

# Toward an Empirical Assessment of the Benefits of Open Source Software

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## Abstract

*There are many claims about the benefits of Open Source Software (OSS). However, these claims are seldom supported by empirical evidence, while on the other hand there are several impediment factors which might overcome the advantages deriving from the use of OSS in a corporate environment: cost of transition, personnel training and, interoperability and integration with existing technologies. These factors are often used by OSS opponents. In this paper we first report of a small-scale deployment of OSS for office automation in Public Administration bodies. We describe the environment, the process and the problems encountered. Next, we describe a proposal for a future experiment for empirically assessing OSS impediment factors, focusing in particular on personnel productivity. We again propose the deployment of OSS office automation tools in Public Administration bodies and we describe a system for monitoring the effect of the use of OSS on personnel productivity.*

## 1. Introduction

Open Source Software (OSS) has grown a lot in popularity. Linux and the Apache web server are found in respectively 30% and 66% of the Internet's public servers, according to Netcraft's survey [1]. We thus have some empirical evidence that OSS can work well, at least for the server side of a client-server architecture.

By assuming the fact above, supporters claim that OSS leads to a reduction in IT expenditure because:

- OSS is free, one does not have to pay any license;
- source code is available, so it is possible to tune the software for specific needs by removing unnecessary, resource-consuming features. This translates in the possibility of using less powerful, thus less expensive, hardware.

The first reason is indeed true, while for the second reason we do not have any empirical study comparing OSS and proprietary solutions: proponents usually report common knowledge experience. Furthermore, such

knowledge and experience are confined to very specific applications such as server architectures or software development. For example, in 2001 Amazon.com adopted Linux for most of its servers and reduced by 24% (\$17 million) the IT expenditure, as reported by the IDG Group [2],[3]. In August 2002, Verizon Communications, one the biggest telecommunication operator in the USA, replaced the Unix and Windows workstations of its internal developers with systems based on Linux and OpenOffice. The average desktop cost dropped from \$20,000 to \$3,000 per developer and in the end the company saved \$6 million [4].

It seems to be that the common feature of these success cases is that OSS has been able to penetrate the market only for applications which require more reliability and efficiency than user-friendliness and usability.

Therefore, it might be that OSS is not well suited for desktop and client applications, for which we know that Microsoft Office is the *de-facto* standard. If we think of a hypothetical deployment of OSS for desktop applications in a corporate environment, such as Public Administrations (PA), there are factors which might overcome the claimed advantages of OSS:

- cost of transition from previous solutions;
- interoperability and integration with existing solutions;
- cost of training personnel for the new tools and hostility to change;
- reduced productivity of the personnel.

The recent FLOSS project [5] funded by the European Union aimed at collecting data about the usage and development of OSS in Europe. Surveys were conducted between February and May 2002 on about 1,500 companies and public institutions, asking whether they were employing, or willing to employ, Open Source software. Four hundred of these were indeed using, or planning to do so in the near future, some kind of OSS.

There are two points of the FLOSS study [5] which are of interest for us:

- OSS for desktop applications (*e.g.* client operating systems, office automation, *etc.*) was employed only by the 20% of those four hundred establishments using OSS. If we further restrict

to the use of OpenOffice that percentage drops to 10%. This confirms common wisdom that OSS is better suited for server and IT infrastructure tasks;

- it turned out that companies and public institutions were generally unable to quantify the benefits deriving from the use of OSS. They were also not even able to quantify benefits like license fees savings and hardware cost savings.

It is therefore important to empirically analyze and assess the benefits and the problems deriving from the use of OSS, in order to provide companies and public institutions with more significant data for their strategic decisions.

In particular, we focus on the OpenOffice suite: a set of key desktop applications which includes a word processor, a spreadsheet, a presentation manager, a drawing program, and an equation editor [6].

In this paper we first report of a small-scale deployment of the OpenOffice suite in several PA bodies. We describe the environment, the process and the problems encountered during the transition.

Next, building on that experience, we propose a future experiment for empirically evaluating the benefits and problems caused by the introduction of OpenOffice. The project aims at showing that OpenOffice allows personnel to produce as efficiently as Microsoft Office.

## 2. Small-scale deployment

The Consortium of the Townships of the Province of Bolzano-Bozen (Italy), in collaboration with the Centre for Applied Software Engineering of the Free University of Bolzano-Bozen, has performed a trial installation of OpenOffice in ten associate townships.

### 2.1 Environment

The trial installation of OpenOffice involved ten townships of the Alto-Adige region in Italy. Townships ranged from very small (five employees) to small-medium size (twenty employees). The activities performed are the usual office tasks: word processing, spreadsheet, *etc.* Microsoft Office was the only office automation tool used.

In the end, OpenOffice was installed on about one hundred desktop computers. The operating system was Microsoft Windows in all the cases.

### 2.2 Process

Transitions lasted from two to four working days and employed two instructors each. Personnel training was performed on-site and one-to-one.

Instructors would first go to the site for “exploring” the environment and for collecting the most used documents by offices’ personnel. The instructors would then return the day after with all the documents converted to OpenOffice’s format. They would then install OpenOffice and train the personnel by working on the very same documents they were usually working on.

The conversion of more than two hundred documents from Microsoft Word to OpenOffice was performed without any particular problem and with great efficiency: the size of an OpenOffice document was generally one third of the equivalent Word document.

### 2.3 Problems

Personnel do not generally look positively at the introduction of new or different technologies and at the abandon of those which is used to: a phenomenon called “hostility to change”. The most reported reason is the refuse to use tools different from those of colleagues or from those used at home. However, during the transition to OpenOffice we found only a few employees showing hostility to change.

We instead found an inefficient use of resources: the personnel routinely used only the very basic features of Office, and did not consider little more complicate features which would have lead to better use of resources.

Users with good knowledge of Office did not have any problem in switching to OpenOffice. Most of the problems were caused by personnel with little Office knowledge.

Personnel training was usually performed on-site and one-to-one, but it turned out that instructors had to frequently interrupt training because of incoming phone calls, urgent documents delivering, *etc.*

### 2.4 Conclusions

The trial installation was quite successful, as all the ten townships are now exclusively using OpenOffice.

## 3. Future experiment

We now describe a proposal for a future experiment for studying, analyzing and evaluating the introduction of OpenOffice for all office automation tasks in the PA, while preserving existing proprietary solutions for desktop operating systems (*e.g.* Microsoft Windows). In particular, we aim at showing that the use of OpenOffice does not significantly affect personnel productivity.

The experiment also aims at becoming a success case for the introduction of OpenOffice, and of OS desktop software in general, in companies and Public Administrations.

The experiment will be jointly conducted by Consortium of the Townships of the Province of Bolzano-Bozen, the Centre for Applied Software Engineering of the Free University of Bolzano-Bozen and a few local IT firms.

The proposal is now being evaluated for funding by the Province of Bolzano-Bozen.

### 3.1 Environment

For this experiment we will identify at most forty PAs interested in OS software. In particular, we will strive to involve PAs bodies of different size, so to have a more representative sample of the PA reality.

### 3.2 Analysis of the Problems

Again, the fact that Microsoft Office is by far the most used office automation tool raises the problem of training the personnel for OpenOffice. To this end, we will organize part-time courses on OpenOffice. The courses will be held off-site, to avoid the disturbing factors experienced in the trial installation. In these courses, offices' personnel will be taught the basic and most used OpenOffice features, with the possibility of suggesting some particular topic of interest.

Another problem which might occur is the hostility to change. In this case, in order to maintain the efficacy of the training action, we might think of motivating the personnel by a series of "bonuses for change". Another solution is to train homogenous groups of people, that is, personnel coming from the same of closely related offices.

The choice of introducing OpenOffice while maintaining the same client operating systems is motivated by the need to minimize the training load for the personnel. That choice allows also a smooth transition, minimum interruption of public services and limits any possible hostility to change.

We will also establish: a hotline, a data base of success cases, a FAQ and a knowledge base. These services are aimed at PA personnel already trained and will offer user and technical support on various OS software of interest for the PA.

### 3.3 Evaluation

To evaluate the effectiveness of the training and of the transition, PA personnel will complete a questionnaire right after the end of the training period. Another questionnaire will be handed out to PA personnel, about one month after the transition. Such a questionnaire aims at collecting more significant data on the daily use of OpenOffice and at investigating the general impact of changing (personnel satisfaction, problems, *etc.*).

A more systematic evaluation of the effectiveness of OS solutions will be performed by comparing twenty PAs employing OpenOffice, with twenty PAs employing Microsoft Office. The enabling technology for this evaluation is the PROM technology devised at the Free University of Bolzano-Bozen. PROM is a software engineering tool originally developed for collecting process and product metrics in software development [8],[7]. For example, it is possible to record the time lapsed in working on a Java source file, or the number of modifications applied.

By the use of appropriate plug-in's we interfaced the PROM tool with Microsoft Office and OpenOffice, so that it is possible to collect process metrics for any kind of OpenOffice or Office document.

From the collected data it is then possible to do a statistical analysis with the aim to investigate the impact of OpenOffice on personal productivity. We note that the data collection is completely automatic and transparent for the user. These data will of course integrate those collected from the questionnaires above, in order to have a dataset as much complete and significant as possible.

## 4. Conclusions

In the past years OSS has proved to be a very reliable solution for many server applications. However, the claims about the benefits and advantages deriving from the use of OSS are seldom supported by empirical evidence or studies.

We considered the use of OSS for office automation tasks, for which no significant success case is known. We described a trial installation of the OpenOffice suite and reported the problems encountered.

The good results of the trial installation motivated the definition of a bigger and more formal experiment aimed at studying, analyzing, and evaluating the introduction of OpenOffice in public institutions.

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