

**SIXTH FRAMEWORK PROGRAMME
PRIORITY 2
INFORMATION SOCIETY TECHNOLOGIES**



FLOSSWORLD

**Free/Libre and Open Source Software: Worldwide
Impact Study**



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1. Introduction

Free/Libre/Open Source Software (FLOSS) is arguably one of the best examples of open, collaborative, internationally distributed production and development that exists today, resulting in tremendous interest from around the world, from government, policy, business, academic research and developer communities. FLOSSWORLD primarily aimed to strengthen Europe's leadership in international research in FLOSS and open standards, and to exploit research and policy complementarities to improve international cooperation, by building a global constituency of policymakers and researchers. FLOSSWORLD contributes to enhancing Europe's leading role in research in the area of FLOSS and strongly embed Europe in a global network of researchers and policy makers, and the business, higher education and developer communities. FLOSSWORLD enhances the level of global awareness related to FLOSS development and industry, human capacity building, and e-government issues in eight developing or transition countries:

- Argentina
- Bulgaria
- Brazil
- China
- Croatia
- India
- Malaysia
- South Africa

The project contributed to establish a stronger, sustainable research community in these regions, as indicated, for instance, by the generation of a number of further projects including members of the FLOSSWORLD consortium and some new partners from other developing / transition countries¹.

This deliverable provides an overview of the overall findings of the three FLOSSWORLD research tracks, i.e. the skills study (track 1), the study on interregional differences in software development (track 2), and the government study (track 3). It concludes with some indications of policy impact.

The basis of these tracks are five surveys that have been developed, carried out, and analysed between end of 2005 and beginning of 2007:

1. Survey of FLOSS developers (track 1)
2. Survey of employers (track 1)
3. Survey of universities and institutes of higher education (HEIs) (track 1)
4. Software development survey (track 2)
5. Government survey (track 3)

The track 1 and track 3 surveys addressed members of the FLOSS community, HR and IT managers with personnel responsibilities, university staff (administrators and IT managers) and government representatives (on all levels, local, regional, and national). The track 2 survey examined software code and included the analysis of technical facilities, such as CVS (software version control information) or Forges (collaborative software development environments), media (such as FLOSS-related magazines), and organisational support structures, such as local user groups (LUGs). A detailed description of the methodology of each research track is provided in the country reports and the international reports.

In the following three sections (chapters 2-4) we present key findings of each of the three research

¹ Such as the SELF project (FP6/IST, with FLOSSWORLD partners FVL and ISOC-BG) and FLOSSINCLUDE (FP7/IST, with several FLOSSWORLD partners)

tracks and evaluate them with regard to the policy impact of the study and its findings. In chapter 5 we draw relevant conclusions across the thematic segregation of the three research tracks for further research and policy.

The survey of FLOSS developers was answered by 1029 respondents (see Table 1), the employer survey was answered by 716 respondents (see Table 2)², and the HEI survey has been replied by 446 respondents (see Table 3).

2. Track 1: Skills Development

FLOSS is not only a viable software development approach, but also a model for the creation of self-learning and self-organizing communities (Sowe, et al. 2004; Sowe et al. 2005). FLOSS is also a virtual learning context in which both professional software developers and novice users benefit by leveraging their knowledge and information access repertoire. Knowledge is mainly acquired in FLOSS through learning by doing. In recent times, FLOSS is making inroads not only in business and software industries but in colleges and universities as well. As a consequence, there is increased interest in the FLOSS learning environment (Sowe, et al., 2004; Bacon and Dillion, 2006) and in FLOSS projects as bazaars of learning (Sowe, et al., 2006). FLOSS is an alternative teaching methodology and an educational model at the same time (Faber 2002).

To a certain degree, the FLOSS community can be considered as a large community of practice (or as a reservoir of many such communities of practice), since membership in this community is not defined by official status but by participation, it develops informally around things that matter to people (in this case: software), and it produces a shared repertoire of communal resources (routines, sensibilities, artefacts, vocabulary, styles, etc.) (Wenger 2000; Ghosh & Glott 2005a). Virtual communities and communities of practice serve as important learning environments. Sowe et al. (2004, 2005) therefore concluded that FLOSS is also a model for the creation of self-learning and self-organizing communities. FLOSS communities can therefore be described as web-based learning communities (Sowe, et. al., 2004) in which individuals interact with collaborating peers to solve a particular problem and exchange ideas.

The FLOSSWORLD project tackled the issue of human capacity building from three angles: It examined the skills development of community members through their participation in this community, it examined how employers value skills that are learnt in the FLOSS community, and it looked at the role of FLOSS for higher education and the role of higher education institutions for the FLOSS community. Especially the latter point, examining the extent to which FLOSS is being created, released and applied within the Higher Education Sector (HES), has been given comparatively little attention so far. Public discussions of the relevance of “open source” programs for e-learning at the tertiary level (at least, those carried on in English language sources) have been largely preoccupied with questions of patent rights and licensing cost of “course management” and e-learning support software (particularly those arising from the “Blackboard Learning System” patents, and the possible threats to FLOSS alternatives such as “Moodle,” and MIT’s “Saki Project”).

But the potential contributions that the activities of FLOSS communities can make to university education and skill formation do not begin and end with the question of the costs to educational institutions of on-line course management software, and this is especially true when the situation of the developing and transition economies are considered. Universities (and educational institutions

2 The employer sample shows a bias towards companies for which FLOSS plays an important role, their share amounts to 75% of the respondents. The results of the employer survey therefore allow to draw conclusions only for the FLOSS-related economy and should not be taken as results that apply to the economy as a whole.

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

Furthermore, the policies of universities and the behaviors of their employees are of interest because the HES is a major employer and user of digital information and computer-mediated telecommunication resources, and the decisions made within these organizations about what hardware and software systems will be acquired and supported are shaped by incentives and constraints that are not identical to either those in government agencies or in private, profit-oriented enterprises. Examining the use and development of FLOSS within HEI's, and the possible differences within the various functional divisions of the university (administration, teaching and research in the arts, and in the sciences) may be informative of more general questions about the ways in which different structures of organization and cognitive activity affect the balance of choice between proprietary software and FLOSS.

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

Main findings of Track 1

- FLOSS communities in developing and transition countries are very young and well educated:
 - The average age of the respondents is 29.2 years, and only China (25.5 years) and South Africa (31 years) differ significantly from the average
 - High school and university degrees dominate in all countries
 - Usually, software engineers, system administrators, and programmers are the professions providing the lion shares of the regional FLOSS communities' members
- The shares of female community members, students, and of self-employed differ significantly:
 - The average share of female respondents is 6.6%, with 2% in Croatia but 11% in China and 23% in Malaysia
 - The average share of students is 16%, but Bulgaria and Argentina show very small shares (5% and 9%), whereas Croatia and especially China exceed the average by far, with 24% and 61%. Within the FLOSSWORLD sample, China is the only FLOSS community where the vast majority of the community consists of students.
 - The share of self-employed is considerably high in Argentina (44%, compared to an average of 22%) and very small in Croatia, Malaysia and China

- FLOSS is a very powerful learning environment in developing and transition countries:
 - Sharing knowledge and learning new skills, together with some ideological aspects (e.g. fighting the power of proprietary software companies), provide the main motivators for joining the community across all eight regional FLOSS communities
 - In almost all communities the same three skills are perceived as the ones that improve most through participating in the FLOSS community: to write code in a way that it can be re-used, to develop an awareness of legal issues, and to accept and respond to criticism from others
 - FLOSS provides not only technical skills but also social, managerial, and legal skills
 - Developers as well as employers report that there are managerial, technical and legal skills that can better be learnt in FLOSS than in a formal computer science course (see Tables)
 - Skills attainment in the FLOSS community is directly related to professional aspirations: the share of FLOSS community members who say that they consider the skills they learnt within the community as a core for their professional career is the biggest one in each of the eight countries, ranging from 41% to 64% (see Figure 1)
 - 64% of the developers think that proven participation in the FLOSS community can compensate for the lack of formal degrees, like certificates or university degrees
- Participating in FLOSS has a positive impact on job opportunities
 - Employers recognise the value of informally acquired skills in the FLOSS community
 - Most employers see no difference between a formal degree and informal FLOSS experience; in China the employers even prefer informal experience over a formal degree
 - FLOSS provides good opportunities to earn money, either directly or indirectly (see Figure 2), whereby direct income derives rather from supporting or administering than from developing FLOSS and indirect income results mainly from getting a job because of FLOSS experience
- the higher educational sector (HES) plays an important role for FLOSS, while FLOSS has become an important educational means for HEIs
 - The average rates of FLOSS use and FLOSS development at universities vary substantially across countries, but FLOSS use lies in the range above 60 percent whereas FLOSS development typically lies in the range below 60 percent
 - A substantial portion of universities ask technical job applicants about their FLOSS experiences and give positive weight to such experience in making hiring decisions.
 - The majority of HEIS offers courses that would provide students with basic and advanced programming skills by using FLOSS
 - Having a departmental policy for purchasing computer software which is clear or which supports FLOSS adoption is neither necessary nor sufficient for a university to attain high levels of prevalence in the adoption of FLOSS; however, when not anti-thetical to releasing FLOSS, such policies appear to be strongly associated with the reported presence of open source software development activity within the institution

3. Track 2: Regional Differences in Software Development

It is fair to say that most FLOSS is usually written and communicated in English and oriented to the sophisticated IT infrastructures of the industrialized countries. Software developers in developing countries (and some other reasons such as Korea and Japan) often face the problem that they do not integrate in the global FLOSS Communities because of language barriers and because of technical problems (e.g. insufficient connectivity to conveniently download programs or send patches).

However, since the FLOSS community is a vital resource for skills development and economic activity, and strengthening e-government and e-Democracy, it would seem fundamentally important to improve the opportunities for developing countries to integrate in the global FLOSS community, in a sustainable way. The aim of this track of the FLOSSWORLD project was to understand the present situation, as a prerequisite for further improvement in integration in the the global community. Such integration would allow local projects to learn from and contribute to local projects in other regions, and to learn from and contribute to global projects.

Track 2 focuses on the identification of structures and patterns of FLOSS activities that already exist in the target partner countries. This involved a three-step process to:

- Identify local FLOSS development projects, and the local user communities (including magazines and User Groups) that engage with such projects
- Study the local projects with respect to various attributes from development aims and techniques, productivity and quality to method of funding and impact on businesses. These attributes were studied to different degrees in each region based on the availability of data and resources; in particular, data for regional differences on productivity and funding proved difficult to gather.
- Compare these attributes for projects across different regions, and compare degree of integration across regions or with the global FLOSS community.

Finally, possible directions for future developments of FLOSS activities in the target partner countries were investigated.

Track 2 started from the hypothesis that, given the language barriers in many target countries, a starting point for FLOSS projects may often be the translation of existing FLOSS into country-specific and regional languages, rather than the independent development of new FLOSS software. Localisation and internationalisation of existing FLOSS applications is not only a precondition for the usability of these systems in many countries, it is also a precondition for reaching and establishing a critical mass of FLOSS developers in these countries, which again is the most important prerequisite for an independent and sustainable local FLOSS community. Finally, it must be assumed that FLOSS in target countries may have greater significance at the local or regional level than it has in richer regions. As the example of the province of Extremadura in Spain shows, it is not unlikely that FLOSS initiatives in underdeveloped regions develop a specific dynamics that address local needs (of businesses and the labour market, of public administration, of the educational sector) and tend to replace proprietary software systems and standards by FLOSS systems and standards because of the low purchasing power of local authorities and organisations.

FLOSS activities in many target countries are strongly based on local initiatives and they may show remarkable differences from country to country and region to region. These different dynamics may result in differences in the structure of FLOSS development, code output of developers, scope and context of software developed, among other attributes that could potentially be benchmarked against metrics from other countries, Europe and global FLOSS projects. An important question in

this context the FLOSSWORLD study wanted to answer is, for instance, whether some countries tend towards having projects performing mainly localisation, while others tend to initiate projects with a global applications.

The key question of Track 2 was: What are the regional and international differences between FLOSS projects across countries?

Main findings of Track 2:

- Local and regional FLOSS communities do exist, and they maintain their own infrastructure for software development. This result was clearly expected by the project, but has been backed with detailed data. Regional communities have been characterised, finding how diverse they are, and providing a first estimation about their size in the target regions (see the detailed Track 2 report for data per country, including for instance, the number of people involved in development, the number of projects, the kind of forges in each country, etc).
- However, these local and regional communities are small in size when compared with the global FLOSS community. This result was expected, but the report has been able of showing to which extent most FLOSS development is really a global activity. It is also remarkable that many of the target countries (such as China, Brazil or India) are among those more likely to have large regional development communities. This means that this result can be considered as meaningful not only for the target countries, but in general.
- Some global projects have been found in regional forges in the target countries, specially in India. This is a clear indicator that the infrastructure for global software development is not only provided by developed countries, and that the results of the report have to be considered with care, since some of the development identified as regional could be in fact a part of global FLOSS development.
- There is a lot of variety in the kind of web sites for supporting regional FLOSS development. These sites, usually called “forges”, are not always run by GForge-like³ systems, although that is the trend, as is the case worldwide. What is maybe more surprising is that they are in several cases not even “true” development sites, but more like repositories of software developed elsewhere. This means that, contrary to the main trend in the global FLOSS community, many regional developments produce public versions of their software, but use little of the usual infrastructure for developing in the open source way (with public source code management systems, mailing lists and bug tracking systems, for instance).
- Regional communities are usually focused on developments that are local, meant for the use of the regional communities themselves. Except some specific cases (India is the most notable, Brazil is also an exception to some extent), the projects and products are not known neither used in other regions, neither are they known to the global software community. Developers also seem to be from the involved region, with little participation of foreign developers (again, India is an exception to this).
- A great share of the projects carried on by regional communities are localisation of global packages. Brazil (which produces many packages of apparently local origin) and India (where many projects seem to be not much interested in localisation) are the most clear exceptions.
- Local languages are usually used for communication in these regional communities. This is almost an absolute fact in countries such as China, Argentina or Brazil. However, there are

3 GForge is the GPL-licensed version of the software behind Sourceforge.net, one of the first and largest global collaborative software development environments.

also some exceptions: English is almost the only language found in India, and very common in South Africa. Although both countries have a significant fraction of their population being fluent in English (which explains the fact), it is interesting how local languages (specially in the case of India) are clearly under-represented in FLOSS development. Language (English) also explains why the community in India, and to some extent in South Africa, are clearly more interrelated with the global FLOSS development community than other target regions. Language also helps to explain the relative isolation of a large fraction of developers in regional communities: if they are not fluent in English, the lingua franca of the global FLOSS community, they are somehow restricted to work with their regional fellows who speak the same language. Although they may be very effective in developing locally useful software solutions, there is clearly a potential value in direct collaboration with the global FLOSS community that is missed in such cases.

- Scripting languages (Perl, Python, PHP) are clearly overrepresented in almost all regions (and even more clearly if localisations of Linux-based distributions are excluded from the analysis). This is curious, and could imply that not all programming technologies are equally interesting for developers in the target regions, or that they are not equally understandable or adaptable to local needs. Scripting languages are typically less demanding in terms of programming skill than compiled languages such as C, although this does not necessarily limit the complexity or sophistication of the software developed.

4. Track 3: Government Survey

The FLOSS User Survey in 2002, showed that 22% of all public sector organizations in the UK, Germany and Sweden use some FLOSS. Although the nearly 1500 respondents to this telephone survey included three categories of business users as well as the public sector, there were 383 public sector organizations. In comparison, other surveys on FLOSS usage in government have been much smaller, typically under 100 respondents, certainly at the Europe-wide level. A later detailed survey of about 500 government authorities carried out by UM for the OSOSS Programme of the Dutch government covered in detail awareness of, attitudes and behaviour towards interoperability, open standards and FLOSS. The FLOSSPOLs survey of government authorities carried out in 2005 covered a broad base of respondents – 955 respondents across over 10 EU member states.

These experiences determined the methodology for the FLOSSWORLD government survey. The coverage in terms of content included:

- Software equipment: what kind of software is used, share of FLOSS, reasons for purchasing
- decisions and strategy, sources where software is purchased
- Practical aspects: size of purchasing budget, supply and maintenance aspects, etc
- IT managers' knowledge of FLOSS, familiarity with programs available on the marketplace, evaluation of advantages and disadvantages of proprietary and non-proprietary software, perception of FLOSS diffusion in recent years and estimation of future trends
- Attitude towards / affiliation with FLOSS community, own FLOSS development and participation in the community
- Assessment of approach to interoperability

The objectives of Track 3 are to provide a first impression of:

- what policies and behaviour do governments around the world adopt towards FLOSS, open standards and interoperability?

- attitudes towards and usage of FLOSS and open standards/interoperability in public authorities at various levels in each target region

Overall, 306 government bodies from the eight targeted countries have participated in the FLOSSWORLD government survey (see Table 4).

Main findings of Track 3:

The response to Track 3 surveys was slightly lower than expected (306 against 400 responses, with very low responses in some countries). As a result, the survey results must be interpreted carefully; in particular, for most countries they cannot be used as a representative measure of the extent of FLOSS use in the public sector. However, the results are nevertheless very useful in providing a cross-country, and often first ever, impression of FLOSS issues for the public sector. Moreover, a number of findings between groups of responses, such as those relating to the reasons for FLOSS use (or lack thereof) can be reliable despite the low number of responses.

- The share of FLOSS users among survey respondents in the eight developing and transitional countries is 65%, plus another 15% that indicated to use one or more FLOSS programs but were not aware that it is FLOSS (“unaware users”); FLOSS usage varied considerably between Latin America and India, where user shares reached about 90%, and China and Croatia, where the respective shares remain below 30% (China) or below 40% (Croatia) (see Figure 3)
- There is a great potential for FLOSS to grow among the respondents from the public sector:
 - 64% of the respondents would find it useful to increase the share of FLOSS in their organisation; this wish was comparably strongly pronounced in South Africa (88%) and India (78%)⁴
 - The majority (two thirds) of the respondents prefer to replace some proprietary components by FLOSS components, i.e. to run mixed systems; a remarkable share of almost one third wishes to replace all proprietary software by FLOSS – the latter applying particularly to Brazil (61%), South Africa (57%), Argentina (47%) and India (44%)
 - 72% of those who use already FLOSS want an expansion of the share of FLOSS in their organisation, but even more strikingly appears that almost half (49%) of the non-users wish to expand the share of FLOSS in their organisation, too
- Proprietary software is still in a dominant position within respondent government organisations in developing and transitional countries:
 - Neither on desktops nor on servers provides FLOSS the standard software, i.e. FLOSS runs either only on a few desktop PCs or servers while others run with proprietary software or FLOSS runs together with proprietary software on the same desktop PCs and servers
 - Proprietary software provides the lion share of the software systems that are used in governments; relevant shares of FLOSS appear with MySQL/PostgreSQL, Mozilla/Firefox, GNU/Linux, Apache, and PHP; OpenOffice.org. is used by only one third of the respondents (see Figure 4)

⁴ Only 8% said they would not find it useful to increase the share of FLOSS in their organisation, which applies especially to Croatia (13%), South Africa (13%) and China (12%)

- There is a strong base of and a strong potential for governments that act not only as FLOSS users but also as FLOSS creators and distributors:
 - 17% of the respondents have directly contributed to a FLOSS project
 - Another 8% have contracted somebody else (i.e. a company or a developer or team of developers) to contribute to a FLOSS project
 - Roughly one quarter (23%) owns software that might be interesting to be shared with other organisations under a FLOSS license
 - In conclusion: almost half of the government organisations in our sample are already or have the opportunity to become very easily more than pure FLOSS users (i.e. FLOSS distributors)
- The size of the government organisation and attitudes towards FLOSS determine the degree of FLOSS usage in developing and transitional countries, while IT budgets, costs of software license fees, or vendor dependency show no significant impact – in contrast to Europe
 - There are mainly two positive statements that drive FLOSS usage: ease of use and ease of customisation
 - Fear of cost and time efforts aligned with training people to use FLOSS and the fear to lack technical support after migrating towards FLOSS turned out as the main barriers towards FLOSS usage
- FLOSS plays an important role with regard to fundamental eGovernment objectives, such as ease of access to government services or ease of data exchange between public administrations
 - 84% (100% in Brazil and Bulgaria) of the government representatives that participated in the survey think citizens should be able to access all governments services regardless of the software platform that they use
 - This opportunity is actually implemented in 68% of the respondents' organisations
 - Since almost all respondents think that citizens should be able to access all governments services regardless of the software platform that they use there is no statistically significant correlation between this conviction and FLOSS usage or non-usage, but there is a significant difference between FLOSS users and non-users with regard to the actual implementation of this opportunity in government organisations: 79% of the FLOSS-using organisations have implemented the opportunity of platform independent access to services, but only 61% of the non-users
 - 88% (but only 52% of the Chinese respondents) think governments should be able to exchange data with other government organisations regardless of the software platform that they use
 - An actual implementation of this opportunity is however reported only from 55% of the respondents
 - Again, there is no correlation between FLOSS usage and the opinion that governments should be able to exchange data with other government organisations regardless of the software platform that they use, while the actual implementation of this opportunity in government organisations differs significantly between FLOSS users and non users:

69% of the FLOSS users have this opportunity implemented, but only 53% of the non-users

- The question whether the usage of FLOSS results in a stronger implementation of platform independent access for citizens and data exchange between public administrations or whether the implementation of this opportunity leads to an increased use of FLOSS cannot be answered - it is however evident that the realisation of these eGovernment goals appears closely related to the use of FLOSS

5. Conclusions

Like in the more developed regions of the world the FLOSS communities in developing and transitional countries are quite young and well educated. For these young generations, with an average age somewhere in the twenties, participation in FLOSS provides a good opportunity to learn skills that are relevant on the labour market and that thus help to earn an income. Interestingly, not only FLOSS community members but also employers – though in our sample mainly affiliated to FLOSS - value skills that are informally learnt within the FLOSS community positive or, at least, comparable to formal degrees. It should be noted that there is no real equivalent to the FLOSS "open community training system" in the proprietary software environment, as development of software in that environment only takes place within companies or other formal structures, so developers need prior training.

The fact that worldwide, in repeated surveys, people say that they joined the FLOSS community because they want to learn and share their knowledge implies that - besides software - "learning" is the second important asset around which the community (re-)creates itself and develops its enduring dynamics. The study has revealed that FLOSS participation results in skills improvements not only in the field of software technology but also in managerial, legal, and social skills.

Though FLOSS community members might not think about their career when they join this community they recognise very soon that the things they learn within the community are something that many employers demand. Community members have thereby a very realistic understanding of what their skills are worth. Thus, it must be assumed that the knowledge transfer within the FLOSS community also enables its members to assess realistically their labour market opportunities.

Together these findings may have strong implications on educational policies, especially in countries that focus on formal certificates as entitlements for the realisation of professional careers, because while certifying bodies exist for FLOSS, learning in the FLOSS environment is rarely automatically certified. We note that "credited author of the Linux kernel" may be seen as some form of certificate - while it is not printed on paper, clear evidence of the author's skill in the form of tens of millions of copies of running software may exist. Another policy challenge for today's educational systems is that human capacity building does not follow pre-defined curriculae. Learning within the FLOSS community is completely self-organised.

In this regard, the principles and practices of learning in the FLOSS community appear helpful to master the challenges that come up with the growing demand for "lifelong learning". These challenges consist mainly in the necessity of new learning arrangements that are more informal, self-organized, and incidental (i.e. driven rather by situational personal interests and needs than by pre-defined curriculae of educational institutions or firms). David & Foray (2002) describe this change as an overall shift from "learning to do" to "learning to learn". Given the potentials provided by the Internet, "communities of practice" (Brown & Duguid 1991; Wenger 1998, 2000), especially Internet communities are considered to be extremely successful in developing and deploying such new learning forms. FLOSS communities often serve as prime examples when the capacities of such volatile network organizations are demonstrated (Faust & Holm, 2001; Demil & Lecocq, 2003; Hemetsberger. & Reinhardt, 2004; von Hippel & von Krogh, 2003; David & Foray, 2002). In fact, the FLOSS developer survey (Ghosh et al. 2002) has revealed that this community is mainly driven by its members' individual wish to learn about and share knowledge of the development of open source software, its philosophy, and the cooperation within the community (Ghosh et al., 2002; Ghosh & Glott, 2005).

The findings of the HEI survey appear meaningful especially in the context of the discussion of this ongoing societal change, as they confirm that FLOSS and education appear strongly inter-related

and that both influence and benefit from each other. It is yet too early to decide whether or not the deployment of FLOSS in the HEIs will lead to the new forms of learning that are demanded for the information society.

The FLOSSWORLD developer survey found a high degree of homogeneity within the FLOSS communities, not only regarding demographic aspects but also aspects of “living FLOSS”, such as motivations to join the community, activities, preferences regarding learning methods and contents. Findings from similar studies in Europe and America indicate that there is hardly any significant difference between developed and developing countries in the FLOSS community - quite a contrast from much of the rest of the economy. The FLOSS community, probably due to its effective communication means, has succeeded in establishing common global standards and values that go far beyond the technological dimension and core of this community. Such values have spread despite the language barriers that frequently prevent individuals from collaborating directly with each other at a global level, especially among populations with low prevalence of English. This is perhaps due to the structure of the communities, which appears to be highly networked, thus allowing for indirect interaction and values exchange between, e.g., several Chinese and Brazilian developers via a few connecting developers forming the interface to the outside world.

Despite this global homogeneity, the Track 2 study of regional FLOSS development differences showed that there are a number of local and regional FLOSS communities that are hardly or not at all linked with the global community and that focus on localisation and projects that are meaningful only on local/regional level. Moreover, it is not easy to empirically verify the anecdotal evidence of small numbers of "connector" individuals who represent the input of local teams in the global community, cutting across language barriers.

Language barriers appear to be one reason for the lack of integration of these local communities in the global FLOSS communities, but this finding should not only be interpreted in a negative way: As the Track 2 survey revealed, these local communities are important for attracting new people to FLOSS, and they prove that the FLOSS philosophy and its work and learning principles work also in – more or less – isolated communities. In this regard, the capacity of FLOSS to serve as a learning environment might be especially meaningful for developing countries, which usually lack of communication and educational infrastructure that is standard in developed countries.

The survey of employers showed that firms value the skills that are learnt through FLOSS communities, and hire people who have learnt skills this way, thus provide direct and indirect support to local FLOSS projects. The employer survey also showed a significant bias towards companies for which FLOSS plays an important or even very important role - those with little awareness of FLOSS were unlikely to be in a position to judge the value of skills developed in FLOSS communities, or respond to the survey. Therefore we can at this moment draw conclusions mainly for the part of the global software economy that is centred around or at least deals to some degree with FLOSS. However, the skills learnt are not FLOSS-specific, and previous employer surveys in Europe have shown that proprietary software companies also hire developers on the basis of technical skills learnt through FLOSS communities. In countries with a growing skills base, those companies that already have experience with tapping the potential of the FLOSS community as a pool of skilled experts and a relatively costless learning environment might have advantages over other companies.

Regarding the practical outcome of the FLOSSWORLD government survey it must be emphasised that it revealed the same share of FLOSS usage (80%, including unaware usage) as in European governments - although the FLOSSWORLD government survey has to be interpreted with a greater degree of caution on this figure due to the lower response rate. Also similar to Europe, FLOSS is usually not a standard application on desktops and servers, proprietary software predominates the

markets for software in both regions. Finally, another thing both regions (Europe and the FLOSSWORLD region) have in common is that there is evidently a great potential for FLOSS to grow, within organisations that use already FLOSS as well as in non-user organisations. Particularly interesting in this regard is the high share (approximately 50%) of government organisations that are already or could easily become FLOSS distributors. This share seems to be higher in the FLOSSWORLD countries than in Europe, at least as a proportion of significant FLOSS users, even if not necessarily as a proportion of government organisations in general.

There is also a number of fundamental differences between government organisations in developing countries and in Europe. First of all, software policies, as far as they could be pursued by the means of an (online) survey play an important role for the usage of FLOSS in European governments, but in developing countries basic cornerstones of such policies (need for customisation or maintenance, IT budgets, share of license fees in IT budgets) do not differ (like in Europe) and therefore these factors have no impact on FLOSS usage. The only “objective” factor that seems to play a role for FLOSS usage in the FLOSSWORLD countries is size of the government organisation. But more than these objective factors the use of FLOSS in these countries seems to be driven by fears and hopes aligned with FLOSS, whereby ease of use and customisation provide the main hopes (and thus drivers) while the fears appear to remain diffuse and diverse across the different countries.

Finally, FLOSSWORLD Track 3 could show that FLOSS has a positive impact on fundamental eGovernment goals, such as platform independent access for citizens to services and platform independent exchange of data between public administrations.

There are few direct policy conclusions that can be made from the FLOSSWORLD data without further analysis, given the broad differences and contexts of the countries covered. But two broad policy areas can clearly use the input of this evidence made available for the first time:

1. education, skills and employment, where FLOSSWORLD studies have confirmed that skills are developed through the participation in FLOSS communities, encouraged simply through increased FLOSS use especially in educational settings. Such skills lead to employment and potential growth of local businesses.
2. eGovernment policy in several countries could draw on the reasons for FLOSS use, and in particular attitudes towards providing accessible government services to all citizens, the implementation of which is correlated with increased FLOSS use.

A final conclusion might be that FLOSSWORLD has proven successful in generating international collaboration with target countries and EU researchers, building an extensive community to further explore issues of common interest. In this context, given the clearly high level of interest, participation and benefit of FLOSS in developing countries shown from the FLOSSWORLD studies, European R&D policy may be further served by promoting international cooperation on FLOSS-related issues.

6. Tables and Charts

Country	Frequency	Percent
ARG	115	11,2
BGR	40	3,9
BRA	541	52,6
CHN	83	8,1
CRO	51	5,0
IND	71	6,9
MYS	77	7,5
ZAF	51	5,0
Total	1029	100,0

Table 1: FLOSSWORLD Developer Survey - Respondents by Country

Country	Frequency	Percent
ARG	43	6,0
BGR	23	3,2
BRA	357	49,9
CHN	26	3,6
CRO	37	5,2
IND	67	9,4
MYS	126	17,6
ZAF	37	5,2
Total	716	100,0

Table 2: FLOSSWORLD Employer Survey - Respondents by Country

Country	Sample size			Female (%)	Age (mean)	Wrote in name (%)
	Number of respondent individuals	IT (% of total)	Admin (% of total)			
Argentina	43	27.91	72.09	9.30	43.19 (10.01)	55.81
Bulgaria	7	42.86	57.14	42.86	35.43 (9.52)	85.71
Brazil	72	69.44	30.56	17.65	42.67 (9.06)	38.89
China	54	48.15	51.85	22.22	36.67 (9.75)	0.00
Croatia	83	68.67	31.33	11.11	38.03 (10.38)	100.00
India	47	72.34	27.66	23.40	40.17 (9.59)	44.68
Malaysia	128	42.97	57.03	23.02	37.91 (8.68)	0.00
South Africa	12	58.33	41.67	0.00	46.58 (8.63)	83.33
Total	446	54.71	45.29	18.26	39.52 (9.70)	38.57
N				438	431	446.00
Pearson $\chi^2(7)$		39.72		13.93		269.33
χ^2 p-value		0.00		0.05		0.00
F stat					4.67	
p-value					0.00	

Notes: see Appendix section 2 in the Track 1 International Report (D31) for explanation of χ^2 statistic and F statistics. Means are across individual respondents rather than across universities.

Table 3: Characteristics of HEI Survey Respondents

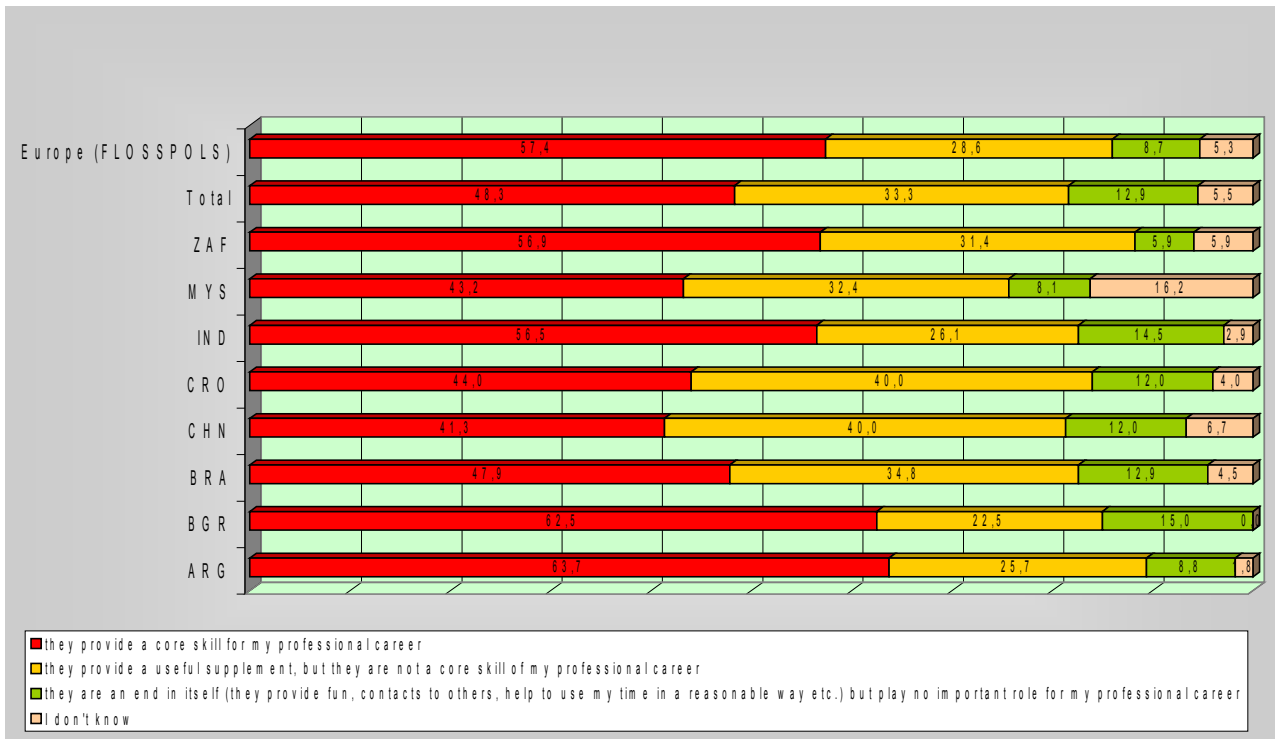


Figure 1: Role of FLOSS Skills for Professional Career

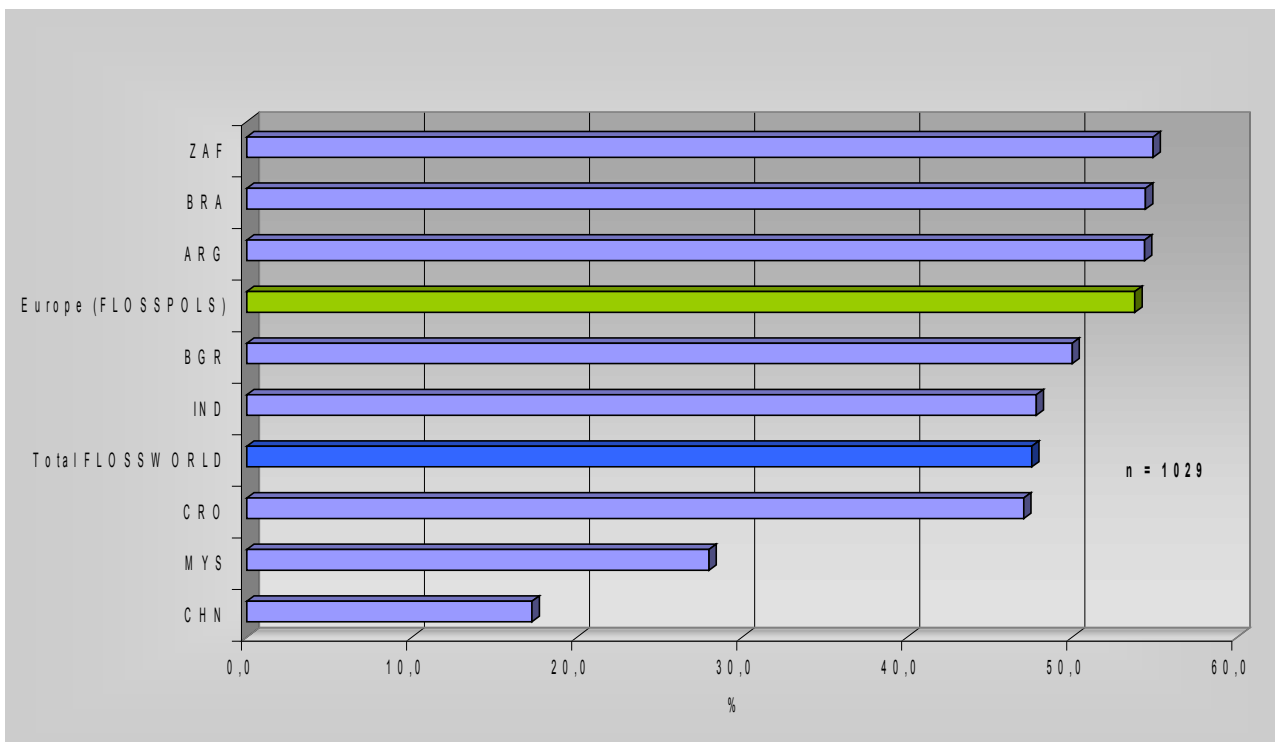


Figure 2: Shares of FLOSS community members earning money from FLOSS

Country	Frequency	Percent
ARG	48	15,7
BGR	11	3,6
BRA	26	8,5
CHN	25	8,2
CRO	50	16,3
IND	23	7,5
MYS	114	37,3
ZAF	9	2,9
Total	306	100,0

Table 4: FLOSSWORLD Government Survey - Respondents by Country

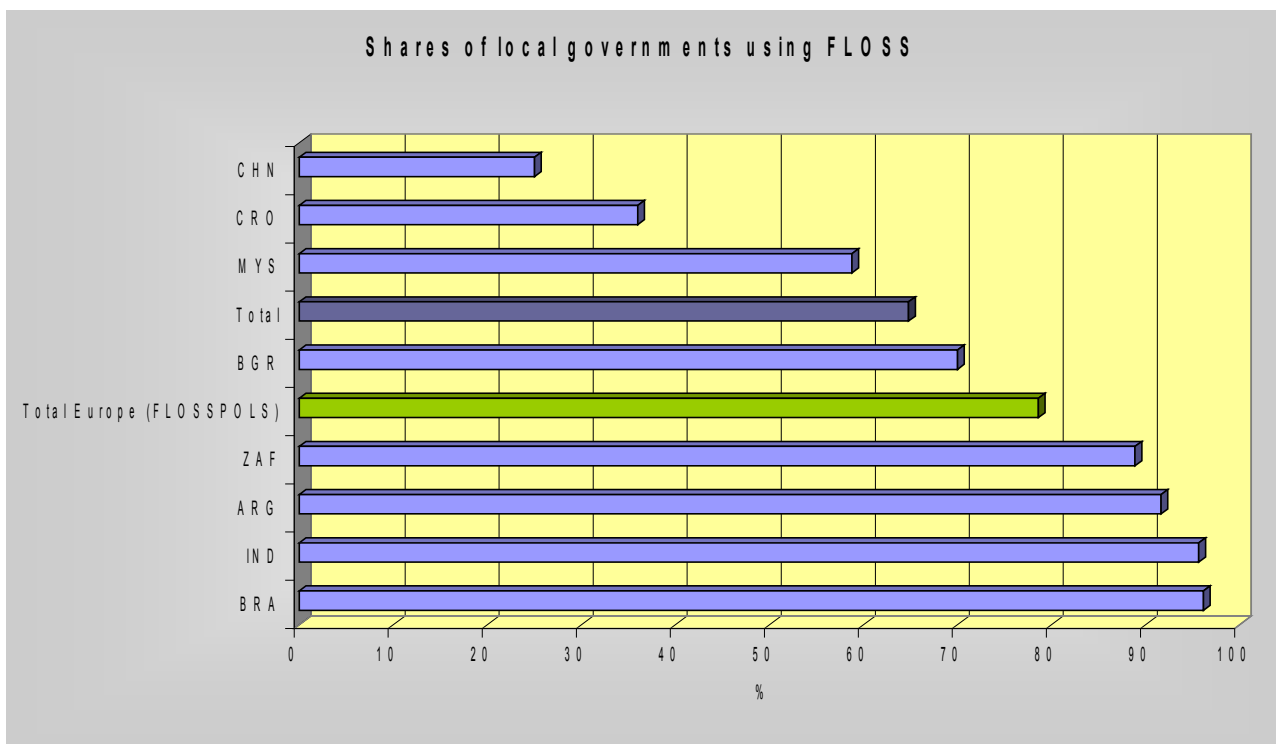


Figure 3: Share of FLOSS using government bodies in FLOSSWORLD countries and Europe

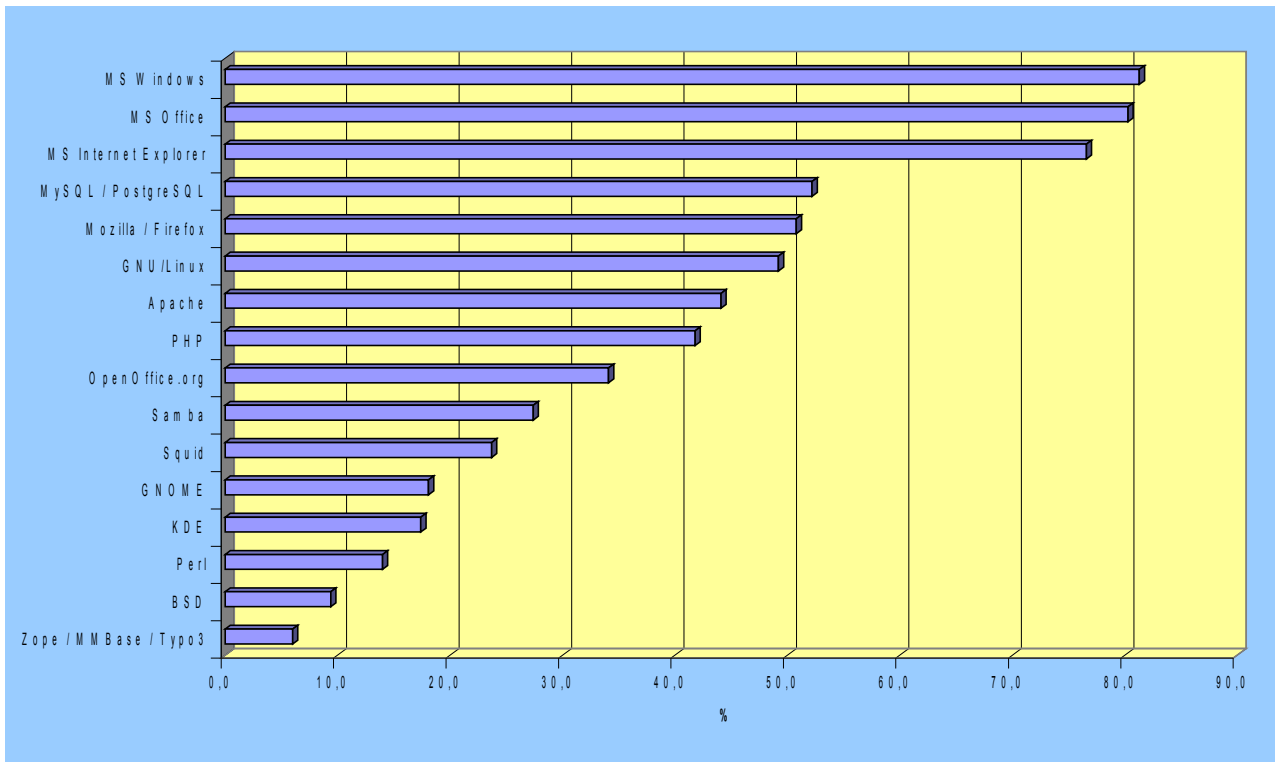


Figure 4: Usage of selected software systems by government bodies

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