Surveying the Adoption of FLOSS by Public Administration Local Organizations

Davide Tosi, Luigi Lavazza, Sandro Morasca, Marco Chiappa

Surveying the Adoption of FLOSS by
Public Administration Local Organizations

Davide Tosi[1], Luigi Lavazza[1], Sandro Morasca[1], Marco Chiappa[2]

[1]Università degli Studi dell'Insubria, DISTA Via Mazzini, 5 Varese, Italy
{davide.tosi, luigi.lavazza, sandro.morasca}@uninsubria.it
[2]Consiglio Regionale della Lombardia, Via F. Filzi, 22 – 20124 Milano, Italy
marco.chiappa@gmail.com

Abstract. Background. The introduction of Open Source Software technologies in the Public Administration plays a key role in the spread of Open Source Software. The state of the art in the adoption of Open Source Software solutions in the Public Administration is not very well known even in areas like Lombardy, which is Italy's largest and most developed region.
Goal. The goal of the investigation documented in this paper is to obtain a clear picture about the introduction of Open Source Software technologies in the Public Administration, the obstacles to their adoption, and the willingness of stakeholders to proceed with their introduction.
Method. We carried out a qualitative and quantitative survey that was submitted to a representative part of the Public Administrations in Lombardy.
Results. The analysis of the qualitative and quantitative information shows that several Public Administrations are already using Open Source Software technologies, though not in all application areas. The savings are one frequently cited incentive to the adoption of Open Source Software. However, one obstacle is the fact that a comprehensive law on software in the Public Administration has not yet been approved.
Conclusions. Our analysis provides results that indicate a common understanding of incentives, obstacles, and opportunities for Open Source Software technologies in Public Administrations.

Keywords: Public Administrations, FLOSS adoption, Survey, Italy

1   Introduction

Transparency, *reuse*, and *participation* are the final goals of Open-Government, based on the four technological cornerstones [1] : *Open Source Software*, *Open Format* and *Open Data* [2] in a context of infrastructure and hosting that is as Open as the *Open Cloud* [7].

In the last few years, there is a slowly increasing interest by Italian public and private entities in the world of Free-Libre Open Source Software (FLOSS) [4]. On the one hand, the increasing level of FLOSS product quality is also increasing the

trust that end users have in FLOSS products. On the other hand, the need for budget cuts to contain costs and expenditures of public and private entities provides new motivations for the adoption FLOSS at the expense of commercial proprietary software products.

The global importance of FLOSS worldwide has also led to the proposal and approval of a number of laws whose goal is to regulate and possibly favour the use of FLOSS in the Public Administration Local Organizations (PALO). For instance, at the Italian national level, Decree No. 267/2000 [5] and directive 19/12/2003 [6] have been adopted to regulate the use of software in PALO.

The Region of Lombardy, with Law Proposals on "Rules on information technology pluralism and adoption of open formats and standards for digital documents in the information society of Lombardy" and on "Provisions on access, publishing and re-use of public data and the regional administration in open format using free software and the Internet" has given a strong signal of openness to FLOSS and Open Data [2, 3]. To obtain concrete outcomes for the effort spent by the Region of Lombardy and the political Regional Council groups, it is necessary to continuously promote the activities related to FLOSS and Open Data with large projects, for instance with the definition of an Observatory on best practices in the use of FLOSS and the publication of Open Data.

This paper describes the execution of a qualitative and quantitative survey for assessing the state of the art in the introduction of FLOSS in the PALO in Lombardy. Specifically, the survey addressed a fairly large sample of the PALO of the Region of Lombardy, as it included municipalities that account for about one-fifth of the population of the region. The survey investigates the degree of use of FLOSS technologies in the region, the obstacles to its introduction, and the willingness of stakeholders to introduce FLOSS. The analysis of the quantitative data from the survey confirmed the qualitative data.

Lombardy is by far Italy's largest region in terms of population and arguably the most economically and technologically advanced region of the country too. So, the large-scale introduction of FLOSS technologies in Lombardy would amount to a large-scale introduction of FLOSS technologies in the country and would propel the introduction of FLOSS in the other parts of Italy.

Several surveys have been carried out worldwide to monitor and understand the diffusion of FLOSS. A fairly comprehensive systematic literary survey concerning the adoption of FLOSS in software-intensive organizations (not necessarily PA) can be found in [11]. The adoption of FLOSS in Venezuela was studied and reported in [12] . The factors that affect the adoption of FLOSS in public organizations was studied in [13]. Although not addressing PA, the framework provided in [13] can be used to explain several of our findings, thus showing that the concerns that affect the adoption of FLOSS in PA are not dissimilar from those affecting industrial contexts.

The remainder of this paper is organized as follows. Section 2 describes the methodology adopted to conduct the quantitative and qualitative survey. Sections 3 and 4 report on the results of the qualitative and quantitative results, respectively. We discuss the results and conclusions in Section 5.

2 Methodology

The survey about the adoption of FLOSS by PALO in Lombardy was based on a) the qualitative analysis of a sample of medium-large organizations and b) the quantitative analysis of all organizations located in Lombardy. Thus, we obtained both qualitative semantically valuable –though not immediately generalizable– information as well as objective and statistically representative data, though possibly less detailed and contextualized.

Qualitative analysis was performed in PALO already acquainted with FLOSS. A questionnaire containing semi-structured open questions was used as a basis for collecting opinions and indications concerning FLOSS from people in charge of IT development and operation. The interviews carried out by means of the qualitative questionnaire aimed at understanding and describing the procedures and best practices used to launch development or migration projects based on FLOSS and at determining the factors that affect (either positively or negatively) the adoption of FLOSS. Accordingly, the interviewer concentrated on understanding the critical factors that characterize the adoption of FLOSS, how risks are managed, and what guidelines are followed in the adoption of FLOSS. In any case, the interviewer also explored additional issues that would be raised during the interviews. The interviews were performed in the municipalities of Bollate, Brescia, Cinisello Balsamo, Milano, Monza, Vigevano, and the Province of Lecco, which range from approximately 36,500 to approximately 1,350,000 inhabitants.

The quantitative analysis was carried out via a questionnaire containing 35 closed-answer questions, defined on the basis of the results obtained by the qualitative analysis. The objective was to exhaustively check the situation of PALO in Lombardy, so, the questionnaire was sent to all the municipalities in Lombardy. The questionnaire was implemented via the FLOSS platform LimeSurvey [www.limeservice.com], which greatly helped users in the filling out the questionnaire and researchers in data collection and analysis. The questionnaire addressed specific issues concerning FLOSS, e.g., the pros and cons of adopted FLOSS solutions, the FLOSS tools being used, the cost of management and the more frequently used open source licenses. The invitation to answer the questionnaire was sent to all the 1536 municipalities in Lombardy on September 9, 2012. Two reminders were sent on October 17 and November 20. The questionnaire was closed on December 31, 2012. 451 questionnaires were returned, of which 256 compiled completely. The received answers were checked to eliminate typos and inconsistencies due to possible misinterpretations.

The received answers account for municipalities with a total of 1,927,189 inhabitants (about 19% of total Lombardy inhabitants), therefore they are a statistically relevant sample. Also the population distribution in the respondent municipalities matches the population distribution in Lombardy municipalities, which is characterized by many municipalities with medium-sized population. While data of this survey refer to 2012, we believe it is still a valid picture of the current

situation of Lombardy. Due to the election of a new regional President and Council (mid 2013), the adoption process of FLOSS was slowed down considerably.

3   Results of the qualitative analysis

Seven professionals in charge of IT development and operations were interviewed. They provided a quite clear and complete view of FLOSS and the pros and cons of adopting FLOSS in a PALO. They reported a clear propensity to use FLOSS. However, they also highlighted the importance of carefully and completely analysing the requirements of the problem at hand to achieve the best solution, be it open source or proprietary.

The adoption of FLOSS in the Italian PA began quite recently, and the process of migrating to FLOSS is still largely unexplored. This situation is probably caused by a very little knowledge of FLOSS and the implications of adopting FLOSS. Moreover, most software platforms in use by the PALO are proprietary monolithic applications that appear difficult to replace or even to integrate with FLOSS. In particular, it appears difficult to integrate FLOSS-based CRM (Customer Relationship Management), DMS (Document Management System), ERP (Enterprise Resource Planning) or network and service monitoring. On the contrary, it seems that the adoption from scratch of completely new platforms and applications can be pursued both via open and proprietary solutions. In the latter cases, the decision to what extent OSS should be adopted is driven by several factors:

• Personal curiosity of IT people with respect to open solutions that could break the "de facto standard" created by multinational companies like Microsoft;
• The political orientation of the administrations;
• Technical considerations concerning qualities like usability, reliability, etc.

Interviewees also stressed that the process of adopting FLOSS is very different for server-side and client-side software. Using FLOSS on the servers is easier –being transparent to both PA employees and citizens– even though installing, configuring and managing OSS software (like Linux, or an open source email server, or an open source Content Management System supporting the municipal Web portal) requires a bigger effort than the proprietary alternatives.

When client software is concerned, the situation is very different. Although mature applications that could be used instead of the proprietary counterparts –like Open office or Gimp– are available, PA employees are not willing to change, and training people to use the new software is a long and expensive process. Moreover, since proprietary file formats (like .doc document files) are widely used by both the PA and the citizens, a seamless and correct conversion of a huge amount of documents is also necessary but difficult to achieve. Finally, the lack of resources makes it difficult to carry out education and dissemination initiatives to promote the usage of FLOSS, especially in schools and in public organizations where cultural "digital divide" is greatest [10].

The advantages of FLOSS for the PA and the factors that are perceived to limit the adoption of FLOSS, according to the interviewees, are listed in Table 1 (in order of decreasing importance).

To overcome the problems listed above, several interviewees advocated region-wide guidelines and rules that drive the adoption of FLOSS in PALO. Such rules and guidelines should also clarify national laws and dispositions [5, 6]. Funding of projects addressing the adoption of FLOSS is also deemed necessary.

Table 1. Reported Pros and Cons in adopting FLOSS

	Pros	Cons.
1	Money savings	Need for training
2	Security and stability of applications	Resistance to change
3	Open and standard data formats	Difficulty to find professionals that can support the adoption and/or migration process
4	Continuous technological update	Difficult integration with proprietary software
5	Support by FLOSS development communities	No funding from the regional administration
6	Possibility of customizing and reengineering FLOSS	Very specific PALO needs are not addressed by FLOSS
7	-	Difficult conversion to/from proprietary formats

4   Results of the quantitative analysis

The IT and Data Centre departments of the interviewed PALO are medium-sized departments, with an average of 46 client machines (with a maximum of 1900 client machines) and an average of 3 server machines at the infrastructural level (with a maximum of 70 server machines). The Milan municipality is the one with the highest weight in this survey. Out of 218 municipalities that responded to question "Do you already Adopt Free and Open Source Software (FLOSS) in your Organization?" 38% does not use any type of FLOSS, while 50% (108 respondents) use FLOSS. The remaining (13%) does not know or gives no response. Out of 108 PALO that adopt FLOSS solutions, the majority declares to use FLOSS software only partially on desktop computers and servers. Very few PALO use FLOSS on desktop computers and servers more than proprietary software solutions. Nine PALO declare to have tested Software FLOSS only on pilot projects.

As clearly shown in the chart of Figure 1, the most common FLOSS solutions are in the software category: "Browser" (20.13%), with a strong preference for the Mozilla Firefox browser, or in the category: "Productivity Software" (17.90%) with a preference for the OpenOffice package. Very adopted are also: Data Base Management Systems (11.63%), with an equal distribution between MySQL and PostgreSQL, Operating System (10.51%) such as Linux, Mail Client (10.29%) such as Zimbra or Mozilla Thunderbird. The qualitative survey shows clearly that solutions for Network and IT Services Monitoring, CRM systems (Customer

Relationship Management), DMS (Document Management System), ERP (Enterprise Resource Planning) and Networking Systems are slightly adopted in PALO. This situation is in contrast with the policy of transparency and dematerialization that PALO should or would like to pursue. As for Operating Systems on PC Clients and Servers, there is a clear predominance of proprietary solutions (i.e., Microsoft Windows): 198 out of 210 operating system installations are based on Microsoft solutions from a client point-of-view (4 Linux distributions and 2 MacOS systems); as for server machines, 191 out of 242 are Microsoft installations (41 Linux distributions and 0 MacOS systems). However, proprietary solutions adopted on Server are out of date (i.e., Windows Server 2003): this means that the monolithic infrastructure designed several years ago are not constantly updated and maintained. Proprietary solutions adopted on PC Clients (such as Windows XP) are often obsolete as well, since the regular upgrade of the proprietary OS is too expensive for the finances of the municipal administrations.

The considerations listed above are confirmed by the desire of mayors and IT municipal managers to increase the use of FLOSS software in their organizations. 54% of respondents would like to adopt new FLOSS solutions, while only 9% are not interested in adopting FLOSS (31% do not know, and 6% do not answer.)
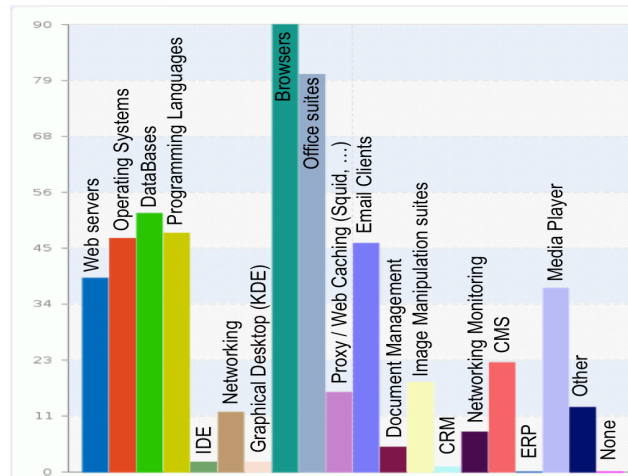

Fig. 1. Micro categories of adopted FLOSS Solutions

A significant proportion of respondents (18%) would like to migrate all of their proprietary software to FLOSS systems, while 74% are interested in migrating only some specific FLOSS solutions (3% do not know, and 5% do not answer.)

However, the migration processes and the ability to access the source code of the adopted solutions are not considered by IT managers as a way to improve their IT department significantly. Only 20% of respondents, in fact, think that access to the source code of the software used by the municipal organizations may be a mechanism to improve the quality of their IT department, while 32% do not see any

relation between the access to the source code and the quality of the IT department (40% do not know, and 8% do not answer.)

To identify the strengths and weaknesses in the adoption of FLOSS solutions for the Lombardy PALO in particular, the interviewed PALO were asked to express specific opinions about some qualitative factors of FLOSS solutions: Table 2 summarizes the results for each quality factor expressed both as percentage and absolute values. Among the different quality factors, the aptitude to customize FLOSS solutions compared with proprietary solutions is considered strategic. Out of 218 respondents, 88% completely agree (or agree) that FLOSS is easier to customize than proprietary Software. Another strategic factor for FLOSS is the ease of integration of the FLOSS Software with proprietary software (44.40% completely agree or agree). The openness of the source code is not enough to adopt FLOSS products: lower prices than the equivalent proprietary solutions are sought (41.67% completely agree or agree). For 36.57% of the respondents, it is difficult to find specialized companies to support the migration to FLOSS and for 41.2% of the respondents, it would be too expensive and too long to train their employees to use FLOSS software. In addition, the respondents think that the proprietary software is easier to use, safer and more reliable than FLOSS [9].

Table 2. Opinions about Qualitative Factors of Software FLOSS

	Fully agree	Agree	Disagree	Fully disagree	No opinion / No answer
a) FLOSS is easier to use than Proprietary Sw	0.9%	22.5%	28.0%	2.3%	37.2% (81)
	(2)	(49)	(61)	(5)	9.2% (20)
b) FLOSS is easier to customize than Proprietary Sw	5.5%	34.9%	14.7%	0.9%	34.9% (76)
	(12)	(76)	(32)	(2)	9.2% (20)
c) FLOSS is more reliable than Proprietary Sw	4.1%	19.7%	28.0%	0.9%	38.1% (83)
	(9)	(43)	(61)	(2)	9.2% (20)
d) FLOSS is more secure than Proprietary Sw	6.0%	19.7%	27.1%	0.9%	36.7% (80)
	(13)	(43)	(59)	(2)	9.6% (21)
e) The overall quality of FLOSS is higher than the quality of Proprietary Sw	1.4%	16.1%	31.2%	2.3%	39.4% (86)
	(3)	(35)	(68)	(5)	9.6% (21)
f) FLOSS can be easily integrated with Proprietary Sw	2.3%	32.1%	19.3%	3.7%	33.5% (73)
	(5)	(70)	(42)	(8)	9.2% (20)
g) If FLOSS would provide only the ability to access the source code without being cheaper than Proprietary Sw, then my PALO would not use FLOSS	11.1%	30.6%	11.6%	1.4%	35.2% (76)
	(24)	(66)	(25)	(3)	10.2% (22)
h) It is quite hard for my PALO to find companies that provide technical support for FLOSS products	9.3%	27.3%	21.3%	2.8%	29.2% (63)
	(20)	(59)	(46)	(6)	10.2% (22)
i) I would like to migrate to FLOSS if and only if other organizations already migrated to FLOSS	5.6%	27.3%	29.2%	2.8%	25.5% (55)
	(12)	(59)	(63)	(6)	9.7% (21)
l) Train the staff of my organization to use FLOSS would be to expensive in terms of cost and time	6.9%	34.3%	24.5%	4.2%	20.4% (44)
	(15)	(74)	(53)	(9)	9.7% (21)

It is interesting to note that, although a significant percentage of IT managers believe that FLOSS is more secure, (25.68%), more reliable (23.85%) and with a higher overall quality (17.44%) than equivalent proprietary and closed software solutions, only 11% of respondents claim to buy new hardware (PC desktop, laptops, etc.) with the Operating System and the main SW packages already installed and then replace the software over time with equivalent FLOSS solutions. In alternative, they directly buy the hardware without pre-installed software to provide the IT staff with the possibility of installing and configuring FLOSS solutions from scratch. 65% of respondents buy new hardware with pre-installed proprietary Operating Systems and software packages, then add FLOSS solutions over-time whenever new specific needs rise in the PALO. In all cases, the pre-installed software (licensed with the hardware) is not replaced. The Microsoft monopoly in licensing new hardware with their Operating Systems and Office suite increases the hesitation in migrating to FLOSS solutions when the software is purchased with the hardware.

The choices on the purchase of software are more influenced by IT managers (17.78%) that decide which Software solutions purchase. In the decision process, consultants who work with the administration can have an important role (13.78%), such as end-users who, with their needs, indirectly push the administration to make certain choices rather than others (14.44%). With an average of almost 4 suppliers and a total of 664 suppliers, which the Public Administrations rely on to supply Software solutions, the responding PALO said they were too dependent on their suppliers in 23.59% of cases, while they declare their freedom from their suppliers in 47.18% of cases. This indicates how the organizations still feel free to act in their own internal choices regardless of the supplier, while confirming the outsourcing of development and maintenance of the solutions in use. For example, in 54.88% of cases, respondents say they rely regularly and frequently on external suppliers for maintenance of their software, while only 34.36% say they do it sporadically.

In 21% of cases, software solutions are released by vendors as "turnkey" products without requiring ad-hoc customizations and personalization. However, in 46.15% of cases, sporadic customization activities of the solutions adopted are requested by the PALO. Frequent tasks of customization are needed by 7.18% PALO. During the customization of the software solutions, the contribution of the FLOSS community is evaluated by 42.56% of the respondents as "good", in line with the quality perception PALO IT managers have about the contributions made by developers of proprietary software solutions (51.28%). It is important to notice that 2.05% of the respondents declare an insufficient support provided by FLOSS communities. The value increases to 3.08% in case of the support provided by developers of proprietary software solutions.

In 2011, the total budget spent by the IT departments of the 140 respondents was equal to € 7.7M (million) with an average value of € 55k (thousand) and a peak of € 2M. Analysing the data point with the highest value (i.e., budget > € 100k) and comparing these data with the responses to question "Does the PALO adopt FLOSS?" and the number of inhabitants of the related PALO, we can observe that:

- Only 12 municipalities have an expense of the IT department > € 100k per year;
- The total expenditure of the 12 municipalities is about € 4.5M for their IT departments with € 377k in average, covering 58.45% of the total expenditure;
- The total number of inhabitants of the 12 analysed municipalities is equal to 628,000 inhabitants (the IT expenditure grows linearly with the number of inhabitants), covering 32.60% of the total number of people reported in Table 1;
- 10 out of 12 municipalities under analysis adopt FLOSS solutions, while only 2 municipalities do not use FLOSS (one of these is the municipality with the highest IT departmental expenditure).

In 23.16% of cases, IT managers declare that the total expenditure, in 2011, for their IT department is too high, while 50% of the IT managers claim that the total expenditure was reasonable. Only 1% of the IT managers say that the total expenditure is too low. In any case, 40% of respondents state that they will focus on a reduction of their total IT expenditure in the next two years, while for 26.84% of respondents, a contraction in the IT budget is perceived as not necessary.

59.41% of the respondents to question "Do you feel a need for addressing (directives / laws) at the regional level on the adoption of Open Source Software in PA?" advocates the adoption of a directive or law on the issues of FLOSS. Only 17.65% of the respondents do not see any legislation as necessary. Very similar is the distribution of respondents about a regional directive / law related to Open Data.

5   Conclusions

The results yielded by the qualitative analysis were substantially confirmed by the quantitative analysis performed in the subsequent phase of the investigation. It is therefore possible to conclude that:

- A relevant fraction of the interviewed PALO is already using FLOSS;
- In general, both FLOSS and proprietary software are used. However, the usage of FLOSS is dominant with respect to proprietary software only in 10% of the PALO that participated in survey;
- Sophisticated FLOSS solutions, e.g., for CRM, DMS or ERP, are rarely used in PALO. On the contrary, OS, CMS, productivity suites and Web browsers are more widely used;
- Operating Systems are mainly proprietary. 17% of the interviewed PALO uses Linux on servers, and only 2% on clients;
- Money saving is an important driver for the adoption of FLOSS, which is generally considered of lesser quality than proprietary software by people in charge of IT operations;
- 60% of the interviewees are waiting for a Regional law that prescribes how to adopt FLOSS and how to publish Open Data. To this end, the creation of a regional board for monitoring FLOSS and supporting its adoption is advocated.

Acknowledgements

References

1. Open Government Partnership: Action Plan Italiano. April 2011. http://goo.gl/qybte
2. Tim Berners-Lee and Nigel Shadbolt. "There's gold to be mined from all our data". http://www.theodi.org/sites/default/files/Times%20OpEd%20TBL-NRS%20Final.pdf
3. Christian Bizer, Tom Heath and Tim Berners-Lee. "Linked Data - The Story So Far". Int. J. On Semantic Web Information System 5(3): 1-22, 2009
4. Open Source Initiative. "The Open Source Definition". http://opensource.org/docs/osd
5. Decreto Legislativo 18 agosto 2000, n. 267. "Testo unico delle leggi sull'ordinamento degli enti locali" Gazzetta Ufficiale n. 227 del 28 settembre 2000 – Supplemento n. 162
6. Direttiva 19 dicembre 2003 "Sviluppo ed utilizzazione dei programmi informatici da parte delle pubbliche amministrazioni". Gazzetta Ufficiale n. 31 del 7 febbraio 2004
7. Open Cloud Manifesto. www.opencloudmanifesto.org/
8. V. Del Bianco, L. Lavazza, V. Lenarduzzi, S. Morasca, D. Taibi, D. Tosi, "A Study on OSS Marketing and Communication Strategies", IFIP Int. Conf. on Open Source Software (OSS 2012). Hammamet. September 2012
9. L. Lavazza, S. Morasca, D. Taibi, and D. Tosi, "An Empirical Investigation of Perceived Reliability of Open Source Java Programs", 27th ACM Symp. on Applied Computing (SAC 2012), Riva del Garda. March 2012
10. C. Friso, V. Lenarduzzi, D. Taibi, and D. Tosi, "How Open Source Software Products Can Support Teaching in Italian Schools", 5th European Conf. on Information Management and Evaluation. Como. September 2011
11. Ø. Hauge, C. Ayala, and R. Conradi. "Adoption of open source software in software-intensive organizations–A systematic literature review." *Information and Software Technology* 52.11 (2010): 1133-1154
12. E. Maldonado. "The process of introducing FLOSS in the PA: the case of Venezuela." *Journal of the Association for Information Systems* 11.11 (2010): 756-783
13. B. Rossi, B. Russo, and G. Succi. "Adoption of FLOSS in public organizations: factors of impact." *Information Technology & People* 25.2 (2012): 156-187.