvia, Lithuania, Luxembourg, Malta, and Slovenia; to the latter group of countries belong Belgium, Czech Republic (although in both countries the FLOSS dynamics seems to slow down after 2006/2007), Denmark, Finland, France, Germany, Italy, the Netherlands, Poland, Portugal, Romania, Slovakia, Spain, Sweden, and the UK.

4 Conclusions

What trends can be observed and what lessons learned from the European experience over the past years, as discussed in this paper? First of all it is clear that the spread of FLOSS has resulted in growing attention for FLOSS within the European public sector. It has clearly moved into the mainstream, and it is not anymore a question of whether it is being used, but to what extent, for what tasks and with which strategy and policy. It is also important to be aware of the various dynamics, fears and opportunities relating to the nine adoption profiles described. Policy might want to target the various groups differently. Further, apart from the various adoption profiles related to the size of the organization and the PC-per-administrator ratio (and skills), it is also clear that adoption of FLOSS shows strong country-specifics, which is due to attitudes towards FLOSS and experience levels with FLOSS on a country level. Looking at the new EU member states it is also evident that there is a possibility for countries to catch up in the process, and that the new-comers possibly less invested in any particular technology may have an advantage. Further, overall the public sector clearly plays a vital role for the development and dissemination of FLOSS, and hence it is important for governments to be aware of their role and develop a clear idea of where they want to go and what strategy they whish to implement. FLOSS, and especially open standards, is increasingly becoming an important cornerstone of software and eGovernment policies in Europe. It is though important to note that these policies do not necessarily aim explicitly at FLOSS, but they have a strong indirect impact on FLOSS when objectives like interoperability are targeted. In that sense it is important to recognize FLOSS as an important part of a larger system, and not necessarily an end in itself. This means that the discussion around FLOSS usage in public sectors should not be done in isolation or without looking at the wider implications, but be included as an integral part of the wider policy discussions. Finally it is also important to remember that the public sector plays an active role along three main dimensions, namely as a FLOSS user (it activly influencing knowledge levels, skills and attitudes and choice of technology), and the Public Sector as a FLOSS provider, where it more directly can make licensing decisions for example. These are both venues where governments can put in leverage. What kind of leverage and what kind of direction is dependent on the outcome of the discourse and actions within the third dimension, namely the public sector and FLOSS policies, where both the explicit as well as indirect impact on FLOSS through policy and strategy must be taken into account. Overall it is clear that the public sector has an important role to play with respect to Free/Libre and Open Source Software, both as a user, provider and policy maker.

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