

**Consortium for studying, evaluating, and supporting the
introduction of Open Source software and Open Data Standards
in the Public Administration**

Project acronym: COSPA



Work Package 6

**Run pilot introductions of tools and data standards in
the partner PAs and evaluation of costs/benefits
of the transition, feeding it back to the work package in
such area.**

Deliverable 6.1

**Report evaluating the costs/benefits of a transition
towards ODS/OS for each key task related to personal
productivity used in the PAs under study.**

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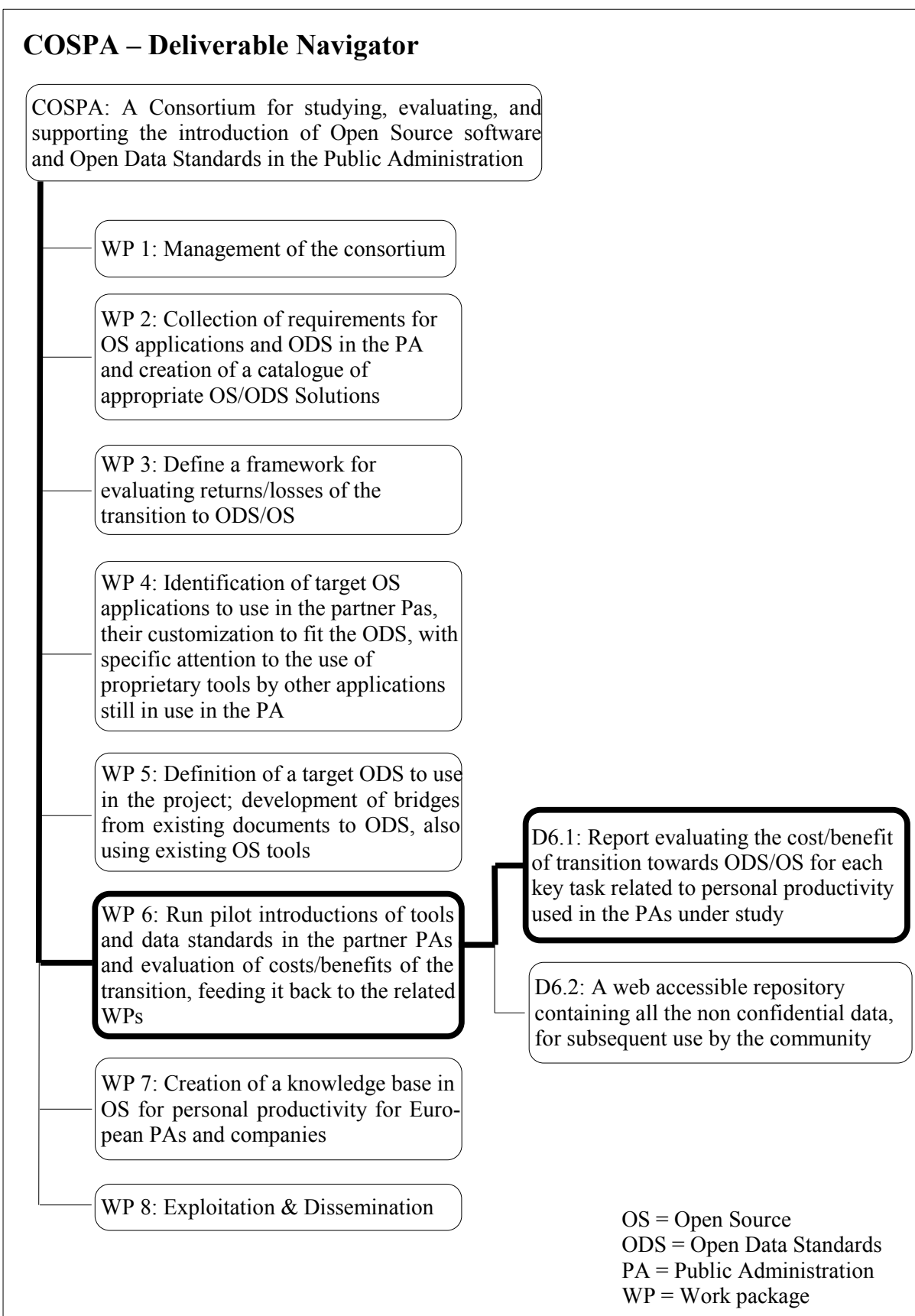
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Deliverables Navigator



Executive Summary

In Workpackage 3, Deliverable 3.1, we introduced two frameworks to study OSS adoption in PAs. These were derived from a comprehensive review of the relevant literature on IT assimilation theory and total cost of ownership. Here we report their application to our PA partners, including Beaumont Hospital (Ireland), SGV (Italy), Extremadura (Spain), Skopje (Macedonia), Pisa (Italy) and Törökbálint (Hungary). First, we apply the framework on assimilation theory – Section One, identifying the most relevant factors. Then, in Section Two, with a large-scale remote survey, we investigate the assimilation factors differentiating them into facilitators and inhibitors to OSS adoption. Finally (Section Three), knowing the context, we present a study on the migration costs and the cost of ownership.

Given that our findings are based on a detailed set of qualitative in-depth case studies, which are then complemented by a large-scale survey on IT assimilation and a data analysis on actual costs of migration, they form a useful basis for management and policy-makers in European PAs and government agencies and institutions interested in this area. The findings, grounded as they are in real practical cases in Europe, ensure that not all PAs are condemned to ‘make the same mistakes’ in relation to OSS adoption; rather they can learn from the lessons of other similar PAs.

Furthermore, the model of costs we present here clearly separates the volatile costs of the migration and the costs of ownership of a software product, as the two types of cost respond to different questions separate in time: “*Do we have the resources to introduce OSS software?*” and “*Can we afford the ownership of OSS solutions?*” Costs of a migration might be considerable and may lock the PA in or there might be a substantial part of intangible costs that may reduce the benefits of the zero license costs in the long term.

Introduction

Open Source Software (OSS) has emerged as a very credible alternative to proprietary software. Various factors such as affordability and potentially improved software security have caused further interest among European PAs. Savings on licenses and access to the source code have also attracted PAs in light of the recommendations of the eEurope 2005 Action Plan for eGovernment.

The COSPA project has investigated a wide range of information sources and conducted quite detailed experimentation with its partner PAs so as to better understand the viability of OSS in practice.

By defining models to retrieve and prioritize software requirements (D2.4/2.5 and D2.8/2.9), and subsequently deriving a framework of factors relevant to the adoption of OSS and detailed measurement of costs (D3.1), COSPA has created a method to discuss the issue.

In this deliverable (D6.1), we present findings derived from the application of this method to the adoption of OSS and the costs of migration to OSS. Findings reveal that OSS represents a valid alternative to proprietary software, provided that certain relevant aspects of the migration context are taken into consideration. In particular, the following factors have been found to serve as facilitators of OSS migration:

- Drastic cuts in the IT budget
- Political decision to follow the European legislation on software licenses
- Strong governmental directives promoting innovation

The migration involves various factors, sociological, financial and strategic that determine its success. On the basis of its findings, COSPA has formulated the following recommendations.

Recommendation 1. (achieving a general level of OSS deployment) To achieve a general deployment of OSS, COSPA recommends that PAs focus on the specific facilitators and inhibitors to OSS assimilation we have identified, prior to migration. Specifically, COSPA suggests recognising that technological benefits of OSS outweigh its disadvantages - e.g. ability to tailor to precise needs, transparency - as these are important facilitators in the assimilation of OSS. In contrast, it is important to overcome the perception that employees might feel their work is under-valued if using 'cheap' OSS products, and also the perception that changing operating models to OSS might be problematic - e.g. no contracted maintenance support.

Recommendation 2. (savings on costs) To base the decision to migrate to OSS to save on licenses costs alone is unrealistic as they are only initial costs, all too easily influenced by inflation and market fluctuations over time. COSPA recommends the decision to be based on two related evaluations: costs of migration and costs of ownership. The former involves high investment for a shorter period, while the latter foresees expenditure for maintenance over a period of at least five years. In the migration, COSPA findings report that a substantial factor are the intangible costs such as costs for peer training. COSPA also reports that there are no extra costs due to lack of productivity arising from the use of the OSS solution. Although training costs are a substantial part of the migration costs their benefits can be realised over the long term in terms of costs of ownership. People are more conscious of the software they work with when they have been trained on open source code. This gives more power to them

in negotiating fees for consultancy and maintenance.

Recommendation 3. (barriers in migration to OSS). As any new radical IT innovation, a transition to OSS involves the discussion on barriers to migration. COSPA analysis has reported that barriers may arise in several areas: a lack of knowledge/experience in relation to what OSS products are appropriate and how they might be deployed. COSPA recommends a policy of both ad hoc and periodic training to help achieve the benefit of a transition to OSS. In the COSPA findings, some of the technical reasons that determined the success of a migration were exchange of documents in an open shared format (ODS), utilization of old hardware in high schools, being independent of software vendors even when creating a distribution or an application for local needs. COSPA recommends considering this factor before deciding to migrate, as the migration costs might not be really affordable and other reasons may need to be taken into consideration.

Synoptic Overview of the Findings

The present analysis on the transition toward Open Source software in European Public Administrations (PAs) is based on a set of in-depth case studies. Our work compares various PAs in terms of assimilation models and migration costs: assimilation factors are collected in each PA and compared with the expectations in literature, whereas costs are collected and analysed for their intangible/tangible nature.

Studies in literature suggest the existence of a gap between the acquisition and the assimilation of a software product. In our analysis, we first evaluate the level of assimilation of a software product (Table 1 and Table 8), then we collect factors inducing the assimilation and validate them against existing models (Table 2 and the respective tables in each case study section).

In Table 1 we summarize the level of assimilation of the OSS. The values refer to the average level of assimilation on the OSS acquired. According to our current data, our PAs have achieved the desired level of assimilation, although not all achieved the highest. Further details about concrete software adopted and dates of achieving the level of assimilation can be found in Table 8 and in each case study section.

BH	SGV	Extremadura	SK	PP	TO
General Deployment	Mostly General Deployment	General Deployment	Mostly General Deployment	Various levels of deployment	Limited Deployment

Table 1: General Level of Assimilation in the PAs. See Table 8 for more details.

Table 1 shows that almost all analysed PAs have a general level of deployment of the OSS acquired. A case apart is the city of Törökbálint where the deployment is limited, since it has been done only within the resources available for the COSPA project. Due to the short time frame of the COSPA project, a general deployment was hardly achievable. Table 1 tells us the level of significance of our analysis: conclusions made in PAs with general deployment are in general more significant than those in PAs with limited deployment.

Table 2 shows a comparison - for each PA and each influence factor in assimilation theory - between the data collected and the expectations in literature.

Factor	BH	SGV	Extremadura	SK	PP	TO
Organization age	☒	☒	✓	☒	☒	✓
Organization size	✓	Partially	Partially	Partially	Partially	Partially
Industry type *	✓	✓	✓	✓	✓	✓
Strategic investment rationale	✓	✓	✓	Partially	✓	Partially
Increasing returns to adoption	✓	✓	✓	✓	✓	✓
Knowledge barriers - extent of experience	✓	✓	✓	✓	✓	Partially
Top management championship	✓	✓	✓	Partially	Partially	✓
Extent of coordination	✓	✓	✓	✓	✓	✓
Sophistication of IT infrastructure	☒	☒	-	☒	☒	Partially

Table 2: Comparison of the Influencing Factors with the Assimilation Results in the PAs

✓ - confirms theory, ☒ - does not confirm theory, "Partially" - theory is not completely confirmed,

* The Industry type applies weakly for our case studies, as all subjects of study are Public Administrations

See comments below and each case study section for more details.

The sophistication of IT infrastructure is the factor that least supports the literature predictions. In fact our findings show that in the PAs the simplicity of the IT infrastructure is not related to the level of knowledge about new IT possibilities and does not hamper their assimilation.

In the case of Extremadura, the value for "sophistication of the infrastructure" is not reported as there was no infrastructure before the introduction of OSS.

Organization age factor seems not to really influence the migration in the PAs, as in all the PAs the assimilation of OSS was undertaken eagerly. BH, SGV, SK and PP are all old PAs that embarked on OSS assimilation and thus the expectation that older organizations will be less likely to implement innovative initiatives appeared not to be true.

In almost all the PAs the organization size factor is supported only partially. According to the literature the organization size influences the adoption of new IT technologies in two ways: 1) the size directly influences the savings, i.e. larger organizations may be better able to leverage the advantages of the new technology and 2) the size influences on the availability of skilled personnel, i.e. in larger organizations is easier to find properly trained employees. While the first is true for large-size PAs (BH, Extremadura, SGV), it is not true for the small ones (SK, TO and PP). On the contrary, the second implication is true for the small PAs and not true for the large ones. For the large PAs we found a major gain in per-seat license savings as predicted in the literature, but a lack of personnel ready to use OSS without additional training, both for IT staff and regular employees. BH represents an exception to this as there were people with necessary experience with specific OSS. For the small PAs the cost-savings from licenses proved to be significant and important in the migration. Meanwhile, as for the large PAs, it was hard to find trained personnel for OSS.

TO and SK are the PAs that least follow the results in literature. The reasons for that might be found in their decision to join the COSPA project. TO joined the project to innovate their infrastructure. On the other hand SK aimed at being in compliance with EU requirements. The lack of budget resources in SK was the main reason not to consider any further direct investment in the migration to OSS, besides COSPA funds.

Furthermore, we have performed a study on the facilitators and inhibitors to OSS adoption. The study was based on an online survey in which 350 organizations from different industry sectors participated (more detail is available in Glynn et al, 2005). Most of the investigated facilitators (six out of nine) and almost all the inhibitors (seven out of eight) were found to be correlated to OSS assimilation at 0.01 level of significance. The correlation coefficients of

the inhibitors were actually higher than those of facilitators and were, in fact, quite significant. This means that inhibitors are influencing the assimilation more.

Comparing the results of this survey with the ones from the COSPA case studies we have found that not all conclusions coincide. For example the participants in the survey identified as the critical enabling factor for OSS adoption the access to source code (with highest correlation of all facilitators). On the other hand, for the COSPA PAs the access to the source code was not crucial for the choice of software to adopt. In fact, half of the PAs (BH, SK, TO) stated they were not interested in accessing the source code, as they had no plans for changing it. Rather, other criteria were important for the choice, like no cost, the possibility to use the software on old computers, etc. PP and SGV had utilized the possibility to access or modify the source of the chosen programs. Nevertheless, they had also stated other factors as more important, like reliability, security and easy configuration.

As mentioned before in COSPA case studies the organization size factor did not fully support the literature predictions. In the survey the variable '*OSS adoption is easier due to large organisational size*' was in fact found to be negatively correlated with OSS assimilation (although not significantly so).

The analysis of the survey also revealed a need for further investigation. For instance, the organizations interviewed reported of a lack of successful exemplars of OSS adoption in the industry sector needed to support any strategy of OSS transition. With this deliverable COSPA aims at shedding some light on the issue supplying new grounded evidence.

To further contribute to such need of knowledge, COSPA has also performed a cost analysis on the transition toward OSS. This analysis aims at responding to two major questions concerning respectively the feasibility of a transition to OSS and affordability of its ownership. COSPA highlights costs that are intangible (hidden), that is that are hard to budgeted and foreseen. Namely, costs like search for software alternatives or documentation are often neglected but might have a considerable impact on the migration and the maintenance of an OSS. The following table (Table 3) shows the relative shares of intangible and tangible migration costs in COSPA case studies.

PA	Software		Support		Training/Learning		Staffing		Total (€K)	
	Tang.	Intang.	Tang.	Intang.	Tang.	Intang.	Tang.	Intang.	Tang.	Intang.
SGV	82%	18%	40%	60%	92%	8%	-	100%	51%	49%
Extremadura	-	-	26%	74%	100%	-	100%	-	48%	52%
PP	96%	4%	77%	23%	-	100%	-	100%	60%	40%
SK	100%	-	28%	72%	27%	73%	-	100%	27%	73%
TO	-	100%	62%	38%	57%	43%	-	100%	49%	51%

Table 3: Tangible vs. Intangible Costs of Migration in the PAs

As Beaumont Hospital migrated before the beginning of the COSPA project, costs of migration were not completely significant. For this reason they have not been considered in the analysis.

Intangible costs displayed in Table 3 represent a substantial share of the overall migration costs. Generally speaking, Table 3 reports that half of the share is allocated to intangible costs. SK is the most visible exception to this as the share is much bigger, 73%. This might be due to their limited budget and their consequent strategy to avoid tangible costs such as licenses or hardware and software purchase.

Depending on the PA's strategy for the migration, the hidden costs appear in different cost categories, as introduced in the deliverable D3.1. Findings report that in most of the cases the

training cost was one of the biggest expenses in the migration. This might be caused by a lack of skilled personnel on OSS and a consequent need of training during the migration. Not all the PAs has reacted the same at this need of training: some planned the migration with a strong and organized guided training – as in the case of SGV – others preferred a loose and less expensive approach, delegating it to self training – ignoring the impact on the intangible costs.

The analysis that COSPA has performed on ownership costs aims at identifying losses and savings of the new software configuration when this may be considered fully operational. A complete analysis needs of a period of five years of monitoring. As we already said in deliverable D3.1, this has not been physically feasible within the COSPA project. Therefore our findings are based on prediction on the initial first year of ownership and historical data. The majority of these costs concerns initial costs of acquisition. As we already mentioned, initial expenses are not a good comparison meter as they are biased by variables related to time.

Table 4 shows the outcomes from the comparison between the costs of ownership of the OSS and closed source solutions in the six PAs we observed.

PA	Savings from the OSS Migration	
	Initial Savings	Annual Savings over 5 years
SGV	✓	☒
Extremadura	✓	✓
PP	✓	☒
SK	✓	=
TO	✓	✓
BH (phase 1)	✓	✓

Table 4: OSS Savings Compared to Closed Solution in the PAs. More details in Table 29.

✓ - savings are encountered, ☒ - Costs of OSS exceed the cost of proprietary solution, = - costs for the two solutions are estimated to be equal

All PAs report significant initial savings, basically due to the zero cost of licenses. In the long term, however, the profit is not that obvious. In some cases (BH, Extremadura) there is a predicted relatively large gain of the OSS during maintenance. The special case of SK relates to the usual situation of limited budget. In this case predictions are very difficult as they migrated to OSS only within the last period of the COSPA project (when they joined the project). In the cases of SGV and PP, though, the expectations are for an increase in costs within the five years. In both cases such costs are imputable to software on servers whose maintenance they expect to be more complex and costly for OSS. On the other hand, the maintenance of the client-side OSS (OpenOffice.org) is estimated to be equal or cheaper than the proprietary solution.

As we have noticed in our analysis on OSS adoption, the employees' attitude to the new solution might be a strong inhibitor for the success of the OSS assimilation. With the PROM tool (described in Section Three) we have analysed the users acceptance of OpenOffice.org in their everyday work. We have also performed a comparison with the use of the Microsoft office suite (MSO). In Table 5 we show the percentages of the employees that worked with the two programs.

PA	Users		
	Pure OpenOffice.org*	Switchers*	Pure MS Office*
BH	82%	9%	9%
SGV	5%	57%	38%
SK	2%	42%	56%
PP	7%	92%	1%
TO	19%	57%	24%

Table 5: Use of OpenOffice.org and MS Office

* Pure OpenOffice.org users are those who used only OOo during the analysed period; Pure MS Office users are those that never used OOo during the analysed period; Switchers are those users that utilized both applications within the analysed period. More details on the patterns of use are available in each PA section.

Table 5 shows a limited usage of MSO at BH and this just for exchanging documents with external organizations. In rest of the COSPA PAs, the majority of the users were switching between the two applications on a daily basis, which is an indicator of no adverse attitude toward the use of OSS. An exception to this is again the city of Skopje (SK): IT staff have reported that the majority of the employees has experienced interoperability problems between OOo (version 1.1.4) and old hardware.

One of the major concerns about the adoption of OSS is whether it can have similar functionalities and easy to use as the corresponding proprietary product, so as to guarantee similar work conditions and personal productivity. In this sense, we have used the workload and the work speed as a comparative measure of cost of software usage. We have monitored the use of OOo and MSO with PROM in five of our PAs. The results show a similar pattern of use with the two applications in term of daily documents worked and average time spent on them. For this reason, we can easily conclude that there is no evidence that using OpenOffice.org may cause additional costs to the PAs.

Section One: In-Depth Case Studies of OSS Adoption

As mentioned in Deliverable 3.1, a number of researchers have drawn upon assimilation theory to investigate the adoption and assimilation of technology. There we drew a distinction between the adoption events of *acquisition* and actual *deployment* of a technology. There is often a long delay between these events, which they termed the ‘assimilation gap’. We believe that OSS as a phenomenon is especially prone to an assimilation gap: the huge amount of mass media coverage on the topic ensures that there is much interest in OSS. Allied to this is the fact that acquisition of OSS products is extremely straightforward, often as simple as a zero-cost download from a web site. Thus, the potential for an organization to acquire OSS in the first place is greatly facilitated. However, given that there is no tried and tested roadmap indicating a clear series of steps to guarantee successful deployment of OSS, the gap between the acquisition and actual deployment events could be expected to be quite significant.

The framework that we derived in Deliverable 3.1 to investigate the assimilation of OSS contained the set of basic constructs presented in Table 6. Briefly summarising, the factors in the left-hand column are those that have been identified as significant variables in previous research on ICT assimilation. A brief explanation of each factor is provided in the right-most column.

Factor	Effects Predicted in Previous Research
Organization age & size	Older organizations are expected to be risk averse and less likely to undertake radical IT implementation initiatives such as OSS. Also, larger organizations may be better able to leverage the advantages of new technology, and have access to appropriately skilled personnel.
Industry type (i.e. Public Administration for COSPA)¹	Certain industry types may be more capable of leveraging the benefits of technology as it may suit their particular value chain configuration.
Strategic investment rationale	Strategic value propositions may justify resource commitments to adopt potentially beneficial technologies.
Increasing returns to adoption	Economies of scale and network externality effects may arise through the increasing contribution of additional adopters
Knowledge barriers - extent of experience	Assimilation of new technology can be impeded by lack of relevant knowledge or experience
Top management championship	New technology assimilation may require radical and high-risk initiatives that require proactive top management championship.
Extent of coordination	Coordination of knowledge across functional units of the organization can promote risk sharing & educate as to benefits of new technology.
Sophistication of IT infrastructure	Organizations with sophisticated IT infrastructure are more likely to have higher levels of knowledge about new IT possibilities, and thus embark on innovative IT assimilation.

Table 6: A Framework of Basic Constructs to Investigate OSS Assimilation

Given that technology acquisition and deployment represent different assimilation events, the degree of assimilation can be viewed as a staged process from awareness/interest through to general deployment. In Deliverable 3.1, we proposed the model in Table 2 to assess the degree of OSS assimilation as a series of stages.

¹ In previous research on ICT adoption, this has been found to be important, but in the context of COSPA this is confined to the Public Administration sector.

Level	Criteria
Awareness/Interest	Key decision makers in organization are aware of OSS and actively committed to learning more about OSS
Evaluation/Trial	Organization has acquired specific OSS products and has initiated evaluation or trial
Limited Deployment	Organization has established a program of regular but limited use of the OSS product
General Deployment	Organization is using OSS product for at least one large and mission critical system

Table 7: *Degree of OSS Assimilation*

1 Assimilation Findings

The case studies we performed are based on questionnaires and interviews. In this section we show an overview of our findings considering the assimilation of OSS. The following table represents the assimilation levels achieved in the PAs. It gives at a glance an overview of the adopted products in the PAs.

Product Type	BH	SGV	Extremadura	SK	PP	TO
Operating System	<i>Linux</i> General Deployment	<i>Linux</i> General Deployment	<i>LinEx</i> General Deployment	<i>Linux Server</i> General Deployment	<i>Fedora</i> Desktop: Awareness/Interest Server: General Deployment	<i>UHU Linux</i> Limited Deployment
Email	<i>Postfix</i> General Deployment	-	-	-	<i>Thunderbird</i> General Deployment	
Office Automation	<i>Star Office</i> General Deployment	<i>OpenOffice.org</i> General Deployment	-	<i>OpenOffice.org</i> Evaluation/Trial	<i>OpenOffice.org</i> Limited Deployment	<i>OpenOffice.org</i> Limited Deployment
Content Management	<i>Zope</i> General Deployment	-	-	-	-	-
Application Server	<i>JBoss & Tomcat</i> General Deployment	-	-	<i>MySQL & Web Server on Linux</i> General Deployment	-	-
Groupware	-	<i>Group-E</i> Limited Deployment	-	-	-	-

Table 8: *Assimilation Level Achieved in the PAs by Software Type*

Each PA adopted different strategy for the OSS migration. Although all case studies are important, the first three are the most interesting ones. BH has started to adopt OSS before the beginning of COSPA project. Nevertheless, during COSPA it continued with a wide migration of many software products and gathered in-depth experience with OSS. On the other hand, SGV migration was totally within COSPA framework and the assimilation of operating system and office automation tools reached the level of General Deployment. The case of the Fundecyt in Extremadura (Spain) is extremely interesting, as it the first case of successfully migrating to OSS of the high schools and public offices of an entire region. In fact, for facilitating the migration special OSS – LinEx – was developed.

In BH the migration had started before the start of COSPA project and the choice of software was not influenced by COSPA. This explains the difference in the office automation tool used, namely Star Office instead of OpenOffice.org. The OSS adoption was massive and affected both servers and desktop computers, thus there was a large number of OSS products adopted and 'General deployment' was reached for all products in the first phase (see section

2.1 for details). Currently the second phase of OSS migration, during which adoption of the hospital information system and the finance systems was expected, is stalled in evaluation/trial level.

Although the migration in BH was successful it is expected that in the near future BH will partially migrate back to Microsoft products. The reason for such migration is that currently in Ireland Microsoft offers not only a good price for its products for the public institutions, but also intensive support with no extra charges. The IT department in Beaumont calculated that such a contract is more advantageous and less troublesome than the OSS solution.

Generally the migration in BH supports the literature with two exceptions. The organization age factor did not operate as predicted. Though Beaumont Hospital is an amalgamation of older institutions it has embarked on OSS implementation. Also, the sophistication of the infrastructure factor does not support prediction in prior research. The heterogeneity and ad-hoc nature of Beaumont's IT infrastructure is due to the fact that products were bought as finance became available in different departments facilitated OSS deployment as no master plan for IT infrastructure existed. Furthermore, the Government plans to establish a common IT infrastructure across all Irish hospitals, based on proprietary software, and tying funding to compliance with that proprietary infrastructure, is a significant impediment to OSS deployment.

On the other hand in Extremadura the migration process started from scratch, i.e. there was generally no proprietary software installed before the introduction of OSS. The migration was massive also in this case and a specific version of Linux (LinEx) was developed. In fact, this case of a mass introduction of Open Source software in the schools within a whole region is unique in the whole world. It was driven by a strong local government decision and support. Most of the influencing factors acted as predicted in the literature, besides the organization size. Though many people were involved in the OSS adoption there were almost no employees properly trained to use the new solution. Intensive training had to be provided to all employees using a combination of courses, seminars and external consultancy.

In SGV the migration was also influenced by strong strategic decisions. It was large-scale and generally supported the predictions. The few exceptions are the organization age and size, together with the sophistication of the IT infrastructure factors. The simplicity and the centralization of the IT infrastructure actually facilitated the OSS adoption. Also in this case, though the PA is of a large size there were no people properly trained to use the proposed OSS software.

For some of the PAs the assimilation of OSS was done as a pilot-project – PP, TO, SK. A group of people in these PAs tried the chosen products in their everyday activities with the goal to test the possibilities for massive migration. The pilot projects were mainly directed into testing OpenOffice.org, however, in most cases it involved also migrating other products, like the operating system on the server side.

Even when the OSS was introduced in a pilot project, the cases differed one from another. While in SK and TO the pilot project did not bring any development of new OSS, in PP investments were done in implementing few software products, like DocTranformer and Callendar. DocTranformer was also published under the Open Source license. This difference in the investment policies can be explained by the strategic reasons that pushed the PAs into OSS adoption. For SK the main priority of the PA was to test the possibility of acquiring cost-free licenses for the software products needed for the proper functioning of its departments. Investments in the form of loss of productivity or internal training were

acceptable, however any explicit financial investments were unwelcome, because of the lack of budget to cover them. On the other hand the main motivation for Pisa for deciding to migrate to OSS was a political decision, to adopt Open Standards for moving away from monopolistic attitudes from several suppliers. Investments were done for support by external experts, for integration, for training the employees and for in-house development, as the OSS technology was viewed as potentially beneficial.

An interesting finding is that the top management championship was only partially an influencing factor for some of the PAs, namely for SK and PP. In Pisa the OSS adoption was supported and important at the beginning of the experimentations, which influenced the migration very positively. However, after a change in the management members, the support is not strong anymore but this does not influence the migration much. On the other hand, for SK, the management provided strategic support to the OSS experimentations as they approved on paper the participation of about 80% of the employees. However, the approval was not a leading factor for the employees' active involvement. The users' awareness of the positive consequences of the migration for the PA and the citizens played a much bigger role. The enthusiasm of the IT staff members seems also to be of great importance.

2 Beaumont Hospital (BH), Ireland

2.1 Application of the Framework in BH

Beaumont embarked on a two-phase approach to OSS adoption. Table 9 summarises the level of assimilation of these OSS products, indicating the date of initial acquisition, the extent of assimilation (using the assimilation scale from Table 7 above), and the date when this level of assimilation has been achieved. The concern in this paper was not primarily to establish the size of the assimilation gap; rather, we were more concerned with establishing its presence and explaining the underlying reasons. Furthermore, rather than just having one estimation of the assimilation gap for an entire technology, we are able to establish differential rates of assimilation for different OSS products. Overall, it appears that less visible horizontal infrastructure OSS products are less prone to an assimilation gap, achieving higher levels of assimilation and deployment. By contrast, the more visible IS infrastructure is associated with a lower degree of assimilation. This is also in keeping with knowledge barriers given the relative inexperience of such deployment, and the consequent higher perceptions of risk in deploying novel technology for these systems. These issues are discussed below.

OSS Product	Date of Acquisition	Current Level of Assimilation	Date of Current Level Achieved (# months)
<i>Phase 1</i>			
Operating System (Linux)	05-2001	General Deployment	08-2003 (27)
Email (Postfix)	01-2002	General Deployment	01-2004 (24)
Desktop Systems (Star Office)	03-2002	General Deployment	08-2003 (17)
Content Management (Zope)	02-2003	General Deployment	07-2004 (17)
Application Server (JBoss & Tomcat)	09-2002	General Deployment	04-2003 (7)
<i>Phase 2</i>			
Hospital Information System (Vista)	06/2003	Evaluation/Trial	06-2004 (12)
Financial Systems (Compiere)	10-2003	Evaluation/Trial	04-2004 (6)

Table 9: Assimilation of OSS within BH

2.1.1 Organization Age, Size, Industry Type

Beaumont Hospital began as a merger of two of the oldest hospitals in Ireland, employing around 3,000 staff directly. Thus, it is an example of an old organization, and given the significant level of OSS deployment in Beaumont, the assumption that older organizations are less likely to engage in technological innovation, such as that represented by OSS, is not borne out in this case.

Given that it employs around 3,000 staff, Beaumont would be considered quite a large organization by Irish standards. According to COSPA classification (D3.1) BH is a VPA-T3 type. Beaumont operates in a public sector environment which is quite risk averse in relation to IT. Many public sector organizations have begun to consider OSS as an option, mostly through a desire to cut costs, but also in some cases due to an ideology that software acquired by public funds should be publicly available as per the Open Source model. Nevertheless, sister hospitals and the majority of other public sector organizations in Ireland have not so far chosen to adopt OSS. At present other agencies are adopting a cautious “wait and see” policy. Several public organisations have approached Beaumont for guidance on aspects of OSS solutions that they were considering.

2.1.2 Strategic Investment Rationale

Similar to many other organizations worldwide, Beaumont's IT budget had undergone a significant contraction since 2000 in the wake of the increased budget in the lead up to the Y2K. Overall, in 2003, Beaumont faced a €17 million budgetary shortfall. Thus, the IT manager did not foresee much prospect of an improved budget allocation in the near future. So faced with the choice of either reducing their overall level of service to cope with these restrictions or looking for less costly alternatives, the focus was on what could be found in the open source market-place. Beaumont's IT staff undertook an extensive phase of desk research over a six-month period. The quality of the exchanges on SourceForge and Slashdot were sufficient to convince the IT manager that OSS was worth investigating further. Some direct experimentation with downloaded OSS programs was then sufficient to convince him that the risk involved was acceptable.

Free access to source code was not really a factor in Beaumont's decision to deploy OSS solutions. The IT manager admits that Open Source software in the Beaumont case amounts to "zero cost or as cheap as possible". Thus, even though they have been seeking OSS solutions, Beaumont are more guided by the zero or low cost availability rather than open source code.

2.1.2.1 Desktop Applications - StarOffice

In February 2002, Beaumont began a roll-out of Sun's StarOffice 5.2 desktop suite². This deployment was very problematic for users and the technical staff. Indeed, the latter became very disenchanted with the adoption. However, this was felt to be largely due to problems in that version of StarOffice. In September 2002, StarOffice 6.0 was deployed with some support from Sun. However this was also troublesome. The IT Manager wanted to pursue a thin client strategy based around the concept that all applications should be downloaded from the network where practical. The StarOffice package was initially loaded onto a single Linux server, but this became overwhelmed, and it was then clustered to sustain a dual server strategy. Despite this, users continued to lose network connections in an unpredictable fashion. This inevitably increased frustration and tension amongst the entire workforce who were dependent on these tools. The IT Manager conceded that:

"we stuck with the network solution too long. It was only after a series of ferocious encounters with users – and with my own staff – that I recognised that we had to shift".

So although it would conflict with a purist architectural dogma, StarOffice was reinstalled on the desktop instead for those who wanted it. While this move did not immediately ameliorate the users' perception of the problem, it did over a number of months have a marked impact on the overall level of satisfaction with the solution. This has resonances with an earlier critique of the "dominant paradigm" for assimilation research where it is generally taken for granted that IT innovation is beneficial. This was certainly not the universal perception from the outset in Beaumont.

However, when things settled, a number of benefits became evident in the OSS solution. For example, one of the unexpected benefits has been the capacity of StarOffice to exploit its in-built XML capabilities. This is a very powerful feature of the application which enables documents to be structured in such a way that processing logic is built into different sections

2 It should be noted that StarOffice is not pure open source. Some proprietary software is bundled with StarOffice, which prevents it being offered on the same terms as the pure open source, OpenOffice.org, with which it shares a common code base.

of the document, i.e. an on-line HR form request, for example, which is then automatically routed to the HR department for processing. This is a significant new feature and provides additional functionality over what was previously offered in Beaumont's proprietary desktop applications.

2.1.2.2 Content Management System - Zope

Beaumont's content management system (CMS) is based on Zope from Digital Creations. The product itself may be downloaded for free, but the deployment in Beaumont cost €20K in support from a local software company, who specialise in brokering OSS solutions. Interestingly, while OSS is sometimes characterised as a threat which will stifle the local software development industry, it is certainly the case that agile SMEs (small-to-medium-sized enterprises) anywhere in the world can leverage the innovative OSS model to create new business opportunities, as they come together to form an overall community ecosystem who can both cooperate and compete.

There have been a number of additional benefits arising through the use of Zope as a CMS in Beaumont. It provides information such as HR policies, laboratory standard operating procedures, personnel and nursing on-line forms, minutes of working-group meetings, multi-disciplinary patient care documents, etc. The Zope application server enables these documents to be managed in an automated manner by using the metatags associated with each document type, which implement rules about how information should be displayed, who is authorised to see it, who can change it, etc. This approach is supplemented by close integration with the Beaumont's LDAP directory server where details of every individual employee are held. Based on their employment category, employees are granted corresponding privileges on the CMS server. Overall, the experience has been very positive, and the use of the CMS is growing within Beaumont.

A recent development on this application was the creation of an "oncology board". This essentially is a virtual meeting-place/conference centre where individual clinicians involved in the treatment of a patient with various types of cancer (there may be up to 17 individual specialties involved) add comments and observations to a patient case. This is then reviewed in a collective conference where treatment decisions are then recorded. This data is available for subsequent reference by any member of the oncology care team and essentially forms the treatment plan for a specific patient. The solution exploits not only the presentational capabilities of Zope, but also involves elements of StarOffice.

2.1.2.3 E-Mail – Postfix

Like many large organizations, Beaumont has been using e-mail for internal and external communications, and held an 800-user license for Lotus Domino. There was a demand from the organization to expand the coverage of e-mail to cover all 3,000 staff, but the cost of achieving this was beyond the tight budget available. A search for an alternative e-mail solution was instigated and a Postfix package was eventually selected. According to the Lead Computer Operator who managed the deployment, this provides all the basic e-mail functions that users require, and more importantly, it provides email access to all staff in the organization, a feature which is greatly appreciated by the various administrative functions in Beaumont. There are currently more than 4,200 members of staff using the system. In addition the systems scope has been expanded to incorporate certificate based external access for about 350 authorised users. This is further evidence that the OSS solutions offer benefits over the proprietary systems they replace, and also illustrates the increasing returns achieved

from adoption, an issue that is discussed next.

2.1.3 Increasing Returns to Adoption

As already mentioned, the number of users which Beaumont was able to transfer to OSS represented a very significant potential cost-benefit. However, there were other quite significant benefits that ultimately accrued as a result of increased adoption of the various OSS products, although the process was by no means unproblematic, as has been discussed above.

2.1.3.1 Giving Back to the OSS Community

Von Hippel and Von Krogh (2003) discuss the problem of “free riders” for a collective action movement such as OSS. Previous research suggests that the non-exclusiveness of Open Source software should lead to resentment from contributors to those who cease to contribute on the basis that “free riders” who do not actively contribute to OSS are still able to benefit more or less equally. This is an important issue as a delicate equilibrium may prevail and OSS developers may come to resent consumers of their products who make no contributions to the code-base and provide little feedback by way of bug reports etc. However, Beaumont has subscribed fully to the Open Source ideology of openness and sharing, “practicing what we preach” as the IT Manager terms it. In terms of contributing to code development on the installed OSS solutions, the IT Manager acknowledged that the hospital was unlikely to be in a position to contribute to the Linux kernel or to other infrastructural OSS systems any time soon. Rather, he stated:

“We believe that there is space for the sharing of applications – which takes the infrastructural components for granted. In truth, we probably know very little about the internal workings of the Linux kernel, but we do understand rostering and dependency and drug prescribing, etc. So this is the area where we would contribute our expertise to the community. In turn, we hope that others will make matching contributions – thereby enriching the pool of resources available to this pressurised and cash-strapped health sector”

Beaumont has created a number of applications which it now offers on an open source basis to other healthcare agencies. A number of hospitals have already indicated their interest, and one hospital has already installed one of these systems. Two more are waiting until internal resources within Beaumont are available to support their deployment. In the context of OSS, this is a very significant development in that it has often been assumed that OSS products will not emerge in many vertical domains as they will not be perceived as an ‘itch worth scratching’ by most developers (Raymond, 1999). However, if organizations in these vertical application domains subscribe to the OSS philosophy and contribute expertise from their domain, it will serve to grow the OSS model.

2.1.3.2 Network Externality Effects

In terms of an overall hospital information system, Beaumont selected the open source Vista Hospital Information System (www.va.gov/vista_monograph/). Vista is a richly-functional integrated solution developed by the Veterans Administration of the US Department of Defence, and it supports many aspects of healthcare delivery – both in an acute hospital setting and in a community/primary care setting. The product has been under development for the past twenty years and has been thoroughly field-tested in almost 200 VA hospitals throughout the US and also in a number of locations in Europe and North Africa. It is

supported by an enthusiastic and active community of users (www.hardhats.org), who provide support to all users of the application in resolving problems that occur in various sites.

At the point when Beaumont was investigating the Vista hospital information system, a number of hospitals in Finland and Germany, who had already adopted Vista, made contact with Beaumont to offer any modifications that they had undertaken and which might prove useful to Beaumont. Indeed, users and IT staff from Finland flew to Dublin to discuss collaboration. Such networking, donating software to others, or receiving help from other globally-distributed OSS users, is a marked feature of OSS communities. However, the significant network externality advantage that such proactive cooperation provides is not one that typically arises in the proprietary software market-place.

The above illustrates the increasing returns to adoption associated with OSS. There are the direct ones evident internally in Beaumont through additional functionality being available with OSS products, greater savings on per-seat license fees, greater level of email access by employees. Also, by contributing applications from its own vertical domain in an open source fashion, Beaumont has helped to grow the OSS model overall. Likewise, the network externality effects of other OSS users offering their knowledge and work should provide increasing returns to adoption overall for Beaumont in the future.

2.1.4 Knowledge Barriers – Extent of Experience

Simply because one can download an Open Source product, does not mean it can be used effectively. As the IT manager put it:

“I downloaded Zope early last Summer and gave it – together with a book I had bought – to a university student who was doing an internship with us. At the end of the Summer he had made very little progress in actually configuring the solution. If we had not involved a specialist local consultancy firm, we would not have achieved the results that we have to date”.

This highlights the fact that acquiring the knowledge to successfully deploy OSS is not a trivial task, and many IT functions have to operate very differently in the case of OSS, especially that of support and maintenance.

2.1.4.1 A Changed Model for Support and Maintenance for OSS Solutions

The IT manager accepted that OSS-based solutions did not offer the same degree of assurance that a commercially-acquired solution would. There is an element of risk in proceeding on the OSS path, since ongoing product support is not provided in the usual way. Thus, there is a need for a complete rethink of the support strategy. In the past Beaumont has always purchased support from a competent third-party provider. While with OSS this option still exists to some extent (i.e. Linux support is available from HP or IBM), there is a significant difference in expectation associated with OSS. Organizations need to be aware that there are support and deployment costs associated with OSS solutions. Also, many organizations may face internal resistance to the fact that their support essentially derives from a series of bulletin boards. Ironically, they may be quite reluctant to purchase consultancy support to effectively deploy a solution, since, as the IT manager aptly summarised:

“If you have a product which costs €1 million – it may seem appropriate to spend €500K on support and consulting. However if the product costs nothing – then spending €500K some-

how seems to be a more difficult decision to take – yet the saving is still €1 million”.

The biggest learning for Beaumont has been to orientate its support staff to effectively utilise the Internet and other resources to deliver support. There is still a hankering to call a support number, and have someone else take care of the problem. While the comfort zone which this offers is readily understandable, the IT manager believes that this is a transitional issue, and that as users and developers get more confident in the success of the systems, this will no longer be a factor. Thus far, the support from online bulletin boards and mailing lists has been very prompt and successful for all the issues Beaumont has faced.

Extent of experience appears to be relevant in that the availability of appropriately skilled personnel was identified as influential in Beaumont’s adoption of OSS was. A number of key staff – particularly in the computer operations department – rapidly adapted to the new OSS environment, and the IT manager described the operations team as the “leaders in the overall adoption of OSS”. The bulk of the OSS search, selection and implementation, was actually carried out by the hospital staff. This necessarily involved a process of learning/experimentation. As the staff confidence and familiarity with OSS products grows, the learning cycles were correspondingly shortened. However a constructive intervention in the learning process was achieved by availing of the expertise of very experienced open source consultants through a funded research project involving Beaumont and the university where one of the authors is based.

It also helped that Beaumont already had a strong experience of UNIX applications to draw on. So the transition was not as radical as it would have been if staff experience was simply based on GUI-enabled systems administration. In the words of the Linux Systems Administrator, “We are not afraid of the command line interface”. This may be significant as developers in the past have referred to the “exhilarating succession of problem-solving challenges” in installing OSS products (Sanders, 1998), and it is unlikely that non-technical users would be entirely comfortable in installing under such conditions, although the user-friendliness of the installation process for OSS products is improving extremely rapidly. Beaumont’s IT staff have also been very impressed with the scalability/stability of the OSS solutions, and have actually moved a number of DOS-based applications onto Linux, in such a smooth transition that the user community never even noticed the change. However, Beaumont now face the threat that the operations staff who have experience in OSS deployment may be poached by other organizations who are planning to deploy OSS solutions.

2.1.5 Top Management Championship

Given the high risk involved in venturing into the relatively unknown of OSS adoption, and absence of the comfort of the traditional hotline telephone support and written maintenance contracts, management championship is undoubtedly critical, all the more so as it moves from invisible infrastructure systems to more visible, high-profile desktop systems and IS applications. In the case of Beaumont, the decision to move to OSS was given full support by the CEO, largely on the basis that there was no other choice given the cuts in the IT capital budget. Interestingly, the CEO, although a strong and committed supporter who mandated the move towards OSS, did not become a user himself. While this might be expected to be a critical chink in the strategy, this has not been the case thus far, and after initial teething problems, the use of OSS has been extremely successful. In addition to this, Beaumont comprises many largely autonomous units which behave independently and raise research

funds to support their activities. This is evidenced by the fact that 120 users have chosen to ignore the overall move to OSS. Typically, these users had sufficient funds to remain independent of central IT support. However the IT Manager has informed them that this would have consequences in that they would have to assume responsibility themselves for ensuring that the hardware which they use is upgraded, and provide resources for future maintenance upgrades, etc.

Furthermore, the early ‘baptism of fire’ in relation to the implementation of StarOffice, discussed earlier, has had a residual effect: Beaumont is located on Dublin’s Northside (think Roddy Doyle rather than James Joyce!), and in typical fashion, users have coined the succinct and disparaging term “Star Bleedin’ Office” to refer to the system. No amount of prose narrative on our behalf could comparably express the user angst and frustration at the problems experienced with the early deployment of StarOffice. In summary then, the benefits of OSS did not immediately become apparent in Beaumont, and it required very strong championship from top management and IT staff to ensure this initiative was not derailed.

The IT Manager of Beaumont readily emphasized that the fundamental underlying principle in OSS adoption was the desire to get the best possible return for the tax-payers’ money as the hospital was largely funded from Government funds each year. He was very frank that it was not driven by any doctrine or anti-Microsoft ideology, pointing out that Microsoft was the first to ease Beaumont’s budget problems by offering academic pricing status in 1995. Also, one of the most recent systems implemented – to support a comprehensive clinical record for renal patients – was entirely based on Microsoft components. However, the importance of individual championship has been extremely significant. The IT manager has undoubtedly been the driving force and OSS champion within Beaumont. In addition to this, some of the user management have been very strong champions at a grass roots level, for example, the nursing staff who championed the rostering system, as discussed below.

2.1.6 Extent of Coordination

This factor has to do with the coordination of knowledge between business and IT units and the extent to which values to do with collaboration and sharing of risk are promoted. This was very much in evidence at Beaumont.

2.1.6.1 Sense of Shared Adventure in OSS Deployment

Given that there is no well-trodden path to OSS deployment, nor any slick vendor marketing campaigns or enthusiastic sales-force to demonstrate functionality in the case of OSS, users and technical staff have to cooperate much more closely to ensure that OSS products meet their needs, for example, scanning bulletin boards to ascertain the kinds of problems occurring in these systems, and how quickly they are rectified and the like. Again, this is not a common scenario in the proprietary software arena. In Beaumont, what has also been particularly striking is the sense of ownership that the nursing staff have developed for the nurse rostering system, for example. These end-users have been very active in demonstrating the system to other hospitals, and their nursing counterparts in the other hospitals have been swayed very much by the positive attitudes of their professional colleagues. Ironically, the large-scale studies of the OSS phenomenon report that almost 99% of OSS developers are male. Given the predominance of females among the nursing staff and the enthusiasm with which they have embraced the ideology of OSS, this suggests that the OSS movement overall could leverage this sector of the population to a greater extent.

2.1.6.2 Fear of Being De-skilled

It is worth mentioning that there was quite a lot of initial resistance to OSS from the potential users of these systems. One of the key complaints from the administrative staff and users in Beaumont who moved to an OSS platform was that they feared being de-skilled if they didn't have skills in popular proprietary applications. In fact, users readily admitted that they would have preferred not to have switched from the proprietary desktop systems to OSS. One user admitted that when StarOffice was proposed, there was a widespread perception that this was a cheap and antiquated package from "Jurassic Park" which would have limited functionality. Thus, not everyone sees OSS as a leading-edge initiative. However, users claim to have gotten up to speed very quickly and now state that they are happy to continue with the OSS systems, and it is seen as a very useful additional skill to add to a resumé.

Beaumont has installed StarOffice 7.0. This contains a number of enhancements that increase the ease of use and attractiveness of the product. "This version really breaks down the myth of needing proprietary solutions for presentations and other purposes" according to Beaumont's lead systems trainer. Given the problems with the deployment of earlier versions of StarOffice, a widespread training and awareness campaign is planned to ensure that the user community is briefed on the new features in StarOffice version 7.0.

2.1.6.3 Perception of Work being Undervalued

Additionally, there has been some resentment in some quarters to the move to OSS systems. This is a complex issue but some staff appear to feel somewhat 'short-changed' and believe their work is under-valued if they are asked to use OSS systems which cost less than those being used by their counterparts in hospitals elsewhere using proprietary system.

Both, the fear of deskilling and the perception of work being undervalued, have resonances with the critique of the dominant paradigm which generally assumes that technology innovation is universally welcomed and perceived as beneficial by all stakeholders. Clearly, this was problematic in this case. Thus, it is imperative that the strategic necessity for such an initiative and the advantages of the OSS applications that have been deployed (discussed above) are communicated systematically within Beaumont.

2.1.7 Sophistication of IT Infrastructure

Beaumont has approximately 1,300 desktop machines to support. Approximately one-third of these are bordering on obsolete, specified at 64 MB RAM or less and with clock speeds of about 300 MHz. This situation arises because of a relatively low level of funding to sustain its IT infrastructure. As a direct consequence of this, as money became available, Beaumont acquired a variety of software of different vintages and capabilities, including a mixture of application packages. This mixed-market philosophy extends to the range of application providers who are involved in business relationships with Beaumont. This includes HP, IBM, Sun, Linux providers (Debian, Red Hat and SuSE) and Microsoft. However, this heterogeneity of platforms and packages resulted in less inertia and fewer constraints in the overall deployment of OSS than would have arisen if there had been a long-term, stable and coherent IT infrastructure in place.

Thus, the suggestion that organizations with a sophisticated IT infrastructure are more likely to deploy a technological innovation is not borne out in this case. Rather, the fact that OSS can make better use of older hardware, and the fact that no overall coherent and planned IT infrastructure existed in Beaumont facilitated the deployment of OSS as it was easier to

propose a range of OSS solutions according to the IT manager, in that there was no strongly championed coherent IT infrastructure to displace. Indeed, the existence of such an architecture based on proprietary software could be a significant barrier to OSS deployment as the discussion below reveals.

2.1.7.1 Compiere versus SAP Financial Systems

In Phase 2 deployment of OSS, Beaumont has trialed and positively evaluated Compiere (www.compiere.org) – a fully functional open source financial management system which offers at least the same, if not a richer, degree of functionality than the current proprietary applications in place. The application is written in Java and runs on Oracle or PostGres. It has been made available as open source because the Compiere developers recognised that the marketing investment which they would have to make to go head-to-head against the more established financial solutions was so significant that it was diverting their efforts away from both service and product development.

However, the establishment of a standard IT infrastructure is ironically more likely to represent a significant impediment to OSS assimilation in Beaumont. Funding comes from the Irish Government through the Department of Health and Children (DoHC). The latter formulates policy on the use of IT within the Irish hospitals. Also, given that they represent several hospitals, the DoHC have bulk purchase agreements with various vendors, and seek to ensure interoperability with IT infrastructure in the various hospitals through the use of common platforms. The DoHC have recently mandated a national IT infrastructure which requires that financial systems be drawn from the SAP family of proprietary applications. The DoHC will only provide funds if Beaumont implement the recommended SAP systems. Thus, Beaumont IT staff and end-users are faced with a situation whereby if they choose to implement the OSS Compiere financial system, which meets their needs functionally, they will have to do so without the possibility of using the savings that arise elsewhere, whereas adopting the proprietary systems would probably result in less inconvenience and does not affect their budget as the DoHC will fund the initiative. In such a scenario, it is very difficult for OSS to flourish. Earlier the Phase 2 deployment of the open source Vista hospital information system was discussed, and the extent of savings for these systems was seen as significant. However, just as with Compiere, the DoHC is also recommending a proprietary hospital information system which would be deployed as standard package across all hospitals in an effort to achieve better interoperability. As can be seen from Table 7 earlier, both the Phase 2 systems are at an early stage of assimilation, despite the significant potential savings that would accrue. Thus, it seems that IT governance policies may often, wittingly or unwittingly, confer an unfair advantage on traditional proprietary software at the expense of allowing consideration of valid OSS alternatives.

2.2 Summary and Conclusions for BH Case Study

Table 10 summarises the manner in which the assimilation factors discussed above either facilitated or impeded OSS deployment in Beaumont.

Factor	Effect Found in the BH Study
Organization age & size	<p>Organization age factor not operating as predicted in previous research. Beaumont is an amalgamation of older institutions but has embarked on OSS implementation.</p> <p>Organization size operating as predicted. Beaumont is a large organisation and has more to gain from OSS adoption in per-seat license savings.</p>
Industry type	Supports prior research prediction. Public sector companies such as Beaumont have been to the fore in implementing OSS, primarily as a cost-cutting measure.
Strategic investment rationale	Supports prior research prediction. In the wake of stringent budget cuts, Beaumont needed to embark on radical shift to OSS to provide the level of service expected.
Increasing returns to adoption	<p>Supports prior research prediction. Beaumont gained most savings from license & annual maintenance fees, for desktop and email systems, for example.</p> <p>Also, the added functionality available in OSS systems (better leverage of XML, for example) could only be realised when deployment had taken place.</p> <p>By making in-house developed applications available as OSS, Beaumont will contribute to the pool of available OSS solutions in the vertical health domain.</p> <p>Classic network externality effects arise as customers using the same OSS products from different countries are willing to share any experiences and code contributions.</p>
Knowledge barriers – extent of experience	<p>Supports prior research prediction. OSS adoption and deployment is a very knowledge-intensive process.</p> <p>No trusted roadmap exists to guarantee successful OSS deployment. Furthermore, the model for OSS support and maintenance is completely different from that of proprietary software.</p> <p>Beaumont had UNIX experience, which was relevant to Linux adoption in particular. Beaumont now fears that experienced staff will be poached by other organizations that are seeking to deploy OSS.</p>
Top management championship	<p>Supports prior research prediction. OSS deployment is a risky venture and requires more than just support, in that some championship is required. In Beaumont, teething problems with the early versions of StarOffice provide evidence of the need for top management championship to ensure that the process did not get derailed.</p> <p>Individual championship by the IT manager was also a significant facilitator of OSS deployment in Beaumont to ensure that the move to OSS did not lose momentum.</p>
Extent of coordination	<p>Supports prior research prediction in the main. Values of collaboration and shared risk between business and IT staff were very much in evidence.</p> <p>Users had to be much more proactive in the OSS selection process, and a sense of shared adventure prevailed.</p> <p>Also, there was a fear of being deskilled on the part of users who had to use OSS alternatives to popular proprietary products. Combating this required extra coordination in promoting the benefits of extra functionality that could be attained by use of OSS.</p> <p>Similarly, the perception in some quarters that the use of free OSS products undervalued one's work as expensive proprietary products were the norm for counterparts in other hospitals points to a need for increased coordination to promote the benefits of OSS.</p>
Sophistication of IT infrastructure	<p>Does not support prediction in prior research. The heterogeneity and ad-hoc nature of Beaumont's IT infrastructure where products were bought as finance became available in different departments facilitated OSS deployment as no master plan for IT infrastructure existed.</p> <p>Furthermore, the Government plans to establish a common IT infrastructure across all Irish hospitals, based on proprietary software, and tying funding to compliance with that proprietary infrastructure is a significant impediment to OSS deployment.</p>

Table 10: Summary of Assimilation Factors in BH

By and large, the predictions from prior research on assimilation were supported in the study, with the factors elaborated with detailed actual examples from this in-depth case study. The two factors that were not supported, *organization age* and *sophistication of IT infrastructure*,

are perhaps worthy of further comment.

In the case of organization age, even though Beaumont is an old and quite risk-averse organization, the drastic IT budget cut-backs left no alternative but to explore OSS adoption, which overcame any desire to remain with the status quo. Indeed, those who chose not to switch to OSS were those who could afford it. This also has resonances with a critique of the “dominant paradigm” for assimilation research where it is generally taken for granted that IT innovation is beneficial. This was certainly not the universal perception from the outset in Beaumont.

In relation to the sophistication of the IT infrastructure, the argument that a sophisticated IT infrastructure facilitates higher levels of IT-related knowledge and hence IT innovation, while undoubtedly having some foundation, can be problematic in the case of OSS. Typically, this sophisticated IT infrastructure will be on a proprietary platform and thus will create inertia, impeding a possible move to OSS. Most of the OSS deployments to date have been ‘under the radar’ deployments by IT personnel, and have not required budget sanction. Thus, they have been in an invisible, semi-unofficial capacity, and probably happened despite the sophistication of the IT infrastructure rather than because of it. This helps explain why the Phase 1 deployment of OSS in Beaumont has achieved a greater degree of assimilation than those in Phase 2, which involved more visible and high profile applications.

Also, it is evident that some factors which facilitate OSS deployment, such as strategic investment rationale in OSS may be simultaneously in conflict with an IT infrastructure that is based on proprietary software, thus inhibiting the deployment of OSS. Certainly, the heterogeneity of platforms and packages in use in Beaumont reduced any inertia that might have arisen if there had been a coherent proprietary IT architecture. Also, in many cases, the flexibility and ready availability of additional features in the OSS applications allowed Beaumont to offer more functionality than what had been available with their proprietary alternatives.

3 Consorzio dei Comuni della Provincia di Bolzano - Südtiroler Gemeindenverband (SGV), Italy

3.1 Application of the Framework in SGV

As recently as 2001, it was quite difficult to find Town Halls willing to use OpenOffice.org. Surprisingly, employees in small municipalities were more favourable towards learning OpenOffice.org and coping with its initial faults, than employees in larger ones. In the meantime, however, OSS seems to have become much more acceptable. We suggest a number of factors which may help explain this shift, including the following:

- The COSPA project which studied the impact of Open Source in public administrations and showed that the use of Open Source was highly beneficial to them;
- A study conducted by the free University of Bolzano-Bozen, which showed that no performance degradation was incurred by moving from Microsoft Office to OpenOffice.org;
- The new almost Word-like 2.0 release of OpenOffice.org;
- The fact that all private citizens can use free software to send a document to the Town Hall;
- The introduction of OpenOffice.org in the public schools of South Tyrol;
- The use of OpenOffice.org elsewhere in the world.

As a result, OpenOffice.org is now installed on almost all PCs in the Public Administrations in South Tyrol (about 7000 PCs) and public employees are slowly beginning to use it.

To make the transition easier, SGV offered courses in word processing, emphasizing the most useful OpenOffice.org features tailored to the needs of the employees. For example, they were shown how to use styles in writing documents, how to format them quickly, how to write a document in both Italian and German using multiple columns, and how to write documents for multiple recipients. Thus, as the transition to OpenOffice.org was made, these courses helped city employees learn to use word processing even more effectively than they had been using it when working with Microsoft Office before.

OSS Product	Date of Acquisition	Current Level of Assimilation	Date of Current Level Achieved (# months)
Operating System (Linux server)	1998	General deployment	April, 2001
Desktop Systems (OpenOffice.org)	2003	General deployment	2004
Groupware (Group-E)	2003	Limited deployment	2004

Table 11: Assimilation of OSS within SGV

3.1.1 Organization Age, Size, Industry Type

Founded 50 years ago, the Südtiroler Gemeindenverband (SGV) or Consorzio dei Comuni della Provincia di Bolzano³, with its 52 employees, 25 in the IT department, is responsible for selecting, developing, and installing hardware and software in the public municipalities and social institutions in South Tyrol, Italy. There are about 3,500 PCs, 180 servers, routers and switches which are currently being serviced. The buildings of the 116 municipalities are

³ <http://www.gvcc.net>

spread out over a radius of about 100 km. South Tyrol⁴, which shares its northern border with Austria, is a highly touristic, mountainous area. The majority of these municipalities have very few employees (2-3). There are 8 public offices for social services and about 30 offices (the number is increasing every year) for social support. According to COSPA classification (D3.1) SGV is a VPA-T1 type.

3.1.2 Strategic Investment Rationale

For SGV, there were three strategic reasons for experimenting with Open Source software and for migrating from their previously used proprietary products to Open Source ones. These included the following:

- The desire to limit public spending;
- The aim to give to the citizens the possibility of using open formats and free software;
- The decision to follow locally the strong promotion of Open Source software and standard carried out by the Italian Government.

These reasons are elaborated below.

Private companies aim to grow, make money and increase their share of the market, and the use of IT certainly plays a major role in meeting these goals. Public administrations, on the other hand, do not compete for market share or customers because they do not need to show a profit. That means that the municipalities in South Tyrol, to which SGV provides its services, do not have to worry about clients or customers, because they have no competition. There are 8 public offices for social services and about 30 offices (the number is increasing every year) for social support in the Autonomous Province of Bolzano-Bozen. The client is the citizen that lives in the municipality. He/she gets whatever the legislative thinks he/she should be entitled to based on regulations, petitions, and special orders. Because of the fact that there are so many rules to follow, clearly help in some computerized form is required.

Public administration requirements for IT infrastructure are similar to the private sector: both are aware of the use, the limitations, and the risks of computers and both try to intensify their use to improve the efficiency of internal operations and strategic management.

While private firms are generally free to decide how much they want to spend on IT – because they pay for it - public authorities must follow precise rules for any expense because the taxpayer pays for it.

Precisely for that reason SGV selects the most competitive solutions to limit public spending. Ten years ago SGV decided to install Open Source and Free software in its headquarters and to gradually replace older proprietary software, in the town halls with Open Source programs. For the past ten years, hardly any money has been spent on proprietary software licenses for server-side software, word processors, spreadsheet programs, and e-mail clients.

Some time was dedicated for searching and analysing a number of Open Source solutions and choosing the best one to adopt. For example, choosing the server side solution that fits best SGV required 2-3 months. Some criteria guided the selection. Most of the consortium's municipalities are unwilling to spend much on frequently updating their desktop machines and servers, and SGV chose solutions that do not require frequent hardware updates and has adapted tools to run on old hardware. This approach improved overall performance at no additional expenses. It was possible to recompile the product since most of the software is open source, with available source code. On the other hand, the choice for Office Automation

4 <http://de.wikipedia.org/wiki/S%C3%BCdtirol>

(i.e. OpenOffice.org) took 1 month. The main criterion for the choice was that the solution had to be independent from a monopolistic vendor. Additionally, it had to allow the provision to the citizens of documents meeting open standards. About the same amount of time (1 month) was needed for selecting a groupware tool and the criteria for this choice were similar to the ones mentioned above.

Testing the software required additional time – 2-3 months for the Operating System and related tools and 1 month for both OpenOffice.org and Group-E⁵ (groupware tool).

The installation of all products was done by the IT staff. More time was needed for the server side installations and setup – about 1 month, while for the installation of the Office Automation tools took about 10 minutes per PC. Specific scripts written by the IT staff were used for remote installation and no intervention by users was required. The introduction of the OSS did not require any new hardware or infrastructure upgrades but only the usual periodical hardware updates.

3.1.2.1 Operating Systems (server-side) – Linux

Linux is the most prominent example of free software and open source development. The installation of Linux in SGV includes 238 servers. They play very different roles: database server, DHCP server, file server (154), proxy server, firewall, and LDAP server. In the case of SGV every Linux server has been customized by adding specific open source packages (Table 12) like Samba Squid, Iptable, Open LDAP, etc.

Function	Software
File server	Samba (http://www.samba.org)
Directory service	Open LDAP (http://www.openldap.org)
Proxy server	Squid (http://www.squid-cache.org/)
Firewall	Iptables (http://www.netfilter.org/)

Table 12: Most important open source packages used in SGV

3.1.2.2 Desktop Applications - OpenOffice.org

The installation of OpenOffice.org⁶ 1.0.1 in the municipalities of the province of Bozen-Bolzano has been massive (2.829 PCs). Employees can choose to use either OpenOffice.org or Microsoft Office. However, some documents (e.g. election templates) on the Intranet are available only as OpenOffice.org documents. This is part of the strategy of SGV to promote the diffusion of Open Data Standards among employees. At least 12 municipalities (344 PCs) have completely migrated to OpenOffice.org.

3.1.2.3 Groupware – Group-E

GROUP-E is an open source platform for communication, organization, and management. The modern infrastructure covers many fields of application and increases the mobility of a working team. Several companies and public administrations in South Tyrol have adopted GROUP-E. The application is written in PHP and the back-end is the open source database MySQL. GROUP-E has been installed in 30 municipalities with 587 users.

⁵ <http://www.group-e.info/>

⁶ <http://www.OpenOffice.org>

3.1.3 Increasing Returns to Adoption

SGV strongly supported the adoption process for as many employees as possible, as a greater number of employees will bring significant cost savings for the PA if migration is successful. As mentioned before, the expected savings represented an important strategic decision, with the goal to limit public spending. In fact, although the migration is still in progress, the installation of open source office automation tools were done on about 2500 employees' computers.

The overall level of satisfaction of the personnel with the solution might be defined as partially satisfied. Evidence of this is the fact that at present about 28% of the documents are in OpenOffice.org format. However, the introduction of OSS brings some new/better features that should be mentioned. During the transition to OpenOffice.org and in order to encourage adoption, most of document templates were upgraded, extended and enhanced, providing more functionality than that offered by the old Microsoft Office templates. At the same time, OpenOffice.org can open and use Microsoft Office documents, it supports open standards (ODT file format) offering the possibility to work with more data formats. Looking at the future, it will allow easier ways to solve the future-proofing of documents. However, we should highlight some slightly negative aspects – OpenOffice.org BASE⁷ lacks of many of the features that Microsoft Access has and some graphical features of Microsoft Excel are better implemented than the ones offered by CALC⁸.

3.1.4 Knowledge Barriers – Extent of Experience

At the beginning of the COSPA project only a small number of the IT personnel (about 10 people) was prepared, i.e. properly trained, to work with OSS, namely with Linux and e-mail servers. Partial training of the IT staff was provided before the current project, as the SGV interest for OSS dates before the start of COSPA. However, an additional three weeks of training were provided to 6 members of the IT staff during COSPA.

The training of the rest of the personnel of the municipalities (the PA employees) to the new functionality offered by the OSS was performed in two different ways. A single day's training was provided to all personnel in the IT Centre. On-site help was provided whenever needed during the regular visits of IT staffs in the municipalities. At the beginning of the migration a helpdesk was available for 1 hour per day and administrators dedicated two hours per day for remote support via VNC⁹ tools. Product documentation was available on the consortium's Intranet. In total, about 2500 employees were provided with training over a two month period. The IT personnel had to be increased with an additional person to support OpenOffice.org. External consultancy was needed for some server side solutions (e.g. Linux).

Apart from the IT personnel and a small number of employees (about 50 people) who were happy with the introduction of OSS in SGV and the possibility of learning new applications and new skills, SGV personnel were mainly negative towards the adoption of OSS. The reason for this may lie in the fact that users who are happy with one product (in this case Microsoft Office) are usually unwilling to change, even to a less expensive or a free product.

After a period of OSS utilization a certain change in the attitude can be noticed. On all the

7 BASE is part of the OpenOffice.org suite and it permits to manipulate database data. It allows creating and modifying tables, forms, queries, and reports, either using different databases.

8 CALC is the spreadsheet application of OpenOffice.org.

9 Virtual Network Computing (VNC) is a platform-independent remote desktop protocol to remotely control another computer

sites where the training was carried out properly, the level of acceptance of OpenOffice.org is extremely high and employees are now satisfied with it. In the cases where the training was not run properly, employees refused to migrate. From the quality point of view, SGV users perceive OSS as being as good as proprietary solutions in most contexts, but OSS usually has a longer lifetime. SGV has had a very positive experience with OSS and Open Data Standards and in a long term strategy plans to eliminate all proprietary software wherever possible.

3.1.5 Top Management Championship

In SGV the use of OSS is strongly supported by the management. In concrete terms OSS is 100% supported by IT people and about 50% by administrative management. At the same time 100% of the IT staff use OSS. This includes a small number of people that use only OSS - a combination Linux and OpenOffice.org (5-6 people) and all others who use a combination of Windows and OpenOffice.org. About 70% of administrative management utilize OpenOffice.org.

Top Management support is also guaranteed by the strategic directions towards Open Source standards and free software provided by Italian government and EU.

3.1.6 Extent of Coordination

In SGV the extent of coordination was being addressed more than adequately. Communication was already good among IT personnel and employees. A special seminar to promote the usage of OSS was conducted, which identified the benefits of using OSS in the public administration sector. Also, they formally advertised the OSS implementation initiative. As mentioned part of the daily needed templates were converted and available in OOo format, which was additionally pushing the employees into using the OSS solution. Therefore, the benefits of the OSS products installed were being well communicated to all stakeholders already, and there was good level of awareness. Furthermore the employees were trained to use a wide variety of functionality for office automation with the help of OpenOffice.org.

3.1.7 Sophistication of IT Infrastructure

SGV is a service provider to a consortium of municipalities that participate in a voluntary manner. Each municipality that decides to enter into the consortium pays a yearly fee for receiving the services offered. There is a central IT department and many individual public administration partners within SGV. In this sense SGV has a star architecture and it formulates policies on the usage of the available servers. The centralised IT management ensured that a significant number of PAs implemented OSS migration. In fact the migration was imposed by the director of SGV. However, the single municipality preserves its autonomy in deciding whether or not to accept the proposed option. Thus in a small number of cases, individual partners chose not to implement OSS.

3.2 Summary and Conclusions for the SGV Case Study

Table 13 summarises the manner in which the assimilation factors discussed above either facilitated or impeded OSS deployment in SGV.

Factor	Effect Found in the SGV Study
Organization age & size	<p>Organization age factor not operating as predicted in previous research. SGV is 50 years old, and some people have enthusiastically switched to Open Source software.</p> <p>Does not support previous predictions considering organization size. Though SGV is quite a large organization only a few of the IT staff were partially prepared to work with Open Source solutions. All the personnel, including the IT department members, needed preparation and education.</p>
Industry type	Supports prior research prediction. SGV has been to the fore in adopting Open Source software in South Tyrol, primarily to promote the usage of Open Data standards in the relations between citizens and PAs.
Strategic investment rationale	Supports prior research prediction. There were many strategic reasons for adopting Open Source standards, pushed both from local government initiatives and by the Italian government. This triggered many strategic investments, mainly for training of the personnel. Partial role for the final decision to migrate had also the fact that SGV IT staff had certain experience with Novell operating system which was relevant to Linux adoption.
Increasing returns to adoption	Supports prior research prediction. SGV is a large organization and can save a significant amount of money in licenses. In fact, SGV gained most savings from licenses and annual maintenance.
Knowledge barriers – extent of experience	Supports prior research prediction. OSS adoption and deployment requires skilled people. At the beginning of the migration only a small number of people were properly trained to work with Open Source software. SGV invested and is still investing in training of employees, especially for OpenOffice.org.
Top management championship	Supports prior research prediction. The adoption of Open Source software has been strongly encouraged by IT management. A small number of technicians use only Open Source software. Moreover the OSS initiative is strongly supported in higher levels, i.e. regional, country and EU levels.
Extent of coordination	Supports prior research prediction. The seminars promoting the advantages of OSS to the employees influenced a lot on their positive attitude to the migration initiative and to the actual usage of OOo. It is also noticeable the strong collaboration between some enthusiastic IT staff and IT management who was very proactive in the adoption of Open Source software.
Sophistication of IT infrastructure	Does not support prior research prediction. SGV has got a well-organized, quite simple and generally centralised IT infrastructure. Nevertheless, between the IT employees there was the necessary awareness about this innovative IT possibility. The simplicity and centralisation facilitated installation and deployment of Open Source software.

Table 13: Summary of Assimilation Factors in SGV

4 Fundecyt in Extremadura, Spain

The assimilation of Open Source software in the Extremadura region in Spain makes an extremely interesting case. The main goal of the Fundecyt foundation is experimenting and pushing for the adoption of the LinEx Operating System. LinEx is a local distribution of Linux initially outsourced by the local administration to a software company in Madrid (Andago) for early deployment, and then internally managed, maintained and improved. The LinEx distribution has been already adopted in all the high schools of the region. In this way, Extremadura became the first region in the world to have successfully completed a migration between closed solutions to open source solutions.

4.1 Application of the Framework in Extremadura

Before the adoption of Linux, a few PCs with the most common application were used very intensively (basically every working day) by school directors, secretaries and professors. No OSS nor in-house produced tools were used. At present, however, no proprietary or in-house tools are used, while OSS like Linux, OpenOffice.org and Mozilla are the basic tools for the everyday work of all in the schools. Students also must use the local distribution of Linux and seem to be enthusiastic about that.

OSS Product	Date of Acquisition	Current Level of Assimilation	Date of Current Level Achieved
LinEx	2002	General Deployment	2005

Table 14: Assimilation of OSS within Extremadura

All the staff, whether IT or not, are now aware of the possibility of using OSS instead of proprietary solutions. Even administrative staff, after the initial period, seem quite happy about the migration. Overall, the degree of OSS assimilation achieved is General Deployment, i.e. the Organization is using OSS product for at least one large and mission critical system.

4.1.1 Organization Age, Size, Industry Type

Fundecyt is young public foundation for the promotion of technology and innovation in the region of Extremadura in Spain. It has been established in 1996 to work as a bridge between the local university and the public administration, and also for promoting the collaboration between these and the Extremadura industry. The foundation is relatively small, but enjoys a high growth in its economic resources.

All the schools of the region have used LinEx since 2002, whilst the project started in 1998 with preliminary studies and an investigation into the many possible options for OSS adoption. Presently, the foundation itself is beginning the adoption of the system inside all its offices and for all the employees. Up to now they have been using Windows machines.

4.1.2 Strategic Investment Rationale

The project, from the political point of view, in Extremadura started in 1998, although it was only in 2002 that all the schools adopted LinEx. The first six months of the project have been spent in choosing which solution to be adopted. At the end, the decision was the introduction of Linux both for the Desktop usage and for the Server facilities. The main topic for the decision was economic, indeed Extremadura with the savings due to this operation has been able to increase the number of PCs in the schools so as to have a ratio PCs/student of $\frac{1}{2}$. Another relevant issue was the fact that the adoption of OSS facilitated user participation in a community distributed worldwide. This can be very useful when problems arise. In this

sense, the concept of “cooperation” was a significant factor.

The initial distribution was created by external experts, i.e. Andago, a company from Madrid. About 8 months have been spent in testing the whole system. Fortunately the installation was easy and no integration problems arose. The operation was initially costly because of the need to buy hardware, cable and switches, and because the outsourcing for Andago was expensive but, in the mid-long term, it resulted in savings with respect to the estimated costs for the use of closed solution in the same time frame. So the investment can be considered a successful one.

4.1.2.1 LinEx

In 1997 the President of the Extremadura Region launched the Regional Strategy for the promotion of freedom and equal opportunities. It had two main objectives – to allow accessibility to everyone and to stimulate technological literacy. This initiative provoked the beginning of the LinEx project. The name is a combination of "Linux" and "Extremadura".

“Its objective is to create a fully functional platform, based on FLOSS, providing universal access of IS tools to all citizens. While doing so, it aims to provide adaptability, economical benefits and security as much as possible, without losing sight of actual feasibility.”¹⁰

“LinEx contains a large amount of software, including the GNU/Linux operating system and several office applications. More functionality is coming however, since Extremadura is also funding a development centre creating accounting software, hospital applications and agricultural applications. All will be run on LinEx. The region's government will ship the resulting software for free to all of its citizens.”¹⁰

“By using a modified Debian distribution, the Extremadura Regional Government has benefited from the fact that there is a large amount of varied software available. As a matter of fact, there are more than 9,000 different software components. The stability, speed and security of Debian should also be underlined.”¹¹

“LinEx is specifically designed for use in regional administration and schools, where the use of LinEx is on a ratio of 1 PC per 2 students, but the software is distributed for free on a much larger scale than public bodies. Besides it's spreading in NKC's and Vivernet, there are examples of manufacturers preloading LinEx on the PCs they sell, or magazines copying the software on CD and distributing it to their readers for free.”¹⁰

4.1.3 Increasing Returns to Adoption

As explained in the previous section the strategic decision to adopt LinEx was mainly related to the license costs savings. The centralised decision for deployment guaranteed that all schools installed an utilised the chosen distribution. The adoption of Linux, resulted early in additional hardware costs at early stage. Those costs, however, have been adequately compensated by the notable savings due to licenses costs.

For the personnel, although there was an initial diffidence towards the adoption of the new tools, after the first training period the overall feeling was of strong satisfaction. The main problem, at the beginning, was a lower usability of the system, although strongly

¹⁰ FLOSS deployment in Extremadura, Spain

<http://europa.eu.int/idabc/en/document/1637/470>

¹¹ Extremadura Regional Government *GNU/LinEx*

http://www.linex.org/linex2/linex/ingles/index_ing.html

compensated by a higher security level. Furthermore, the students also must use the local distribution of Linux and seem to be enthusiastic about that.

4.1.4 Knowledge Barriers – Extent of Experience

Fundecyt encountered huge problems when promoting the migration to this new Linux Distribution. At the beginning of this ambitious project, indeed, the personnel of the high school (director, secretary, etc.) were not properly trained to work with the Linux Operating System. Most people did not know anything other than Microsoft Windows 95/98 system and the MS Office suite for office automation. Even the IT staff inside schools (typically one or two mid-career technicians) were not able to use the new proposed tools. To cope with this not very surprising problem many activities have been promoted and established. The IT personnel have been trained for one year to improve all their skills related to the acquisition of the new system. The following initiatives have been adopted:

- guided learning, courses;
- seminars;
- external consultancy.

The external consultancy has been necessary for the installation of LinEx and for all the following actions to get the people operative with the new framework. Nevertheless, the self-guided learning of the IT staff, mainly at their homes in the evening (after having attended a course or a seminar) has been the most important solution to the initial problems. At the beginning the personnel were not happy to learn new tools, because people very often do not want to change their habits and any change promise to imply extra work. Now, after the initial period, all the users feel comfortable with OSS. Indeed, the operation has been conducted in such an organized way that almost no extra work has been necessary. This was partially due to the fact that the introduction of Open Source software led to the hiring of new people, in particular each school hired a new expert technician to cope with the administration of Linux and to help the colleagues in learning the necessary things to do in case of need.

4.1.5 Top Management Championship

The adoption of OSS was forced by a centralised government decision, thus the schools had no choice other than to adopt it. However, the Fundecyt management not only supported the adoption of OSS but they are even using, intensively, these same tools showing a good acquired ability with the new system.

4.1.6 Extent of Coordination

One of the main advantages of using OSS is the fact that it is possible to share experiences with a worldwide community. Simply the fact of introducing Linux as the only operating system led to a more intense discussion between the IT staff members about problems' solutions and technical procedures for using specific features of the system. Also the communication between the administrative staff and the IT personnel significantly increased, since the non technical people usually needed some consultancy for solving technical issues. Furthermore, the staff started to communicate more often with similar departments worldwide to share experiences, ask question, etc.

4.1.7 Sophistication of IT Infrastructure

The adoption of the LinEx Operation System has been promoted by the local Government of Extremadura, although technically guided by the foundation. For this reason all the Directors of the high-schools of the region were obliged to conform to this directive. Typically the IT department of each school consists of a couple of people that follow the instruction of the Director. In this sense the decision for the adoption has been very centralized and there were no specific policies for the software usage.

4.2 Summary and Conclusions Extremadura Case Study

Table 15 summarises the manner in which the assimilation factors proposed in D 3.1 and discussed shortly at the beginning of this report either facilitated or impeded OSS deployment in Extremadura.

Factor	Effect Found in the Extremadura Study
Organization age & size	The organization age and size factors act as predicted, considering the Fundecyt Foundation. It is a rather new and small organization and eagerly accepted the migration to OSS, although its personnel were not properly trained. More interesting is however the assimilation within school. As all the high-schools are involved the organization can be viewed as of a large size. In this sense the size factor does not perform as predicted. There were almost no personnel ready for the migration to OSS.
Strategic investment rationale	Supports predictions. The strategic decision was made on the level of Province Government for the use of OSS in the high-schools. The savings from licences costs would allow investments in upgrading the infrastructure and increasing the number of PCs. It also triggered strategic investments for software development (i.e. the LinEx distribution) and for training of the personnel.
Increasing returns to adoption	Supports prior research predictions. The strategic decision allowed general adoption of OSS, which led to huge savings from software licences. These savings covered not only the initial investments for the deployment and training, but also the buying of many new computers for the schools students.
Knowledge barriers – extent of experience	As expected: At the beginning of the project the users, including the schools IT staff, were not properly trained for working with LinEx. Intensive training had to be provided to all employees using combinations of courses, seminars and external consultancy.
Top management championship	Supports predictions. The support of the top management was extremely high. Together the strategic government decision and the positive model of the Fundecyt Foundation helped overcoming the severe difficulties of the initial period.
Extent of coordination	Supports previous predictions. The communications within the schools increased in all levels, but also outside, in order to share experiences, ask questions, solve problems, etc.
Sophistication of IT infrastructure	As the assimilation of OSS was compulsory because of the region's government decision the sophistication of the structure factor does not apply in this case.

Table 15: Summary of Assimilation Factors in Extremadura

5 Public Administration of the City of Skopje (SK), Macedonia

5.1 Application of the Framework in SK

In year 2005, 60 employees and all the IT staff of the Public Administration of the City of Skopje took part in the pilot introduction of Open Source software that was part of the COSPA project. The tests for evaluating the possibility of migration to Open Source products continued for about 5 months. The pilot project had two main parts:

- 1) Migration of the existing Windows based server solution to a free alternative and
- 2) Gathering experience with an open source office automation tool, namely OpenOffice.org.

During this five months period some of the participants in the OpenOffice.org trial dropped out due to problems, described further in this case study. On the other hand, as shown in Table 16, the migration of the server side software was instantaneous and totally transparent to the users.

OSS Product	Date of Acquisition	Current Level of Assimilation	Date of Current Level Achieved (# months)
Server	2005	General Deployment	2005 (immediate)
Office Automation	2005	Evaluation/Trial	2005 (5)

Table 16: Assimilation of OSS within SK

5.1.1 Organization Age, Size, Industry Type

The City of Skopje has a very old Public Administration with about 500 employees. It is a special unit of local self government, incorporating 10 other municipalities of the city of Skopje. Its IT department consists of seven people, divided into three divisions – one unit for GIS, one unit for information system development and one unit for informatics and communication infrastructure development. It is quite a big public administration by the country's standards, and according to the COSPA classification it is VPA-T3 type. It performs a wide variety of services for the citizens and firms, through organization, management, coordination and monitoring of public institutions, and enterprises founded by the city. The city PA has competence in the following activities: public enterprises (for public transport, parking management, water supply and sewerage system, streets and highways, communal hygiene, parks and green areas); cultural institutions (libraries, cultural centres, museums, zoo, cultural buildings) and secondary schools.

Currently the PA owns about 100 PCs. The expectations/plans are that by the end of the year 2006 their number will be almost doubled to 180 workstations. Even after the upgrade, 200-300 employees will still need a computer to perform their tasks. While the computers inside the PA campus are networked with optical cabling, the Internet connection is provided by a 256k DSL link. This connection has to be shared among all 100 PCs, providing limited bandwidth.

5.1.2 Strategic Investment Rationale

In Macedonia almost 90% of organizations use Microsoft products and 10% use OSS as alternative. In many cases Microsoft products are not legally licensed due to budget constraints of organizations, but use of legally licensed software is increasing by implementation of law. The government of Macedonia had signed a strategic contract with

Microsoft for licensing Microsoft products, for giving free-of charge licenses of its products, including server and desktop operation systems and Office Automation Tools, to the Public administrations. This agreement should affect also the PA of the City of Skopje. However, more than two years into this agreement, the PA had still not officially received any promised licenses from Microsoft. Due to the situation just described, the IT department of the PA of the city of Skopje was very eager to experiment with the possibility proposed by COSPA to migrate to Open Source software. Such migration would free the PA from the troubles caused by missing product licenses, the acquisition of which, due to the PA's limited budget, is almost impossible. In this sense the possibility to access the source code of the OSS was not a significant argument for choosing from the available alternatives. Of much greater importance was the possibility to legalize, i.e. acquire licenses, the need for the daily work software tools without expenses for the PA, and higher stability and better access protection.

It should be mentioned that investment in the form of time taken from productivity for internal training was acceptable, however any explicit investment were unwelcome. We should note that partially the pilot project failed because there was a need for certain hardware upgrades that were not satisfied, thus the chosen software could not be utilized.

5.1.2.1 Office Automation Tools - OpenOffice.org

In Macedonia an organization, called 'Open Source Macedonia' regularly promotes Open Source solutions. It was from this organization that the IT department of the city of Skopje heard for the first time, shortly before the contact with COSPA was made, about OpenOffice.org and especially its version in the Macedonian language. Despite the existence of such a version, for the pilot project the English version that was provided by the COSPA project was used. The main reason was that the employees were already using an English version of Microsoft products and were used to the commands and menus in English. The assumption was that switching to the new solution will be easier, if the software menus were kept in the same language. Almost no time was spent in choosing OpenOffice.org, as its installation was requested by COSPA. As mentioned the main motivation for experimenting with OSS is the possibility to have no-cost licenses.

IT department members performed a one month test period of OpenOffice.org installation on their machines and utilized it as a replacement of Microsoft Office. Afterwards the software was installed again by the IT staff on 60 employees' PCs. The installation and configuration process took about one hour for each workstation including PROM installation, the software provided by COSPA to monitor the experimentation. A certain inconvenience that was encountered was that on PCs with Windows XP that were used by more than one user a separate installation was needed for each user account. It was noticed that OpenOffice.org consumes much more resources than the respective Microsoft Office installation. Thus, on many of the older systems with low technical specification, OpenOffice.org and PROM were first installed, but later removed.

For the COSPA test period no additional hardware was acquired, neither were upgrades done to the machines or to the existing infrastructure. Nevertheless, some of the problems that the users encountered were most probably caused by the machines used lacking the necessary resources. This was also the reason OpenOffice.org was not installed on all the available PCs of the PA.

5.1.2.2 Server Side Software – Linux and Web Server

Almost no time was spent in choosing the open source solutions for the server side to be utilized during the experimentations. For the Server side operation system Linux was chosen and MySQL and a Web server were installed on top of it. Both were chosen for security reasons and were actually proposed by a company cooperating with the PA of the city of Skopje in a previous project.

On the other hand, the installation and the support for the server were provided by the same external firm that proposed the solution. It took about a week for the installation and setup, but all the process was done in parallel with the old server still available, so the switching was absolutely transparent to the users. Considering installation and support costs of the initial phase, everything was provided free of charge as a donation to the PA. On a later stage, however, certain payments were requested in cases of support requests. The firm was paid on each visit depending on the cause and the complexity of the problem.

5.1.3 Increasing Returns to Adoption

The PA of the City of Skopje is a rather large PA by the standards of the country, and the expectation to radically decrease the costs of licences for a big part of the employees' workstations was a strong stimulus for the strategic decision to test the possibility to migrate to OpenOffice.org. In fact there was an approval of 80% of the employees to participate in the pilot project.

After a five month test period the employees that participated are partially satisfied with the OSS adoption. As it was mentioned, they were initially very happy with the introduction of OpenOffice.org and switched to use it easily. The fact that there is also a huge support and useful help books for using OpenOffice.org assisted a lot. The users found that there are only minor differences in the organization of the functions between the previous and the new product. Also the possibility to save documents in PDF format was noticed by the IT staff and was proposed to the other employees as a useful, new and better feature, in particular, to increase interoperability with non-OpenOffice.org users. However, the problems encountered were discouraging for the users. OpenOffice.org was also often crashing without obvious reason. Often such crashes happened when copying part of one document to another, but even during simple text typing. The biggest problems, however, occurred when documents had to be exchanged with other users who didn't have OpenOffice.org and they had to be converted back to MS Office format. Other formats also were not found very comfortable for use. For example *.rtf and *.dos documents couldn't be opened in certain programs (e.g. QuarkExpress). Compatibility was not very good and troubles with fonts appeared when formatting the texts. There were also problems with the response times, with the Macedonian language, etc.

Nowadays only a small portion of the initial users still use OOo, even though the pilot project is over.

5.1.4 Knowledge Barriers – Extent of Experience

At the beginning of the COSPA project neither the IT staff, nor the other employees were properly trained to work with open source software. In fact, a large number of people in Macedonia (90-95%) are not prepared/trained at all to work with open source solutions. Furthermore, different Macedonian and international organizations and foundations (ex. USAID, UNDP) often donate to the PA the possibility of participating in expensive training,

courses and even certified examinations. The latest examples in 2006 are the courses for Microsoft Server 2003, Security+ etc. that the IT staff followed.

In order to accomplish the COSPA pilot project, the IT staff spent about a month per person in self-guided learning, mainly using Internet sources of information and support from the COSPA project team. Afterwards, a one day class was carried out by the IT members in every participating department to train the employees involved in the project. In total 10 days were spent by one person of the IT department for such guided training. No external training was necessary, however during the 5 month of the pilot project help was provided whenever needed via help-desk. The help-desk was available also before the COSPA project and the introduction of Open Source software. To answer questions and resolve the daily problems, one person spent about one hour per day. The help-desk was not created especially for the OSS pilot project, but it is part of the normal support provided by the IT department.

The introduction of OSS did not necessitate an increase in the IT staff. Four of the IT staff were however intensively occupied with the COSPA experiment.

Interestingly the users switched to Open Source software, namely OpenOffice.org, very easily and at the beginning were very happy with the solution offered. They were told that the costs for software will drastically decrease and there will be no problem of licenses. Another motivation factor for the employees was the opportunity to take part in an EU project. These arguments made them accept OSS eagerly, however many of them were then quite disappointed due to the problems they encountered. Many of the problems were related to the slow or unstable behaviour of the OpenOffice.org version deployed (at that time v. 1.1.4). The reason was mainly related to the low resources available on the machines used for the migration. Users were particularly frustrated when they had an urgent task and in such moments they were switching back to Microsoft Office. Many problems and difficulties were also encountered when exchanging documents with other employees. Currently only a small part of the initial participants continue to use OpenOffice.org – less than 10%.

5.1.5 Top Management Championship

Considering top management support we should mention that all managers approved on paper the participation in the project of about 80% of the employees. The other 20% of the regular employees had a very crucial role in the external communication of the PA and interoperability was too important to experiment with.

Meanwhile, only 10% of the top management decided to participate in the experimentation. At the same time the top management approval meant only a lack of barriers for the participation in the project. More crucial appeared to be the initial enthusiasm of the IT department management and the rest of the IT staff. They promoted the possibility and the functionalities of OOo with enthusiasm.

5.1.6 Extent of Coordination

While introducing and installing the OpenOffice.org to the employees' desktop machines the members of the IT department also tried to explain the strategic reasons for participating in such an experiment and to emphasize the positive factors which can result. The two main reasons, as mentioned also previously, were: 1) that the costs for software will drastically decrease and there will be no problem of licenses; and 2) the opportunity to take part to an EU project. This 'advertisement' of the OpenOffice.org influenced the attitude of the major part of the participants in a very positive direction. They were eager to explore the

possibilities and to learn the new tool.

Due to the introduction of OpenOffice.org, a certain increase in communication between employees was noticed. The reason was mainly the solution of common problems, so users were discussing possible alternatives. The help-desk functionality also became more active and thus the communication between the employees and the IT department became more dynamic. However the increase in communication remained within the PA and did not spread to other similar departments or institutions.

5.1.7 Sophistication of IT Infrastructure

Before the beginning of the pilot project the infrastructure (from the technical point of view) of the PA of the City of Skopje was quite homogeneous. However, because of the different needs of each department, a few different software combinations were used. Each department is rather independent in selecting the software that has to be used within it, and the IT department generally has to cope with the departments' requests for different functionalities, proposing the possible technical solution. In this sense the IT department is the one that suggests a plan and needs an approval of the departments' directors, but no specific policies for software exist.

According to the IT department the introduction of the OSS brought some additional complication and sophistication in the infrastructure. More options and possible ways to do the same task were available, which was confusing for some of the employees and led to a partial reduction in productivity.

5.2 Summary and Conclusions SK Case Study

Table 17 summarises the manner in which the assimilation factors discussed above either facilitated or impeded OSS deployment in SK.

Factor	Effect Found in the SK Study
Organization age & size	<p>The PA is an old organization and the positive attitude, shown by the top management, IT staff and the other employees, to test migration to OSS differs from the expectations of previous research.</p> <p>The organization has a relatively large size by the country's standard. A very strong factor for the positive attitude to the switch was the total amount of savings, mainly from licences, that such migration will bring to the PA budget.</p> <p>However the supposition that larger organizations will have access to appropriately skilled personnel appeared not to be true in this case study, as a specific situation exists in the whole country considering qualification to work with Microsoft products.</p>
Industry type	<p>Supports the suppositions of D.3.1. The City administration deals mainly with management of different public institutions and firms and offers services to the citizens. They mainly work with simple documents. No particular technological advantages were brought by the software switch, however employees also did not have much difficulty in changing their work tool, in the sense of missing functionalities. As no practical disadvantages were predicted and encountered the expected savings of the license costs were crucial.</p>
Strategic investment rationale	<p>Partially supports previous research. The main priority of the PA was to acquire licences for the software products needed for the proper functioning of its departments. Investments in the form of loss of productivity or internal training was acceptable, however any explicit financial investments were unwelcome, because of the lack of budget to cover them. The pilot project partially failed because there was</p>

	a need for certain hardware upgrades that was not satisfied.
Increasing returns to adoption	Support the assumptions of previous research. The PA wanted to involve as many people as possible so that an eventual migration to OOo would lead to big savings from licences. However the employees encountered many problems and missing functionalities. No in-house development was triggered, neither were there any network externality effects. Only one new feature was discovered which was not additional, but rather compensation to the missing compatibility of OOo and MSO. Soon after the end of the pilot project the employees returned to the previous solution.
Knowledge barriers – extent of experience	As expected in the framework described in D 3.1: There was a lack of relevant knowledge. This is true not only for the regular employees of the PA, but also for the IT department members.
Top management championship	Partially supports literature expectations. The management provided strategic support to the OSS experimentations as they approved on paper the participation of about 80% of the employees. However the approval was not a leading factor for the employees' active involvement. Much bigger factor was the users' awareness of the positive consequences of the migration for the PA and the citizens.
Extent of coordination	Supports expectations. The promotion of the OOo by the IT staff and their positive attitude to possible migration influenced a lot on the positive attitude also of the other employees. It reflected as a willingness on the part of the participants to make the effort to learn a new tool. Cooperation between employees and the IT staff was noticeable. Mainly the increased communication had the goal of sharing ways of solving common problems.
Sophistication of IT infrastructure	Does not support previous expectations. The PA had a relatively simple infrastructure, especially considering employees' workstations participating in the experimentation, which often have similar software installed. The introduction of OOo brought sophistication for the IT staff in terms of more products to support and maintain and at the same time to the regular employees who had more ways for doing the same task. Nevertheless the switching was accepted easily. It was promoted in a centralised manner by the IT department to the top management, and after approval, down to the other employees.

Table 17: Summary of Assimilation Factors in SK

6 Province of Pisa (PP), Italy

6.1 Application of the Framework in PP

The services provided by the Province of Pisa have changed during the last 10 years following the strategic program of expansion to give more competences to an intermediate structure between the Region and Commons. The province is very active in technology transfer. Since 1999 PP has been receiving funds from the Italian Ministry of University and Research for a project called SITI. SITI has been the support project to the GIS technology development for the territorial information system. The objectives of the project are to consolidate the technological resources and the skills in this field, the sharing of the DBs, the development of specific agreement protocols, and the activation of specific projects in GIS.

PP started its participation in COSPA in 2002. Within COSPA a pilot project was conducted, aiming to introduce OpenOffice.org inside their software domain. This project was two-fold: in conjunction with OpenOffice.org acquisition, PP started a wide-range migration towards Open Source software, which led to the implementation of several applications, some to support OOo acquisition (like DocTransformer, described further), and to fulfil new requirements coming from the evolution of their ICT infrastructure. In the latter case, this mutated attitude led to the use of as much software with an Open Source license as possible, eventually developing in-house extensions, rather than choosing a commercial product.

OOo experimentation involved all IT members and a significant part of staff (nearly a fifth of the total employees). The participants were chosen on a voluntary basis, in order to embrace the change without suffering from a self-formation process they were pressed to complete.

The COSPA experience represented for PP a chance to apply previously planned political choices, in order to improve OSS presence inside their production environment. The migration would lead to general benefits in cost reduction, in sophistication of services offered to internal staff, for local software companies involved in customization of OSS, in advertising PP skills, letting citizens know how many benefits PP had obtained from this process.

The following table represents the current situation of OSS assimilation within PP.

OSS Product	Date of Acquisition	Current Level of Assimilation	Date of Current Level Achieved (# months)
Desktop	2002	Awareness/Interest (installed on 20% of the PCs)	2002 (3)
Server	2001	General Deployment (on 100% of the PCs)	2001 (3)
Office Automation	2002	Limited Deployment (on 60-70% of the PCs)	2003 (12)
Thunderbird	2005	General Deployment (on 80% of the PCs)	2005 (3)

Table 18: Assimilation of OSS within PP

6.1.1 Organization Age, Size, Industry Type

The administration of the province of Pisa is quite an old public administration with about 600 employees, of whom about 120 participated in the COSPA project. The IT staff consists of 6 people and all of them participated in the OSS migration experimentation. It can be classified as a middle size unit by the country's standard and is VPA-T4 according to COSPA

classification (D 3.1). The PA's main activities are monitoring and management of the territory, road networks management, education and training, together with the coordination of small entities.

6.1.2 Strategic Investment Rationale

The PA of Pisa has taken a political decision not to be bound to only one proprietary software supplier. This led to the choice for migrating to OSS. It also strongly influenced the willingness to invest not only in the training of the employees, but also in the in-house development of open source utilities that will be provided to the OSS society and which services will be offered to the citizens. After the initial in-house developed tool, the development of another one followed, that allowed automation of certain tasks within the organization.

Choosing the appropriate software to which to migrate is an important and in certain situations difficult and time-consuming step. However, for the Province of Pisa it took a relatively short time to choose the appropriate products, as some of them were requested by COSPA. At the same time security and reliability issues were also crucial for decisions related to migration, mainly for the server side software. On small number of computers an Open Source solution was installed as operating system, namely Fedora. However the larger move was the deployment of OpenOffice.org to a large number of PA workstations – 120 PCs. Meanwhile also a new e-mail client was installed for all participants in order to start the introduction of a groupware suite. All products were tested for about a month before starting the mass installation.

The installation process was done partially (40%) by external experts. The rest was split between IT staff (30%) and other employees (30%).

The migration neither involved upgrades of the hardware, nor needed to change the infrastructure in any way. Still there was an integration process for some of the applications installed. Meanwhile the migration required the development of an in-house tool – DocTransformer (described below), which is also offered to the citizens as a services and that was provided to the Open Source community.

Considering the legacy issues it should be also mentioned that the software houses owning several pieces of legacy software accepted Pisa's request to use OpenOffice.org formats in future releases.

6.1.2.1 Desktop Operating System – Fedora

For the desktop systems Fedora was chosen and the time needed to do the choice was one month. The Linux-based desktop operating system is installed on dual-boot machines, which prevalently are used in their Microsoft Windows configuration due to users' choice. This choice was due to the need to use Microsoft software (especially Office suite) which is unavailable under GNU/Linux environment. Also, inside PA they use some critical legacy system for workflow tasks that can only run on Microsoft systems, which is why GNU/Linux systems are in practice rarely used.

Considering installation times for the five desktop systems on which Fedora was installed a total of 15 hours were spent (i.e. three hours per installation). In this case there was no need for any integration with legacy systems.

6.1.2.2 Desktop Applications – OpenOffice.org

OpenOffice.org was requested by COSPA as an office automation tool, so its choice took about a week. Inside COSPA Project, this software has been introduced, with a good level of penetration among staff. Its introduction has been a strong help to enforce the PA's policy about Open Document formats. It may be said that only a small minority of documents in use inside the PA's dynamics are in a closed format. This is obtained also thanks to the PA's firm requests to its software suppliers to support in every case open standards.

For the installation on the employees' PCs two hours were required for each OpenOffice.org installation. Such installations were done on 120 workstations, and for OpenOffice.org were done mainly by the users themselves.

6.1.2.3 Mozilla Suite (Firefox, Thunderbird and Calendar)

Also for choosing the Mozilla Suite with the Firefox, Thunderbird and Calendar about a month was needed. Criteria for choosing these applications were the easiness of use and the intensive support of a big community which is available. However the Mozilla Thunderbird, Firefox and Sunbird testing required a bit more extensive period than the other products – 3 months.

The PA has decided to adopt the Thunderbird email client, to substitute Qualcomm Eudora, in order to start the introduction of a groupware suite. At current state, only Thunderbird is in production environment. Thanks to the freedom allowed by its license (Mozilla Public license), PA executive staff decided also to develop an extension for this program, able, in its first release, to convert an attachment in a closed format into an open one. This service relies on an open source tool that was also developed within the PA of Pisa (i.e. DocTransformer described below).

The installation of the Mozilla Suite was done by the IT staff and took one hour for each installation (120) in total.

6.1.2.4 Server Applications

One week was enough for choosing the server side OS, namely RedHat and a number of reasons eased the choice. Oracle constraints, the fact that RedHat was requested by COSPA, together with the reliability and the security of this solution were in its favour.

Considering installations, which were 11 in total, one day was needed for each server plus 4-5 days were spent for integration. Summing up 11 days were spent for installations and about 50 days for integration.

6.1.2.5 In-house developed applications (Calendar)

A specific application was developed in-house using Open Source technologies, which allows users to know rooms' availability inside PA's buildings.

6.1.2.6 In-house developed applications (DocTransformer)

With the introduction of OpenOffice.org at the beginning of COSPA activities the staff inside the Province of Pisa was split into two parts: OpenOffice.org evaluators and the rest, which did not have it on their PCs. To allow the whole staff to start moving to an open document format in an easy way, PA's executive staff decided to develop internally a web application. The needed functionality was to convert the attachments in a Microsoft Office format into an

OpenOffice.org one. The creation of this ad-hoc add-on took three months.

DocTransformer is a web application which converts documents in a closed source format into an open one. At current state, it is able to deal with Microsoft Office formats, transforming them into OpenDocument ones, or to Portable Document Format (PDF). As this is a public service, it gives a strong support to communications coming from and going to the PA, as a citizen can easily transform a document for PA into an open format, even if he can not rely on OpenOffice.org, for example.

DocTransformer capabilities are also exploited by the Mozilla Thunderbird plug-in mentioned.

This tool, with OpenOffice.org described above, permits a strict policy inside PA, of avoiding as far as possible any use of documents in a closed format.

6.1.3 Increasing Returns to Adoption

For the current experimentation about 120 workstations were used, but the Province of Pisa has about 600 PCs. The expected savings, in such a sense, are quite large. The migration experiments show that it does not bring any additional costs. Actually some savings were encountered due to a change in decision-making strategy inside the PA. In fact, there is now a different approach to solutions evaluation in which Open Source solutions are considered earlier and in more detail than the closed source solutions. Before, the PA just evaluated commercial software in case of a new acquisition, instead now they just look for a solution in the free/open source market before in the commercial one.

The level of satisfaction of the personnel with the solution might be defined as partial satisfaction. Some employees still prefer using Microsoft Office as they claim it to be more efficient with it comparing their work with OpenOffice. However, the users and the IT staff are completely satisfied by the server-side software and Mozilla Thunderbird. Also a new functionality was discovered and positively accepted. Namely, this is the use of a corporate calendar that was not known to the users before, due to use of Qualcomm Eudora where such feature is not supported. However some features that were available in Microsoft Access application were missing and brought certain inconvenience.

6.1.3.1 Giving Back to the OSS Community

The Province of Pisa developed an open source tool for transforming documents from Microsoft to PDF or Open Standards formats. The tool is called DocTransformer (<http://www.provincia.pisa.it/doctransformer/>) and is provided online as a service for the citizens and also as source code to the Open Source community. A more detailed description is available in the previous section.

6.1.4 Knowledge Barriers – Extent of Experience

In the initial phase of the COSPA project all IT personnel (15 people) were partially trained and ready to use Open Source software. However, experience and qualification was gathered by using mailing lists and forums. For this, one hour per week in a period of three months was used. Additionally, about 800 hours in total were spent on self-guided learning of the IT staff for the server-side software.

Similarly, for the rest of the employees (i.e. the ordinary staff) training/learning of OpenOffice.org consisted mainly in self-guided learning, supported by an internal forum and

phone calls to IT staff. Administration assigned more or less 30 hours a week to staff to learn how to use the new software. The time spent by IT and experimenters on internal community tools to ask and give support was one hour per week. Some of the ordinary staff people helped IT staff in this task. Both groups of employees had access to news on the internet. Part of the employees (12-15 people) had a one-hour personal demonstration made by an external senior consultant on OpenOffice.org. On the other hand for the Linux Desktop 4 people had a three-hour personal course again made by an external senior consultant.

At the start-up phase of the migration from proprietary to Open Source software, the province of Pisa needed external consultancy for certain products. More precisely, at the start of the migration to OpenOffice.org one junior external consultant was hired for the installation and to help with the first formation of insights, as mentioned above. Meanwhile, a senior consultant was available online and helped in the individual formation. The same strategy was adopted also concerning Linux desktop solutions – one junior external consultant for the installation and the first educational steps plus one senior consultant online for further help and training. In this manner the number of IT personnel did not change due to the migration process.

Considering the personnel attitude to OSS it should be mentioned that generally people were happy with the migration. Both in IT and in the user group there were many people wishing to improve their skills. Moreover there is a strong attention of the staff on contributing to an improvement process involving PA, to emphasize their role into society, to lower total costs and a rationalization in PA organization, which also had influence on the positive feelings once involved in the COSPA project. Also at a later stage of the migration the feelings are generally good, with smaller peaks of people enthusiastic or unsatisfied.

6.1.5 Top Management Championship

Currently the use of OSS is not much supported by the management. Under the previous management, there was great interest in such thematic. This fact certainly influences the utilization of OSS by the management – at this time only some Directors, Assessors and some of their staff explore this possibility.

6.1.6 Extent of Coordination

In the PP a certain advertising of the possibility to use OpenOffice within the COSPA framework was done by the IT staff and the IT management. However, the PA users have a lot of freedom to accept their proposals or not. As mentioned for the COSPA experiment part of the employees on a voluntary principle formed a group of evaluators of OpenOffice. About 30% of the evaluators installed OpenOffice by themselves. As IT management introduced OOo in a voluntary group, they were motivated to use it and to partially self-learn the functionality of OOo, while also having a senior consultant reachable to every user by phone to ask for specific support.

With the introduction of the new software solution an increase of the communication between the Province of Pisa's employees could be noticed. Thanks to adoption of a specific mailing list and intranet services, it is possible to notice an improvement in number of communications, which exchange OSS experience to help each other. Communication with IT staff, however, might be considered comparable to the one prior OSS adoption, but IT staff is actively involved in mailing list and intranet services. The staff also started to communicate more often with similar departments of other institutions, but in an

informational level more than in technical experiences.

6.1.7 Sophistication of IT Infrastructure

In the PP the IT department has the responsibility of searching for proper software, acquisition and offering the solution to the final users. However, the users have the freedom, up to certain extent, to decide which solution best fits their needs. This freedom is given to every user, thus the IT staff is actually fulfilling the request for an internal client, more than placing policies for the installation and usage of software in PP. In this sense the infrastructure is not very sophisticated. It is rather centralized, with the IT department supporting all the users, but also giving the users a lot of freedom. IT staff was prepared to deal with the new software, as it participated into mailing lists/forum activities and by phone; there was moreover a senior consultant reachable for every user by phone to ask for specific support.

Important to mention is the fact that the IT infrastructure became more sophisticated because of the introduction of OSS.

6.2 Summary and Conclusions PP Case Study

Table 19 summarises the manner in which the assimilation factors discussed above either facilitated or impeded OSS deployment in PP.

Factor	Effect Found in the PP Study
Organization age & size	Does not support predictions. Though the PA of Pisa is a rather old organization the political decision not to be bound to only one supplier led to the choice for migrating to OSS. Organization age factor supports the prediction. As a small organization there were not many people ready for the OSS usage. Only the IT staff was partially prepared to use OSS. Training was needed for all the personnel.
Industry type	Supports prior research prediction. PP has been to the fore in adopting Open Source software, primarily to promote the usage of Open Data Standards in the relations between citizens and PAs. It is also part of a strategic movement of all PAs in Italy and in the EU in general.
Strategic investment rationale	Supports the previous experience. The main motivation for Pisa for deciding to migrate to OSS was a political decision, to adopt open standards to moving away from monopolistic attitudes from several suppliers. Therefore, top political management, which were dissatisfied by that situation, when they discovered free/open source software, asked IT management to start introduction of OSS inside PA IT services. Then COSPA and other projects arrived. Thus the possibility to use open standards in order not to be bound to only one supplier, was crucial for the decision to migrate. Investments were done for support by external experts and for integration, as the OSS technology was viewed as potentially beneficial. Investments were done also for training the employees and for in-house development of some office automation tools with OSS technology.
Increasing returns to adoption	Supports the prediction. A big part of the savings was due to omitted license costs. We can notice that the PA contributed to Open Source community with an in-house developed tool. DocTransformer was also made available to the citizens online.
Knowledge barriers – extent of experience	Supports previous research. Neither IT staff, nor the other employees were completely ready to use OSS and extension of knowledge was required. Mainly self-guided learning was used by the ITs that had previous experience with OSS, while for the other employees also guided training was required.
Top management championship	Partially supports expectations. The support of the top management was strong at the beginning of the experimentations, which influenced very positively on the migration. After a change in the management members the support is not strong anymore but this does not influence much the migration.

Extent of coordination	Supports prediction. The possibility to use OOo was introduced by the IT staff to the rest of the employees. Extended communication within the organization between employees is noticeable, provoked by the need to solve problems and share experience. Also in informational level communication increased with other institutions. Meanwhile, IT staff started much more active participation in mail lists and intranet services.
Sophistication of IT infrastructure	Does not support previous research. The IT infrastructure was rather simple and centralised, with the IT department proposing to the other employees possible software solutions. The IT staff found almost all needed information to launch the migration to OSS in mailing-lists and forums, so was rather prepared to embark the OSS assimilation. Users have the freedom to choose what best fits their needs. However this autonomy did not stand in the way of the migration, as a large number of the employees were volunteers for the experimentation.

Table 19: Summary of Assimilation Factors in PP

7 Törökbálint Nagyközség Polgármesteri Hivatala (TO), Hungary

7.1 Application of the Framework in TO

The PA of Törökbálint decided to participate in the experimentations with OSS mainly for economic reasons. The main objective was to decrease the IT costs in the long-term. The possibility of saving on licences, while at the same time continuing to use the available, rather old, computers, was crucial for the decision. For dealing with COSPA issues one manager joined the IT staff and was responsible not only for the technical tasks but for the whole administration the project. Shortly afterwards the Microsoft expertise was changed for FLOSS expertise. A large part of the employees participated in the migration process. The current levels of assimilation are presented in Table 20 below.

OSS Product	Date of Acquisition	Current Level of Assimilation	Date of Current Level Achieved (# months)
Desktop	July 2005	Limited Deployment	January 2006 (6)
Server	January 2006	Limited Deployment	March 2006 (3)
Office Automation		Limited Deployment	

Table 20: Assimilation of OSS within TO

7.1.1 Organization Age, Size, Industry Type

Törökbálint Nagyközség Polgármesteri Hivatala has a relatively young and small Public Administration with about 55 employees, organized into few departments often with only one or two people. All departments are at walking distance from each other. The IT department consists of only three people. More specifically, there is one person who helps in informatics-related purchases and manages supplies as occasions require; one person formats the strategic documents in part-time work (1 day/week) and another person is a system administrator in part-time work (2 days/week). At the initial phase of the experimentation the IT department increased by one person, who was dealing with all issues related to COSPA. After a certain period this person started to carry out the functions of the system administrator and the two positions were combined.

In general there are only three levels in the organization: notary and mayor; managers; and line employees. The services offered by TO include supporting local government, making by-laws, collecting local taxes and investigating for settlement. Employees are using rather old computers running Microsoft Windows. There is a network but it is mainly used for incoming and outgoing communication, not for internal communication within the PA. Files are exchanged using floppy disks. Two servers are used, but users do not have access to a network file system.

7.1.2 Strategic Investment Rationale

TO decided to participate in the COSPA project for economic reasons. The fact that European funding would cover most of the costs was a very important factor. The main objectives of the migration to OSS and ODS in TO are to reduce the costs of ICT services over the long term. Considering this certain investments were made, mainly in terms of time for choosing the necessary software solutions and in their installation on the employees' machines.

The choice for software to adopt was a long process especially for the Office Automation

tools. The initial experimentations were done on OpenOffice.org, however finally the TITAN framework was chosen (please see the detailed description below). For testing of the chosen software, namely for the desktop operating system, about three months were spent. For the office automation tools the test period is expected to start soon. On the server tests are being done continuously while building the various new services.

All the open source software was installed by the IT staff and a standard installation of the desktop operating system took approximately three hours per each PC. The server installation was more time-consuming and was estimated at two days. As about 20 desktop installations and 2 server installations were done, it took to the IT personnel about half a man-month for this task. Continuously the IT staff has to solve additional integration issues, spending about 30 minutes a day. Henceforth the workers can use the help desk service by phone and in person. At the same time as the COSPA manager installs any software, he introduces it to the workers soon afterwards and gives the links to additional tutorials. This process also takes about 30 minutes a day.

Certain upgrades of both hardware and infrastructure were performed in TO during COSPA. Different sites were connected together with Ethernet and fiber optic and old computers were upgraded so that to have minimum of 256 Mb memory.

7.1.2.1 Desktop Applications – OpenOffice.org

The OpenOffice.org version 1 was used during the experimentation phase in the TO. However this version of OOo had some problems:

- compatibility with MS Office documents
- the unknown menu structure and solutions of formatting (but this structure and solutions was more logical compared with MS Office for COSPA manager).
- the need for duplicated storing (OpenOffice.org and MS Office formats) because of the most of partners are using MS Office as yet.
- the English help.

Fortunately, the new version 2 solved all this problems. Furthermore the workers more-or-less know the OpenOffice.org now.

The installation process was easy: The COSPA manager made an installation kit on a CD and intranet that contained the OpenOffice.org setup program, the official document templates used in TO and OpenOffice.org user manuals. Afterwards, the COSPA manager was running a batch file in Windows workstations. Every Linux workstation is also installed by COSPA manager. As UHU-Linux contains OpenOffice.org 1 only one bash script was needed to be run for upgrading OpenOffice.org to version 2, including the apt-get process.

Currently the user manuals are also accessible in the internal web server by all employees.

The OpenOffice.org migration was quite easy because of the COSPA manager had already been using it for a long time and knew it quite well. As macros are not used in TO the migration did not bring any troubles.

7.1.2.2 Desktop Applications - TITAN

TITAN is an office automation tool, developed by a Hungarian company Ritek Ltd. The company is owned by a Hungarian town council (Szeged). The goal of this software is to cover the e-government for local government, initially focused mainly on the functionalities

needed for Szeged town. TITAN is developed with OSS development tools and the running software is based only on OSS components: PostgreSQL, PHP, JAVA, Apache, Linux, OpenOffice.org. TITAN is built from different modules for different applications, each of them responsible for a specific functionality. It is a framework system with document management, security features, connected to the mail server and it has own portal for citizens. You can use TITAN across the internet even with a character-based web-browser (e.g. Links).

One year was needed to choose the TITAN framework that hopefully will be installed within this year (2006). It was chosen because there is a Hungarian development for local governments and the components are using OSS.

7.1.2.3 Operating System - UHU Linux and Ubuntu

The choice of software for the desktop operating system took less time – one month. UHU Linux 1.2 and XFCE were chosen mainly because of the existing support for the Hungarian language. The low cost and easy use and configuration, even on old hardware, also influenced the choice. For the server side temporarily UHU Linux 1.2 was chosen, which later will be changed to Ubuntu. Criteria for the choice were existing Hungarian language support, low cost, easy configuration and the opportunity the operating system gives to use old hardware. It took one week to select the server side software. The support provider was not important for the ITs so the type and the intensity of the support provided to the OSS were not a crucial factor for the choice.

7.1.3 Increasing Returns to Adoption

The PA has tried to involve as many employees as possible in the migration process, and the licensesavings are significant for the PA. At the same time it should be mentioned that certain additional savings were done. The planned change of all old PCs was cancelled as instead of the resource-consuming Windows-based solution Linux was installed. The saving was of about 280 euros per PC, which totals to more than €5,000.

However, the overall level of satisfaction of the personnel was partial. The positive aspect was the easy administration of the whole networked system, however there was missing the 100% compatible Windows API, which some Windows applications need. This was found to be a very important issue by the ITs, as easy administration needs all of PCs to be with a homogeneous operating system.

7.1.4 Knowledge Barriers – Extent of Experience

Before COSPA project's start neither the IT staff, nor the other employees were properly trained to work with Open Source software. As mentioned, for dealing with all COSPA issues the IT staff expanded by one new member. The IT staff training consisted in self guided learning of this person mainly from books and Internet sources. Everyday mailing lists and forums were used by this person for getting the needed information and it is a continuous process. He also participated in a few presentations on the related themes.

Considering the training of the rest of the personnel, generally they get information from COSPA manager directly and personally. They can also use the manuals which includes the translated COSPA presentations about OpenOffice.org. It is important to mention that generally the employees of TO are not using sophisticated functions for office automation, but rather the basic features of the software. Therefore they found MS Office and

OpenOffice.org rather similar and easy to switch.

For the introduction of OSS no need for external consultancy was required, neither did the number of existing IT personnel really needed to be increased. As explained above the COSPA manager assumed the functionalities of another IT member and thus substituted him.

However, the personnel were not happy with the change. The negative attitude was due to difficulties in the interpretability, and because of the need to learn new things without increase in the salary. The situation did not change with time – the employees are using OSS because they must, but they are still not happy with the forced change.

On the other hand the OSS is more eagerly accepted by the IT personnel, as they clearly see the advantages. For example they report that the with OSS the system administration is easier; the hardware lifetime is longer; building the whole networked system is easier, due to the absence of restrictive licences and the possibility to use the elastic and rich bricks.

It should be also mentioned that with the introduction of TITAN system, described above, courses that will continue for a few days will be provided to all employees and a continuous help-desk will be available from Ritek Ltd.

7.1.5 Top Management Championship

The migration process is supported by the TO management with the mayor approving the participation in the COSPA project. Also most of the leaders are using OpenOffice.org.

7.1.6 Extent of Coordination

The introduction to the functionalities and possibilities offered by the OSS were presented to the employees together with the installation of the software on their computers. The presentation was done personally by the COSPA manager in face-to-face meetings. During the testing and the migration period the employees started to communicate more intensively among themselves. As they had to learn new things they were helping each other. The communication with the IT staff also increased, because of the specific support provided for work with Open Source software. However the communication with similar departments of other institution remained the same as before COSPA.

7.1.7 Sophistication of IT Infrastructure

The IT infrastructure was rather simple before the introduction of OSS. The small IT team actually did not have the necessary knowledge for embarking on IT innovation. According to the IT staff the IT infrastructure became more sophisticated because of the introduction of OSS. The reason is that the IT administration can use SSH between Linux desktops.

7.2 Summary and Conclusions TO Case Study

Table 21 summarises the manner in which the assimilation factors discussed above either facilitated or impeded OSS deployment in TO.

Factor	Effect Found in the TO Study
Organization age & size	<p>Organization age factor operates as predicted. The organization is young and has accepted eagerly the experimentation with the new possibilities offered.</p> <p>Organization size factor also operates as predicted. Between the members of the small IT staff there were no people with the necessary qualification for the migration.</p>
Industry type	Supports previous research. The PA wants to move to OSS mainly for cost saving reasons, but also an important factor is the general movement to e-government and Open Standards.
Strategic investment rationale	Partially supports previous research. The strategic decision to participate in the OSS migration project was taken mainly due to economical factors. At the same time the other crucial factor for taking the decision was that the European funding will cover most of the costs. In other words the PA was not very eager to explicitly invest in the migration. However some investment was made for searching for alternatives, installation and training.
Increasing returns to adoption	Supports previous research. The main savings were done from licences, together with savings from hardware upgrades (for each computer). Thus the PA tries to accomplish the migration on as many computers as possible.
Knowledge barriers – extent of experience	Partially supports previous research. At the beginning neither IT staff, nor the other employees were trained to use OSS. It was necessary to hire a person with the relevant knowledge for the IT department. As the person was already familiar with the OSS, self-training was enough, though it is a continuous process. However the training for the rest of the employees was done only with small amount of face-to-face support and help-desk. Most of them are not using the sophisticated features but they are using the software at a basic level. Therefore they find features similar on both software types.
Top management championship	Supports previous research. The migration was supported in all top-management levels and this helped to overcome the initial resistance of the personnel to change their work tools.
Extent of coordination	<p>Supports previous research concerning the IT staff. Though the ITs were not OSS oriented, the employment of an OSS expert and the increased communication with him, reflected general change in the ideology, in the sense that the Microsoft expertise was replaced by FLOSS expertise.</p> <p>For the rest of the employees though this factor does not apply, because the employees were obliged to use the OSS.</p>
Sophistication of IT infrastructure	<p>Partially supports previous expectations. The PA had a relatively simple infrastructure, especially concerning employees' workstations participating in the experimentation, which often have similar software installed. The introduction of OOo brought sophistication for the IT staff in terms of more products to support and maintain and at the same time to the regular employees that had more ways for doing the same task. Nevertheless the switch was accepted easily. It was promoted in a centralised manner by the IT department and top-management to the other employees.</p> <p>Meanwhile, the simplicity of the IT infrastructure was the reason for the IT staff not having expertise in OSS. This was easily overcome with temporary employment of an OSS expert, who afterwards took the place of the previous system administrator.</p>

Table 21: *Summary of Assimilation Factors in TO*

Section Two: Survey of Facilitators and Inhibitors to OSS Adoption

As described above, the first phase of the research involved the derivation of a framework to study OSS adoption, based on assimilation theory. This initial framework was then validated through a series of in-depth case studies. This led to the model in Figure 1 below, which postulates a set of facilitators and inhibitors to OSS adoption. It is postulated in the figure that the facilitators are likely to increase the rate of OSS assimilation, while the inhibitors are likely to militate against it. This survey is discussed in more detail in Glynn et al, 2005.

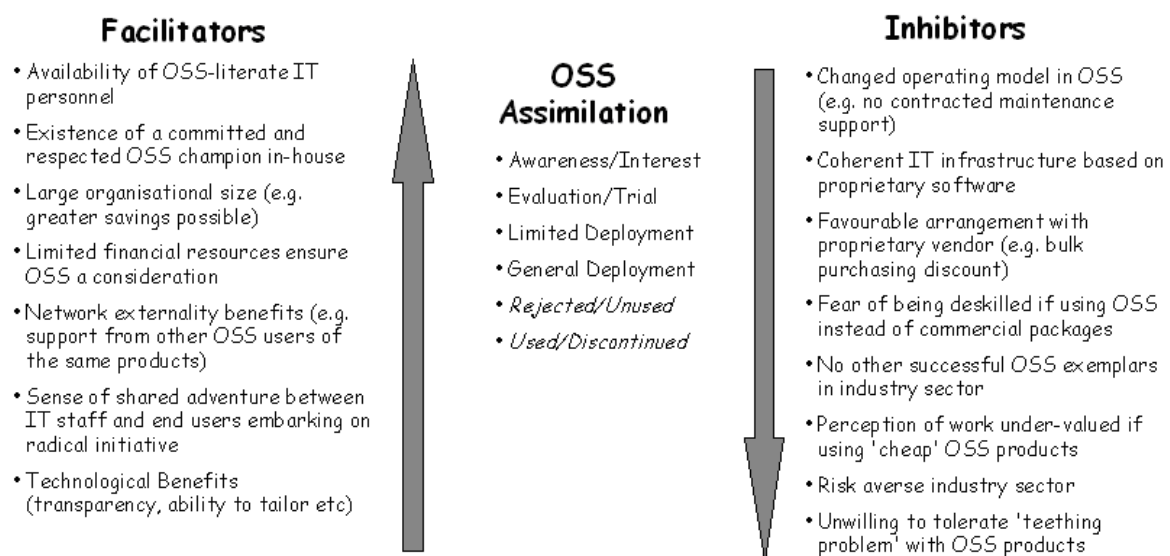


Figure 1: Facilitators and Inhibitors to OSS Adoption

A questionnaire was then constructed based on this figure. As well as background demographic information, the factors underpinning each of the assimilation theory constructs were operationalised as a statement and respondents were asked to rate their agreement or disagreement with each statement on a 6-point Likert scale. The questionnaire was then pre-tested over several months prior to the survey. Using an overall population of more than 900 IT companies available from the National Software Directorate in Ireland, we derived a representative sample of organisations, for whom a named individual responsible for the IT function was available to us. This resulted in a total sample size of 350 organisations. We received 111 usable responses, which represents to a response rate of 32%, which is actually quite high for surveys in this area.

Given that the questionnaire involved a good deal of nominal or categorical scale data, non-parametric methods for testing statistical significance were the most appropriate. However, even where the data involved interval or ratio scales, there are certain conditions with respect to normality of distribution and homogeneity of variance which need to be satisfied before parametric tests are appropriate. An inspection of the findings revealed that the requisite conditions with respect to normality (Kolmogorov-Smirnov test, $p < .001$) and variance were not satisfied for most factors. Furthermore, given that these tests were being carried out on

sub-groups of a relatively small sample, non-parametric tests for contingency analysis and analysis of variance were used.

The issue of non-response bias was investigated through the use of late respondents as surrogates for non-respondents, and comparison of a random sample of these late responses with a random sample of 'normal' responses (Wallace and Mellor, 1988). This analysis revealed that the only questions on which the late respondents differed significantly from early respondents was in relation to extent of experience with OSS and extent of deployment of OSS with late respondents scoring lower in these categories. This indicates that late respondents were less experienced in OSS and less committed to OSS deployment. Thus, if late respondents are reasonable surrogates for non-respondents as suggested, then it appears that the non-respondents were less likely to have adopted OSS and hence would be less relevant to our survey.

8 Analysis of Survey Responses

8.1 Demographic Factors

As can be seen from Table 22, respondent organisations represented a wide range of industrial sectors, with the largest numbers coming from the Consultancy/Software House category (61%). In terms of organization size, the largest cohort was the 21-to-100 category with 30%. In terms of length of experience with OSS, 69% had between 1 and 5 years experience, with 7% of respondents having more than 5 years experience of OSS.

I.Business Category		No. of Employees	
Constr/Manuf/Distrib	4%	1 to 5	22%
Consultancy/Software House	61%	6 to 20	21%
Wholesale/retail trade	2%	21 to 100	30%
Finance/insur/real estate	3%	101 to 500	11%
Govt/pub sector/education	10%	501 to 1000	3%
Service/communications	9%	1000+	13%
Other	11%		
Length of OSS Experience			
Less than 1 year	24%		
1 – 5 years	69%		
Greater than 5 years	7%		

Table 22: Demographics of Respondent Organisations

We analysed the extent of adoption of OSS by industry sector, organisation size, and length of experience with OSS. The results suggest that the consultancy/software house and service/communications sectors have gone furthest in relation to OSS adoption. There has been limited deployment of OSS in the government/public sector category. Also, larger organisations were more likely to achieve general deployment of OSS, which ties in with the increasing returns that can be gained by adoption of OSS in large organisations.

8.2 Analysis of Facilitators and Inhibitors of OSS Assimilation

As can be seen from Figure 1 above, we have derived a set of factors which may be posited as 'facilitators', in that they are likely to increase the assimilation of OSS, and 'inhibitors' which are more likely to impede the assimilation of OSS. These effectively represent a set of independent variables that influence the dependent variable, OSS assimilation. In this study, we asked respondents to rate the level of OSS assimilation achieved in relation to OSS

adoption, as per the scale in Table 7 above. Initially, we sought to investigate whether some of these variables might be inter-correlated as this could lead to potential problems with multi-collinearity when forming the eventual model. Thus, we calculated the Spearman rank correlation coefficient for all pairings of independent variables. Spearman rho values in excess of .7 indicate variables which may be multi-collinear and which require further analysis. All variables were well below the .7 value apart from one pair of variables: *Staff resistance due to fear of being deskilled if using OSS instead of commercial packages* and *Perception of work under-valued if using 'cheap' OSS products*. These variables seem indeed to be related, although they had been identified independently by different staff in different work situations within Beaumont. To further test this pair of variables, we performed a chi-square test for independence and calculated Cramer's v to measure the association between the variables. The chi-square value of 171.699 and the Cramer's v value of .622 confirm a strong association between these variables (a Cramer v value in excess of .5 indicates a strong association). Thus, it suggests that only of these variables will be necessary in the final model.

Again, the assumptions that would be required to allow the use of techniques such as linear regression were not satisfied by the characteristics of our data set as discussed above. Given that all the other variables seemed to be independent of each other, we performed bi-variate correlations on the set of nine facilitator variables and the set of eight inhibitor variables. The results are presented in Table 23 and Table 24 below. Table 23 identifies the variables which correlated most significantly with OSS assimilation at the .01 level of significance. The correlation coefficients are quite high, ranging from .324 to .382. The technological benefits of OSS emerged as the most significant facilitator. Access to source code has been identified as the critical enabling factor for OSS. Organisations may see access to source code as a way of adding desired functionality, and removing dependency on a software vendor. The importance of availability of OSS-literate IT personnel was also highly significant. While, studies of total cost of ownership (TCO) of OSS have been ambiguous to say the least, training of personnel is one of the biggest cost factors in these studies.

The importance of top management support also emerged as an important variable. Indeed, top management support is likely to become even more important in the future as OSS adoption moves out of the domain of invisible infrastructure systems to visible, high-profile desktop systems, and overall IS infrastructure. Personal support for OSS ideology was also found to be an equally important variable. Thus it appears that the charisma and drive of an OSS champion may be a significant factor influencing OSS adoption. The remaining facilitators (*Limited financial resources ensure OSS a consideration* and *Sense of shared adventure between IT staff and end users embarking on a high profile radical initiative*) were not found to be significant even though these had been identified as extremely important in the Beaumont case study. Finally, the expectation that OSS adoption might be easier due to large organisational size was in fact found to be negatively correlated with OSS assimilation (although not significantly so). This is somewhat surprising as larger organisation would see to have more to save through the deployment of OSS in per-seat license savings. Also, given that large organisations have large IT departments often, one might expect that they would be more likely to have an available pool of OSS-literate IT personnel. However, it is also the case that large organisations are likely to have advantageous agreements with proprietary software vendors, one of the inhibitors discussed below.

Work Package 6, Deliverable 6.1 - Report on cost/benefits evaluation

Variable	Spearman Rho
Technological benefits of OSS outweigh its disadvantages (e.g. ability to tailor to precise needs, transparency)	.382**
Availability of OSS-literate IT personnel	.363**
Top management support for OSS adoption	.332**
Personal support for OSS ideology	.332**
Network externality benefits from OSS (e.g. availability of extra functionality developed, or support from other OSS users of the same products)	.327**
Existence of a committed and respected OSS champion in-house	.324**
Limited financial resources ensure OSS a consideration	.155
Sense of shared adventure between IT staff and end users embarking on a high profile radical initiative	.017
OSS adoption is easier due to large organisational size (e.g. greater savings possible)	-.121

Table 23: Influence of Facilitators on OSS Assimilation
 **Correlation is significant at the 0.01 level (2-tailed).

Table 24 below presents the analysis of the inhibitors on OSS assimilation. As can be seen from the table, all the correlations are negative as expected, with a number appearing as quite significant (.317 to .573). The most significant correlation emerged in relation to the perception of work being under-valued if using 'cheap' OSS products. The next most significant factor was that of the change of operating model implied by OSS, that is the departure from the normal model of maintenance supplied by a vendor under contract. Also, the fear of deskilling if not au fait with popular proprietary packages appeared to be quite a significant inhibitor. The lack of a successful exemplar of OSS adoption in the respondent industry sector also appeared to be an important inhibitor. This confirms the importance of the 'me too' phenomenon, and may also reflect a lack of pressure from organisations to experiment with OSS if competitors do not do so, as they do not have to worry about possibly losing some competitive advantage that may arise from OSS deployment. Staff also seemed unwilling to tolerate the temporary inconvenience that might arise through the deployment of new technology. Another significant inhibitor seemed to occur when an organisation had a favourable arrangement with a proprietary vendor (e.g. bulk purchasing discount). A similar factor, that of the existence of a coherent, stable and planned existing technological architecture, was also found to militate against the adoption of OSS. The final inhibitor, that of an organisation being in a risk-averse sector, was not found to be significant. Thus the argument that risk averse organisations might not embrace the type of risk involved in OSS deployment was not supported.

Variable	Spearman Rho
Perception of work under-valued if using 'cheap' OSS products	.573**
Changing operating model to OSS might be problematic (e.g. no contracted maintenance support)	.525**
Staff resistance due to fear of being deskilled if using OSS instead of commercial packages	.498**
No other successful OSS examples in the industry sector	.446**
Staff unwilling to tolerate 'teething problem' with OSS products	.380**
Organisation has a favourable arrangement with a proprietary vendor (e.g. bulk purchasing discount)	.374**
Current IT infrastructure coherent and based on proprietary software	.317**
Organisation in a risk averse industry sector	.089

Table 24: Influence of Inhibitors on OSS Assimilation
 **Correlation is significant at the 0.01 level (2-tailed).

Section Three: In-Depth Case Studies of TCO and Migration Costs

This section presents the application of the framework on migration costs defined in D3.1. It reports analogies and differences among the different PAs. Following existing literature ([Winslow, 2004], [Gartner, 2003], [Linux ROI]), costs are divided in four macro categories: 1) Software, 2) Support, 3) Learning/Training, and 4) Staffing. In each cost category, we highlight the presence (if any) of hidden cost.

Existing cost models usually capture specific perspectives of cost analysis. Our approach (Deliverable D3.1) focuses on surfacing intangible costs. Intangible (hidden) software costs are often neglected, specially when there are no costs for licenses, which may lead to the wrong conclusion of zero costs of ownership. Namely, other unforeseen costs can appear in the long term.

This study contains and presents data collected through different means: questionnaires, interviews, and objective data gathered by PROM¹². Administrating the questionnaires was not straightforward. To get the best quality for our data we visited each interviewee explaining the meaning of the questions - in particular giving examples of hidden costs they might have incurred during the migration.

Table 25 summarizes the total costs of migration for the PAs we have monitored. We have broken down costs into subcategories and highlighted their intangible part. Subcategories labelled as intangible include costs that are hard to budget and compute. For example, in the category *Software* the item “pilot projects” is considered intangible. Often, a pilot project requires the use of spike solutions and new technologies to be tested on the fly. These costs are often not foreseen. Another example is in the category *Support*. The costs for searching alternative solutions or documentation are always considered intangible [Shapiro, 1999]. The category *Training/Learning* contains most of intangible costs. For example, except the annual regular training, in a transition there are other types of training, like peer support or ad hoc training. Also the category *Staffing* has often a large percentage of hidden costs. For example, when an employee, whose tasks concern regular maintenance, is used to migrate to or introduce new IT solution, part of his salary might be considered as hidden cost for a transition: if no migration were ongoing he/she would have performed different tasks. Employees extra hours and bonuses might be budgeted and thus are tangible cost. However, incentives are often not budgeted - the staff might be reimbursed for the extra effort during the migration with free hours or other not budgeted bonuses. For example, the employees might be allowed to participate to a conference abroad, that is certainly an intangible cost.

Table 25 reports the categories we have worked out from the template in deliverable D3.1.

¹² PRO Metrics is a tool to collect in an non-invasive way data about time and document types worked daily in a PA (D4.2).

Cost category	Cost	Intangible?
Software	Pilot projects	Y
	Data conversion tools	
	Interfacing to legacy software	
	Software add-ons	
	Security tools	
	Upgrades	
Support	Search for alternatives	Y
	Search for documentation	Y
	Data compliance	
	Search for new support contracts	Y
	External support fees	
Training/Learning	IT personnel training for the new solution	
	IT personnel self-learning	Y
	Employees' training for the new solution	
	Employees' self-learning	Y
	Lack of productivity	Y
Staffing	Employees extra hours and bonuses*	
	Salary of temporary employees	
	Installation and deployment	Y
	Overheads and bonuses*	Y

Table 25: Migration Cost Categories

* The bonuses in the two categories differ. Depending on the cause of the cost the bonuses might be tangible (as the first is one) or intangible (the second). See also the examples on the previous page.

Costs of a migration are volatile – either intangible or not. They are directly due to the dynamic process of migration – for example, the hiring of temporary personnel allocated to the transition. They give insight on the effort and resources that managers need to invest to migrate to an Open Source solution. Generally speaking, these costs do not include any maintenance effort. In D3.1 we have clearly separated volatile costs (migration costs) and ownership costs (maintenance, initial costs of acquisition, etc.) as they have a different nature and respond to different needs. A comparison based on ownership costs is hard as is based on a at least five years of monitoring of each software solution. A comparison between initial costs such as licenses costs is instead little significant as initial costs are biased by time variables.

For these reason, our model is more detailed for the costs of migration than to the ownership ones. Nonetheless, we report them to complete the overview of our case studies.

We have compared the cost of ownership of the open and the comparable closed solution, collecting the data in the following categories of costs (Table 26).

Cost of ownership	Open Source Software Solution		Comparable Closed Source Software Solution	
	Initial Cost	Annual Cost over 5 years	Initial Cost	Annual Cost over 5 years
Acquisition (licences)				
Updates				
Upgrades				
Software add-on				
Security (explore vulnerability)				
Maintenance (internal)				
Maintenance (support contracts)				
Consultancy				
Salary of employees				
Employees' regular training				
IT staff regular training				
Lack of productivity				
TOTAL				

Table 26: Migration Cost Categories

For every PA, we present our model with tables and charts describing the breakdown of costs into the categories and highlighting the hidden component of them.

9 Findings about Costs

In the current section we summarize our findings and conclusions on the impact on costs of the transition towards OSS in the COSPA PAs. We present the costs in two ways according to our assumptions: migration costs and ownership costs. The costs of ownership are divided into initial costs for acquisition and annual costs calculated over a five years period. The costs of ownership strongly depend on the proprietary software and the OSS alternative chosen. On the other hand the migration costs are split into the four categories described above. Table 27 summarizes these migration costs within each PA.

PA	Software (€K)	Support (€K)	Training/Learning (€K)	Staffing (€K)	Total (€K)
	Tang. Intang.	Tang. Intang.	Tang. Intang.	Tang. Intang.	Tang. Intang.
SGV	€39.5K 82% 18%	€82K 40% 60%	€292.5K 92% 8%	€246K 0% 100%	€660K 51% 49%
Extremadura	€0 -	€680K 26% 74%	€180K 100% 0%	€100K 100% 0%	€960K 48% 52%
PP	€99K 96% 4%	€32.5K 77% 23%	€61K 0% 100%	€7K 0% 100%	€199.5K 60% 40%
SK	€0.01K 100% 0%	€0.83K 28% 72%	€3.07K 27% 73%	€0.075K 0% 100%	€3.985K 27% 73%
TO	€20K 0% 100%	€53K 62% 38%	€233.5K 57% 43%	€33K 0% 100%	€339.5K 49% 51%

Table 27: Summary of the PAs Migration Costs by Category

In the table the migration costs for BH are missing because the transition was done before the beginning of COSPA project and the costs of migration were not completely significant. In the table the costs are given in totals and depend on the organization size (number of computers and people involved in the migration). Therefore, bigger PAs (SGV and

Extremadura) have total costs much bigger than the smaller ones (SK, TO). They also depend on the country standards, as many calculations are based on the average salaries of the IT staff and the other employees within the PA.

As mentioned previously all migration costs were split into subcategories and tangible and intangible costs are analysed. The amount spent in each category and the shares of hidden costs (shown in Table 27) depended strongly on the PA strategy for the migration. In SGV, for example, the biggest share of hidden costs falls in staffing category, while the training/learning expenses were mostly tangible. This is because SGV allocated mainly internal personnel to manage the migration process, but at the same time recognized the high importance of training and included it into the annual cost balance.

Training and learning appear to be the biggest expense in three of the cases shown in Table 27 - SGV, SK and TO. It is on the second place for the other two – Extremadura and PP. In Extremadura the expenses for support were bigger, as the local government took the cautious strategy of planning, selecting, and customizing the OSS with the help of external experts. In PP, on the other hand, the expenses for support exceeded those for training, as in the PA many tools were developed to facilitate the regular employees' work with the new solution. Still the training costs are relatively high.

In SGV and Extremadura the training was provided mostly in a formal manner, i.e. through courses, thus the costs were mainly tangible. In the other PAs the training was mainly through self-learning and caused a big intangible share in the migration expenses.

One of the major issues concerning the cost of a migration is whether the utilization of OSS brings additional costs to the organization. Rephrasing the concept, we want to investigate whether the tasks and speed of work are performed as with the proprietary solution. Since COSPA focuses on office personal productivity we have monitored the use of OOo and MSO with the PROM tool. Table 28 summarizes our conclusions.

PA	Conclusions
SGV	<i>In SGV the migration to OpenOffice.org has been massive. The adoption has been not uniformly accepted, but a significant number of employees fully use the open solution. No extra costs and decrease of speed of work has been found with the use of OpenOffice.org. Tasks have been performed regularly.</i>
PP	<i>The use of OpenOffice.org in the Province of Pisa was extensive; the application was more tried than deeply used though. But, it was tried to perform usual office tasks. Comparing individual usage, the use of OpenOffice.org does not impact on the overall workload and effort of the daily office routine. No negative attitude toward OpenOffice.org has been detected.</i>
SK	<i>The pilot project for migrating to OpenOffice.org in PA of the City of Skopje showed very stable behavior in the employees' work. Moreover, the absence of a drop of OpenOffice.org usage towards the end of the period suggests that OpenOffice.org was quite capable in substituting Microsoft Office in the appointed tasks, whatever their complexity might have been.</i>
TO	<i>The analysis of the software usage in TO show that the general pattern of use is similar for the two applications and that the productivity is also comparable in the two cases. Since there were a significant number of switchers– users that utilized both products within the period that is analysed, meaning that users are actually participating in the experiment, we can also conclude that the use of OOo could not have a negative impact on the work of the organisation.</i>
BH	<i>Adoption of Open Source software started well before COSPA experimentation. Employees have gained some experience with open formats. The expert employees of BH work similarly and produce more documents with OOo than with MSO. Therefore no extra cost but perhaps an intangible return on the investment is experienced in BH. We found that Beaumont Hospital has still to maintain proprietary formats for the purpose of document exchange. As top management decision Beaumont Hospital is considering though to partially migrate back to proprietary software.</i>

Table 28: Conclusions from the Comparison of the Utilization of OOo and MSO

To conclude on the objective data we have speculated on the different types of migration (see deliverable D3.1) and the assimilation practices that have been used (section One).

Further in the document we also give more details on our analysis in each PA. A big part of the study, however, has not been included here in order to avoid intricacy. Nevertheless, our conclusions were done within the context of the migration to OSS in every PA. We have taken into account the description and the parameters of the assimilation, discovered by questionnaires and interviews and described in the previous sections.

In all the PAs we found no negative attitude towards the use of OOo. In some cases the employees were more trying OpenOffice.org then actually using it as a main tool (PP). In other PAs it was the main office automation application (BH).

Additionally, we have done an analysis on OOo users and MSO users excluding the ones that switch from one to the other application. The results are that the two groups of users have very similar working patterns, in terms of number of documents produced and time worked on them daily. This makes also the speed of work with the two solutions almost the same, thus we can conclude that the utilization of OpenOffice.org instead of MS Office does not bring additional costs to the PA.

Table 29 shows a summary of the ownership costs comparison for the OSS and closed source solution. Generally, the initial costs that are reported in the cost of ownership section differ from the migration costs. For example, in the migration process there are costs for comparing possible OSS solutions and finding appropriate documentation. Such cost does not appear in the cost of ownership for the chosen product, as it is possible that many possibilities are

evaluated, but only one was chosen for real adoption.

PA	Open Source Software Solution		Comparable Closed Source Software Solution	
	Initial Cost	Annual cost over 5 years	Initial Cost	Annual cost over 5 years
SGV	€240K	€170K	€800K	€144K
Extremadura	€1.140K	€270K	€6.000K	
PP	€7,1K	€3.4K	€25,6K	€2K
SK	€0,7K	€2,4K	€23,1K	€2,4K
TO	free	free	€31K	€11,3K
BH (phase 1)	€68K	€45K	€735K	€169,6K

Table 29: Cost Comparison of OSS versus Comparable Closed Solutions in the PAs

The total sum of the costs of ownership strongly depends on the size of the PA, i.e. the number of computers that are migrating to OSS and on the national standards and PA's budget. For example, a total saving of 22K predicted for SK is a very significant cut-off the PA's budget.

In most of the case studies we analysed there were significant one shot savings due to the absence of costs for licenses. Nevertheless, one should be aware that in certain cases the expected annual cost might be higher for OSS than for close source solution. For example, the cost of ownership predicted for SGV and PP are slightly higher in the case of OSS maintenance. Mosts of these costs are expected for server-side support, while the cost of office automation tools is commonly expected not to exceed the previous solution.

10 Consorzio dei Comuni della Provincia di Bolzano - Südtiroler Gemeindenverband (SGV), Italy

10.1 General Overview of the Migration

The migration of SGV to Open Source software started in 1998 with a server-side transition to the Linux Operating System. After a positive experience with Linux a wide migration of the existing office automation tools to Open Source alternatives has started in 2003, namely OpenOffice.org was installed. In 2004 a general deployment was achieved. In fact, after 2 years of usage about ¼ of the documents are already in OpenOffice.org format. Note that with OpenOffice.org documents can be opened and saved also in Microsoft Office format, while vice-versa is not possible.

Table 30 shows a summary of the migration costs and effort in SGV. Each category is afterwards discussed in more details.

Category	Intangible?	Effort (man/months)	Cost (€K)	Subtotal (€K)
Software				49.5
Pilot project	Y	3	9	
Interfacing to legacy software		3.5	10.5	
Software add-on		1	3	
Upgrades		9	27	
Support				82
Search for alternatives	Y	10	30	
Search for documentation	Y	6	18	
Data compliance		10	30	
Search for new support contracts	Y	0.5	1.5	
External support fees		-	2.5	
Training/Learning				292.5
IT personnel training for the new solution		2	6	
IT personnel self learning	Y	7	21	
Employees' training for the new solution		88	264	
Lack of productivity	Y	0.5	1.5	
Staffing				246
Installation and deployment	Y	82	246	

Table 30: Summary of the Migration Effort and Costs for SGV

10.2 General Overview on Hidden Costs

Figure 2 shows that most of the hidden costs occur in Support and Staffing, this is due to internal strategies for the migration in which the management has decided to allocate only internal personnel to manage the migration process and a considerable amount of time has been spent in searching documentation, suitable Open Source products, and external support.

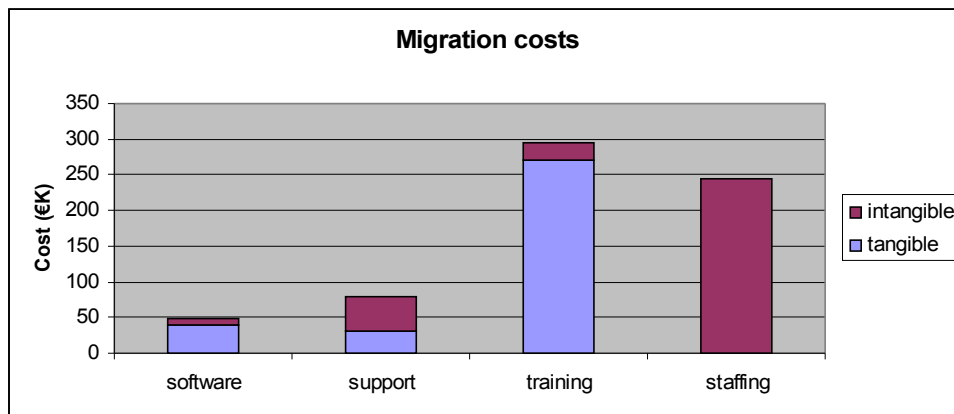


Figure 2: Tangible and Intangible Costs in SGV

On the other hand, almost all training costs are explicit. This happened because the management has recognized the high importance of training as a critical factor for a successful migration and has included this cost into the annual cost balance.

10.3 Analysis of the Cost by Category

Table 31 shows a summary of the migration costs and effort in SGV by software type.

Cost		Effort (man/months)			Cost (K€)		
		Linux	Open Office	Group-E	Linux	Open Office	Group-E
software	Pilot project	0,5	2	0,5	1,5	6	1,5
	Interfacing to legacy software		3	0,5		9	1,5
	Software add-on			1			3
	Upgrades	6	2	1	18	6	3
support	Search for alternatives	3	6	1	9	18	3
	Search for documentation	2	3	1	6	9	3
	Data compliance		10			30	
	Search for new support contracts	0,5			1,5		
	External support fees				0,5		2
training	IT personnel training for the new solution				2		4
	IT personnel self learning				14	6	1
	Employees' training for the new solution					264	
	Lack of productivity					1,5	
staffing	Installation and deployment				170	55	20

Table 31: Summary of the Migration Effort and Costs for SGV by Software and Category

10.3.1 Software

Before generally migrating to the chosen solutions, pilot projects were set-up for each of the three software categories. For the Operating System and the Groupware solution, the effort

for the pilot project was about 0.5 man-months and €1,5K each. For OpenOffice.org, on the other hand, it took 2 man-months and €6K. There were no costs for data conversion and security tools. However both time and money were spent for interfacing legacy software as shown below. In the case of Group-E there was a need to configure Pegasus (an e-mail client) to access to Group-E via IMAP protocol. For migrating to OpenOffice.org a conversion of existing applications based on Microsoft Office was required, especially the ones for the technical office and the decision management.

Only for the groupware (Group-E) additional costs appeared for add-ons. More concretely, these were €3K and 1 man-month effort. While this was one-time expense regular costs are expected in order to cover upgrades. Generally, such costs will appear once every two years or two years and a half. It is calculated for 238 servers on which Linux will run and about 3,000 PCs that are needed for the SGV employees on which OpenOffice.org will be available.

Certainly, other costs appeared caused by the introduction of Open Source software. For books and other training materials €1K was spent for Linux and OpenOffice.org (€0,5K each).

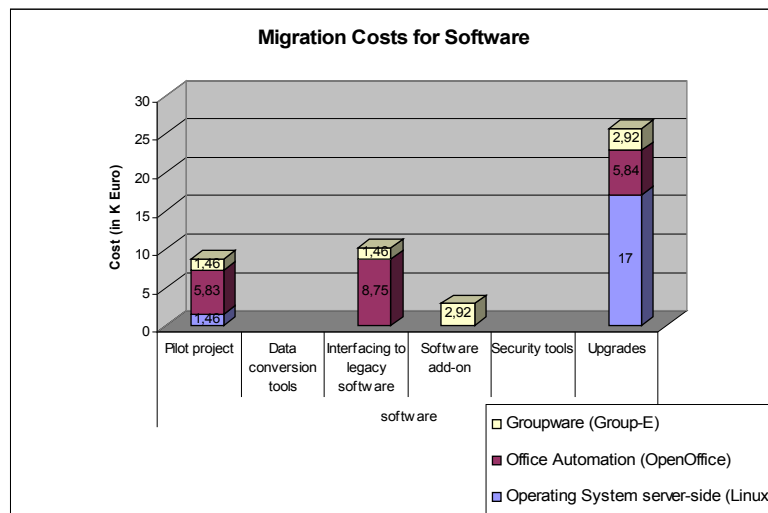


Figure 3: Migration Costs for the Software in SGV

10.3.2 Support

The migration process started with the search for alternative Open Source solutions to the used proprietary software and a comparison of the available options. This initial phase took in total 10 man-months and €30K. To be more concrete, for choosing the operating system for the server side 3 man-months and €3K were spent; for the office automation 6 man-month and €18K and for the groupware 1 man-month and €3K.

Searching for documentation for the chosen Open Source solution is sometimes quite time-consuming and, thus, implicitly influences migration costs. The estimated costs are as follows: the biggest share falls to searching documentation for OpenOffice.org - €9K, followed by the information related to the Linux operating system – €6K and, lastly, €3K for the Group-E.

Additionally, for achieving technical and data compliance and interoperability, expenses of €29K were added to the migration costs. They were spent as 10 man-months for the

conversion of the common documents (i.e. OpenOffice.org).

For some of the chosen open source packages external support was necessary, namely for the Linux and Group-E the reported cost is €2,5K. Furthermore, a 0.5 man-months and €1,5K were spent for searching for new support contacts considering Linux operating system and the final choice was a one year support contract for SUSE. For the groupware solution the support is provided by Group-E developers - Endo7¹³.

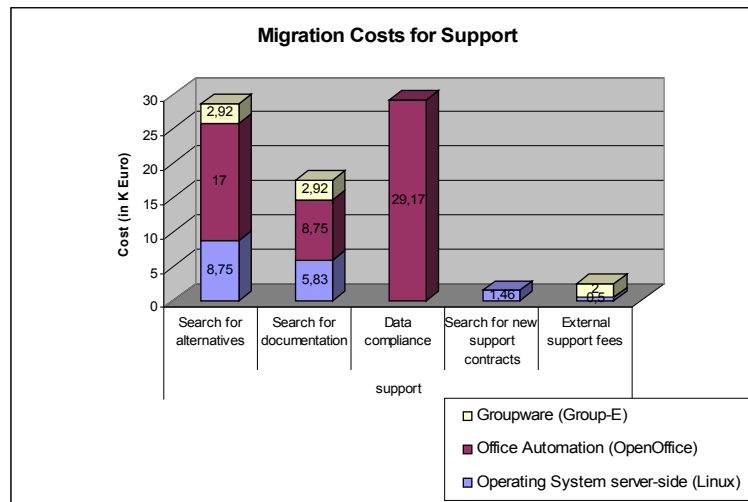


Figure 4: Migration Costs for the Support in SGV

Summing up, support expenses were mainly for searching for alternative solutions to proprietary software used before, for finding appropriate documentation, and for achieving technical and data compliance and interoperability of the OSS. However, the costs for achieving technical and data compliance and interoperability was dedicated only to OpenOffice.org, as shown on Figure 4.

10.3.3 Learning/Training

During the migration the biggest cost share in SGV is for Learning/Training. However, SGV anticipated the problem of the lack of properly trained personnel, and provided formal training to its employees. This caused relatively big tangible and a small intangible share for Training/Learning in the migration costs.

At the beginning of the COSPA project only a small part of the IT personnel (about 10 people) was prepared, i.e. properly trained, to work with OSS, namely with Linux server and e-mail server. Partial training of the IT staff was provided before the current project, as the SGV interest for Open Source software dates before the start of COSPA. However, additional three weeks training was provided to 6 members of the IT staff during COSPA. The cost of this external training might be estimated to €2K. Nevertheless, much more significant is the estimated cost of the self-training for the 6 persons that dedicate most of their time on the Linux servers – it is estimated to about 0,8 month per year. In total this gives 5 man-months effort to the total cost of almost €15K. Self learning was required also for the OpenOffice.org and Group-E and was estimated to be €6K and €1K respectively. For the groupware solution also an external training was required and was provided by Endo7 for the cost of €4K.

¹³ Endo7 is the company that develops and maintains Group-E.

The training of the rest of the personnel of the municipalities (the PA employees) on the new functionalities of the Open Source software was carried out using a combination of approaches. One day of training was provided to all personnel in the IT center. This mode of training includes additional travel expenses, which were impossible to trace in SGV. On-site help was provided whenever needed during the regular visits of the IT staff in the municipalities. At the beginning of the migration a helpdesk was available for 1 hour a day and administrators were dedicating 2 hours a day for remote support via VNC. Products' documentation was made available on the Intranet. Summing up, training was provided to about 2500 employees throughout a 2 month period. The IT personnel had to be increased with one person to support OpenOffice.org and external consultancy was needed for some server side solutions (e.g. Linux). All this makes the biggest expense during the migration, which is €264K.

At the same time the lack of productivity of the employees, for both IT staff and all other users, should be considered in the staffing expenses and is an important hidden cost.

As reported previously, the IT administrators were spending 2-3 hours a day during the first two month of the migration period for supporting users via help desk and remote VNC support. This time should be calculated as lack of productivity for the employee that needed the help. The cost can be estimated to €1.5K.

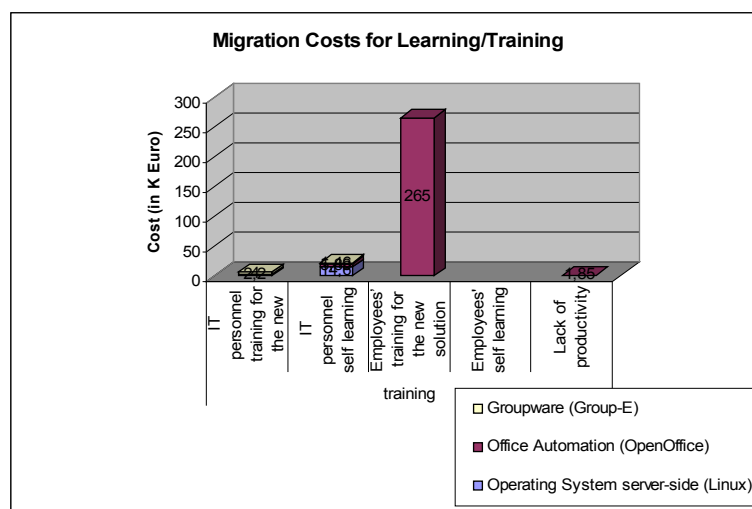


Figure 5: Migration Costs for Learning/Training in SGV

10.3.4 Staffing

One of the biggest expenses during the migration period was for the staffing of the installation of the new software solutions. It was estimated to €246K. Much bigger is the share of the server-side solution, as it involved from 6 to 10 people for a one month period. For the client side the installation was done by the administrators (IT staff) via remote installation scripts. Nevertheless, as the quantity of client-side machines to which OpenOffice.org was installed is rather big (2,829 PCs), the cost for the installation was also relatively big.

During the migration no temporary employees were required. Also there were no additional costs for regular employees' extra hours or bonuses caused by the migration to Open Source software. However, the IT personnel increased by one person, especially dedicated to support

OpenOffice.org.

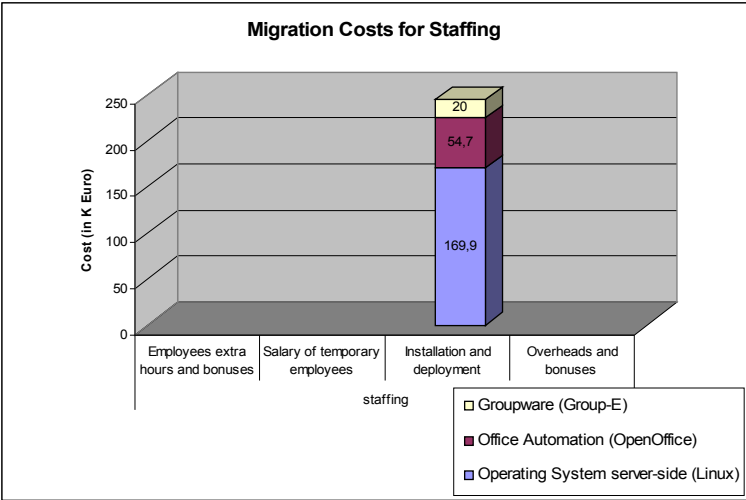


Figure 6: Migration Costs for Staffing in SGV

10.3.5 Summary of the Costs by Software Category

The total cost for software and support have been estimated to €130K and took about 43 man-months for the three software groups we have monitored (i.e. server-side operating system, office automation, and groupware), not counting the training and staffing costs. Learning/training appeared to have the biggest share in the migration expenses – almost €295K followed by the staffing expenses – about €245K. Most of the expenses are due to the introduction of OpenOffice.org, as shown on Figure 7.

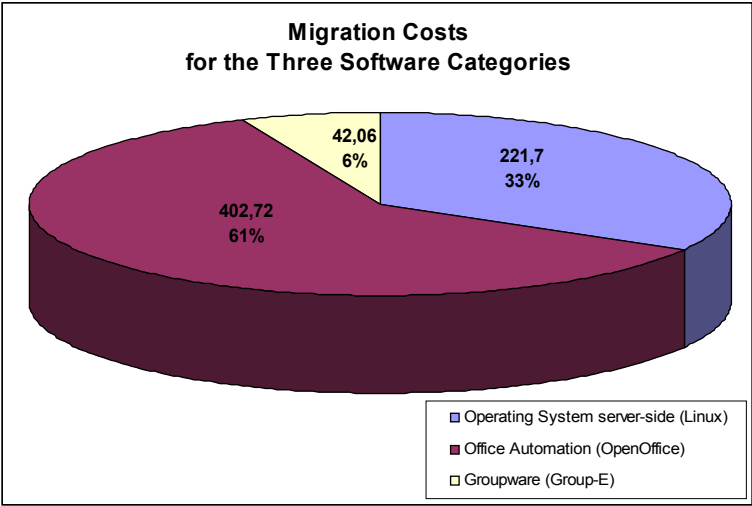


Figure 7: Migration Costs for the Three Software Categories in SGV

As shown on Figure 8 below the biggest share of the costs in each of the four cost categories falls in the office automation, followed by the server-side operating system. The explanation is that the number of employees' PCs was relatively much bigger then the number of servers that were migrated. At the same time one can notice that the OpenOffice.org share is biggest at its training category while for the servers the main costs were for staffing.

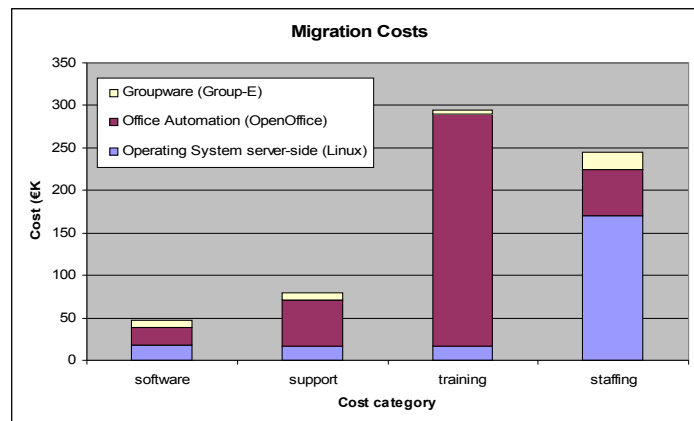


Figure 8: Migration Costs Divided by Category in SGV

10.4 Cost of Ownership

SGV started COSPA experimentation with a heterogeneous software setting, which consisted of both open and closed software solutions. However, almost all open source products installed were server-side software packages. COSPA migration consisted, mostly, in a massive installation of OpenOffice.org in all the municipalities of South Tyrol.

10.4.1 Former Solution

Table 32 shows that all initial costs of ownership include license and installation costs. In the long term, the majority of total annual costs are related to maintenance, updates, and upgrades of software. Training has only a limited impact on the overall expenditures and costs are equally distributed between IT staff and employees.

In general, such setting would require three people to manage Microsoft Windows 2003 server (€105K) and 1 person to manage Microsoft Exchange server (€35K). These activities include maintenance, updates, training, and internal consultancy.

Cost of ownership	Closed Source Solution					
	Initial Cost (€K)			Total annual costs (€K)		
	MS Win2K3 Server	MS Office	MS Exchange Server	MS Win2K3 Server	MS Office	MS Exchange Server
Acquisition	600	130	70	-	-	-
Maintenance, updates, upgrades	-	-	-	254	25	5
Employees' regular training	-	-	-	-	10,5	-
IT staff regular training	-	-	-	10	-	-

Table 32: Cost of Ownership of a Closed-Source Solution in SGV

10.4.2 Current Solution

Table 33 shows that most of the initial costs are due to the installation of open source packages. In addition, other costs are added to buy ARKEIA¹⁴, a backup software for Linux €20K, subscribe a support contract for SUSE Linux (€0,5K), and train employees to use OpenOffice.org.

¹⁴ <http://www.arkeia.com>

Most of total annual costs are due to maintenance, upgrades, and updates. In addition, minor costs are necessary for a support contract (€2K) with Endo7 and IT and personnel's regular training (€10K).

Such setting requires three people to manage Linux servers (€105K), one person to manage maintenance, upgrades, and training of OpenOffice.org (€35K), and, finally, one person that spends 20% of his time to manage Group-E (€7K).

Cost of ownership	Open Source Solution					
	Initial Cost (€K)			Total annual cost (€K)		
	Linux	OpenOffice.org	Group-E	Linux	OpenOffice.org	Group-E
Acquisition	170	50	20	-	-	-
Software add-on	20	-	-	-	-	-
Maintenance, updates, upgrades	-	-	-	268	14,5	3
Maintenance support contracts	0,5	-	-	-	-	2
Employees' regular training	10,5	-	-	-	10,5	-
IT staff regular training	-	-	-	10	-	-

Table 33: Cost of Ownership of OSS in SGV

Table 34 identifies the OSS components adopted by SGV, and clearly shows that the actual cost savings in the transition to Open Source software were extremely significant. The once-off savings compared to proprietary alternatives are about €600 thousands.

Application	Open Source Software Solution		Comparable Closed Source Software Solution	
	Initial Cost (€K)	Annual cost over 5 years (€K)	Initial Cost (€K)	Annual cost over 5 years (€K)
Operating system (server-side)	170K (Linux)	164K	600K (MS Windows 2003 Server)	140K
Desktop systems	50K (OpenOffice.org)	4K	130K (MS Office)	0K
Groupware	20K (Group-E)	2K	70K (Microsoft Exchange)	4K
TOTAL	240K	170K	800K	144 K

Table 34: Cost Comparison of OSS versus Comparable Closed Solutions for SGV

However, looking at the annual maintenance costs, viewed over a five year period, we can notice that OSS is expected to require additional expenses. A total of €26K a year should be budgeted for supporting the OSS solution. Most of these expenses are needed for the maintenance of the Linux servers.

10.5 Cost of Use of OpenOffice.org

"In SGV the migration to OpenOffice.org has been massive. The adoption has been not uniformly accepted, but a significant number of employees fully use the open solution. No extra costs and decrease of speed of work has been found with the use of OpenOffice.org. Tasks have been performed regularly."

In SGV we analysed a sample of data from 08.01.2005 to 17.02.2005. The period of time we have chosen is representative of the whole period of the experimentation (lasted about one year).

The number of users monitored has been very high (1525 PCs). One third of the users never used OpenOffice.org. The existence of such a big number of users that did not take part of the experimentation, but have been monitored might mean that there was a top management decision (the central IT department) for the migration. We might conclude that there was a partial resistance of the personnel. This might be related to the structure of SGV as association of several councils, some with little infrastructure and dependent from the central IT department and others with a very modern IT infrastructure and, therefore, independent from the central IT decision quarter.

83 users (5,45%) used only OpenOffice.org. Although this number is small in percentage, its absolute value is noticeable. As the central IT department is relatively small, 83 people working only with OOO means that several non-expert fully adopted this application for their daily routine.

Comparing the usage in the two groups - excluding users of both the applications - we can see a great similarity. Table 35 displays the similitude of the pattern of use (in average) of the two applications.

	Open Source	Microsoft
Average number of events per document	18.49	12.92
Average time spent on a document (seconds)	955.88	800.03
Average number of users working with a document	1.35	1.26

Table 35: Types and Number of Users for SGV

We may conclude that the way of work is very similar despite the different application.

10.5.1 Effort and Productivity with the Two Applications

Now, we perform our analysis excluding the pure MSO users. Almost two thirds used both the applications (about 900 people). For these users we found that the daily number of Microsoft Office documents per user is the biggest. The average time spent on documents per user by day is roughly 3-4 times higher for Microsoft Office than for OpenOffice.org. Only a small part of Microsoft Office documents were opened in OpenOffice.org. Instead, the common format for documents opened with OpenOffice.org was the native OpenOffice.org document format.

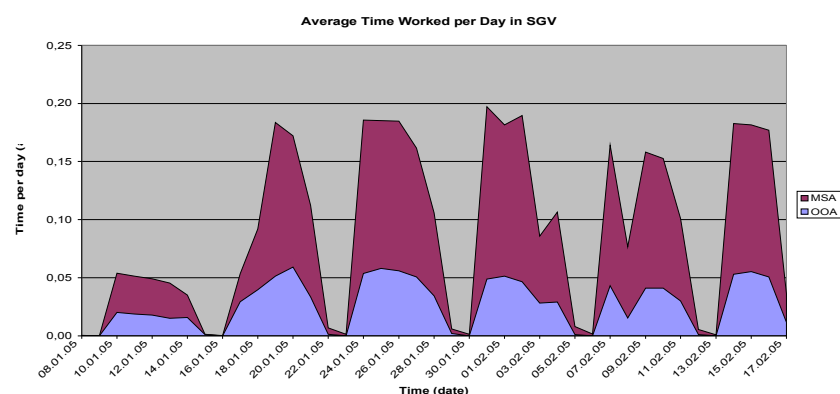


Figure 9: *Average Time Spent on Documents per User by Day for SGV*

As we have already said, productivity is a measure of the “speed of working” (the number of documents produced divided by the time spent working). Daily productivity is higher when using OpenOffice.org documents proving at the first sight that OOO users work faster than MSO ones. Figure 10 Shows that the productivity of OOO is somewhat twice as high as the productivity of MSO.

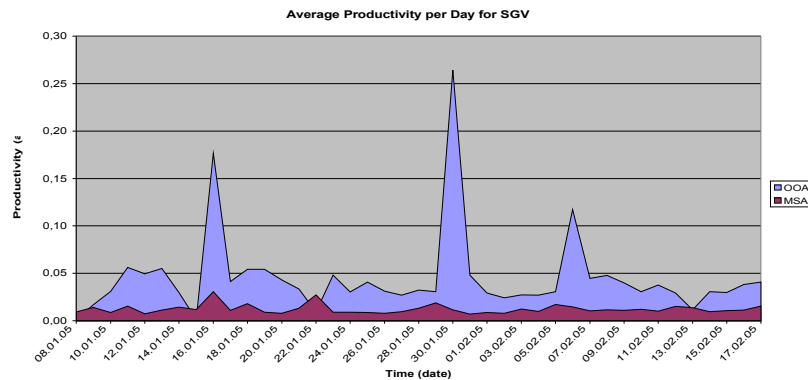


Figure 10: *Average Productivity by Day for SGV*

We can conclude that people are working faster with OOO than they are working with MSO. The absence of any decrease of the usage of OpenOffice.org suggests that OpenOffice.org was quite capable in substituting Microsoft Office in the daily usual office tasks of the employees.

Finally, we have performed a deeper analysis of the users utilization of the two solutions, considering only pure OOO and pure MSO users.

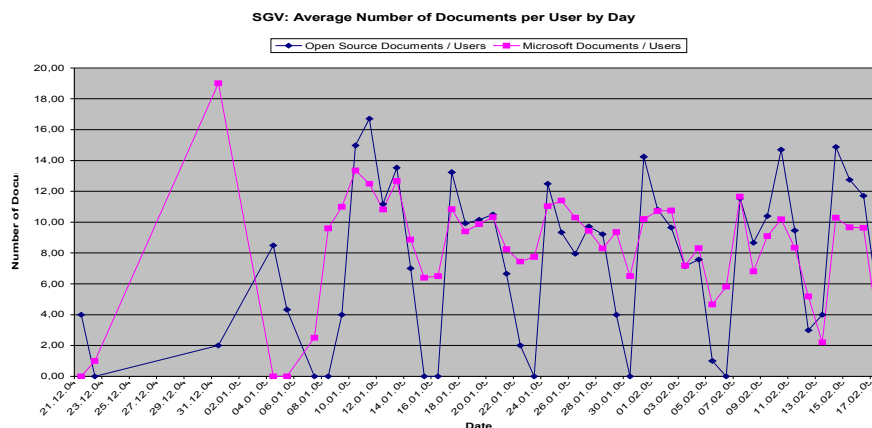


Figure 11: *Average Number of Documents per User by Day for SGV (pure users only)*

The average number of documents worked by user per day is slightly higher for MSO (8.27) then for OOO (7.41). The pattern on the chart, however, is very similar, thus we can see that the employees were doing comparable work.

Meanwhile, this similarity can be noticed on the comparison of the total time worked on documents daily by the users. Also here we can see the similarity of the usage patterns between the two applications.

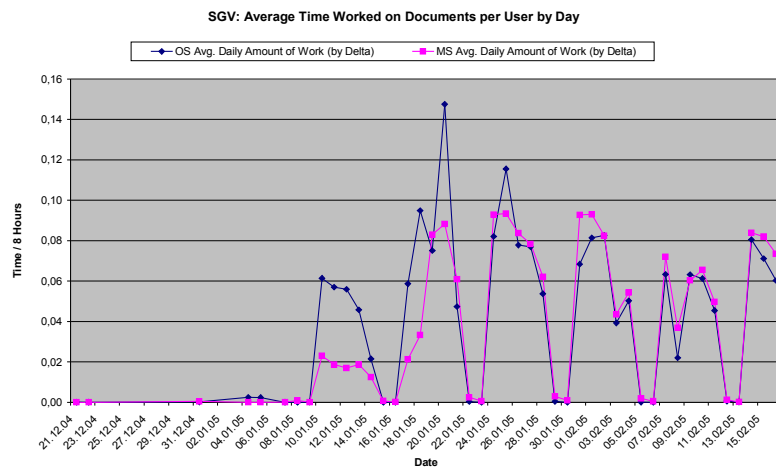


Figure 12: Average Time Spent on Documents per User by Day for SGV (pure users only)

As both the number of documents worked per user daily and the effort on them had similar patterns it was expected that also the productivity with the two products will be similar. In fact, as shown in the Figure 12 and Figure 13 the values are almost all the time within the same limits.

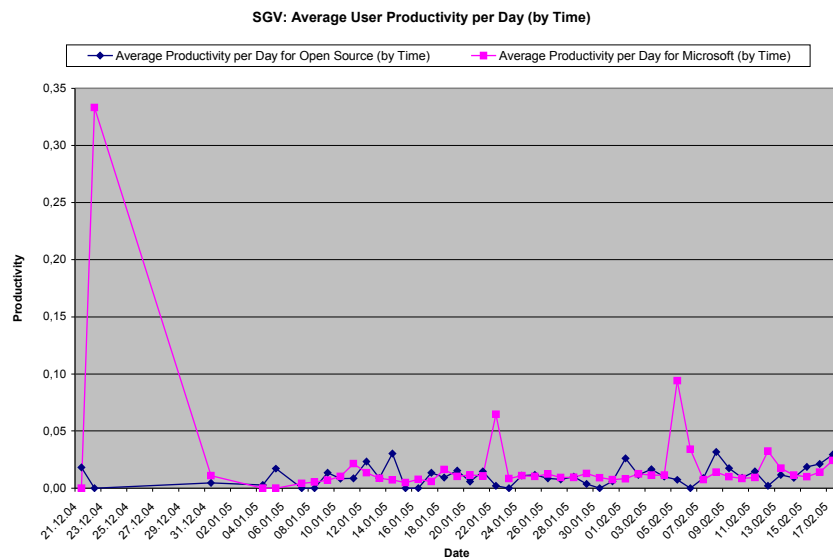


Figure 13: Average User Productivity by Day for SGV (pure users only)

11 Fundecyt in Extremadura, Spain

The Spanish Region of Extremadura is the first case in the world of adoption of Open Source software in high schools and public offices.

11.1 General Overview of the Migration

Extremadura is the poorest region of Spain, lagging behind the rest of the country in both the economic and technological area. In the mid-90s, the regional government decided to invest in information technology as a means that could help the Region to overcome its historical peripheral situation. The strategy of the government was twofold: provide Internet as a public service to citizens and train people to use new technologies.

The LinEx (Linux Extremadura) project is a Linux distribution created to provide universal access of the regional IT services to all the citizens. The main goal of LinEx is not innovating the software itself, but rather to be concentrated on specific aspects of translation and customization. To avoid any kind of technical problem during the initial phase of the project, a Spanish company (Andago, Madrid) was hired to take an existing set of Linux software from the web and customize it.

LinEx is specifically designed for use in regional administration and schools, but the software is distributed for free on a much larger scale than public bodies.

Table 36 presents an overview of costs needed to introduce LinEx in the Public Administration of the region of Extremadura.

Cost	LinEx	
	Cost (€K)	Subtotal (€K)
Support		680
Search for alternatives	400	
Search for documentation	100	
External support fees	180	
Training/learning		180
IT personnel training for the new solution	90	
Employees' training for the new solution	90	
Staffing		100
Salary of temporary employees	100	

Table 36: Summary of Migration Effort and Costs for Extremadura

11.2 Analysis of the Costs by Category

11.2.1 Software

The adoption of the Linux distribution did not generate costs for data conversion, interfacing with legacy software, and similar typical migration problems as these problems were not present neither during the pilot project nor during the final adoption. All necessary upgrades have been provided by Andago and they are included in the costs of external fee support (€180K). The only additional costs caused by the introduction of Linux have been:

- Hardware for €150K
- Graphical Design for €30K

11.2.2 Support

The first phase of the project was related to the evaluation of different alternatives for the adoption of Open Source software in schools. To cope with this problem, special staff has been hired: five persons for the first two years and, then, three persons for two years more. Each member of the team cost €25K gross per year. Thus, the total cost of this operation has been €400K. After this initial phase, all the remaining work has been provided by the external company (Andago) for the cost of €180K. They provided:

- installation and deployment;
- support during the adoption.

A pilot project started before the official adoption of Linux. The involved 14 schools continued their normal activity (study and lessons) during this timeframe, so the costs of this pilot project can be considered zero (with no concrete human resource time consumption).

11.2.3 Learning/Training

For the training of the personnel (both IT and administrative) €45K per year have been spent for four years totalling up to €180K. The training has been organized as explained above (courses, seminars, etc.). There has been no lack of productivity in the schools work, as good and timely training was provided, thus zero costs due to it.

As training was formal it was budgeted and, thus, appear as tangible in the migration costs.

11.2.4 Staffing

While the salary of a permanent IT staff member is between €25K and €60K gross, the salary of temporary employees is €50K gross. For the adoption of Linux two temporary staff members have been hired for 1 year with a total cost of €100K. In this way no extra working hours have been necessary for the permanent staff (extra performed time would have been repaid as extra spare time).

11.3 Cost of ownership

Table 37 below presents the cost of software ownership for Extremadura. As mentioned previously this case study is rather specific, as the OSS adoption started from the ground. There was no closed source solution before the OSS was adopted. In this context, the comparison of the costs of the two solutions, which was done for the other PAs, is much more difficult here. However, the predicted estimation of costs for both open and closed solution, including operating systems and office automation tools, within five years is reported below. Note that the annual cost for OSS over five years is also an estimation, as the five years period since the introduction of the OSS has not passed yet.

Cost of ownership	Open Source Solution		Closed Source Solution	Total Savings
	Initial Cost	Annual Cost over 5 years	Annual Cost over 5 years	
Acquisition, Updates and Upgrades	860	-	-	
Maintenance support contracts	Included in acquisition, upgrades and updates	-	-	
Consultancy	Included in acquisition, upgrades and updates	-	-	
Salary of employees	100	-	-	
Employees and IT staff training	180	-	-	
TOTAL	1.140K	270K	6.000K	5.730K

Table 37: Cost of Ownership of Extremadura

The initial costs were mainly for acquisition and adaptation of the LinEx software. The contract with Andago includes also maintenance and consultancy. The table shows also the annual predicted savings, though they were not divided in the categories of costs .

12 Province of Pisa (PP), Italy

12.1 General Overview of the Migration

Since 2003, the Province has adopted a local law (L.P. N°. 186 dating from 21/10/2003) that recommends the use of ODS and OSS. Before the beginning of the COSPA project the province has analysed a possible OSS migration with two pilot projects:

- “Gare di appalto” software. In 2003, the Province decided to re-engineer a piece of legacy software in response to the new law. The strategy applied was to replace the old proprietary version and use in-house skills and resources to develop a new version. At the same time, the Province has modified the contract to have the ownership of the code of the new in-house version and the right to freely distribute it to other PAs. The resulting software is released under GPL¹⁵.
- The GIS area. In this case, the Province has adopted OSS only for the whole area and at the same time signed a yearly contract with five external consultants, due to lack of availability of in-house IT staff. The Province has saved money on licenses as well as training and wages for in-house IT staff, even though the external consultancy incurs additional costs. Two internal employees act as work coordinators and the cost of each external consultant is more or less the same as that of the in-house technical staff.

From this experience the PP has adopted the following strategy:

- 1) Before transitioning to a new solution, it analyses the availability of OSS. OSS is both a challenge and an opportunity to reduce costs;
- 2) It analyses the transition towards OSS in all software developed in-house. Often these products need re-engineering, since they began without a clear overall design;
- 3) It extensively adopts the Open Data Format. Where possible, the Province requires its software suppliers to produce solutions that work with the Open Data Format.

When COSPA began, the province had already a good experience of OSS and ODS migration. Within the COSPA experimentation, PP has migrated 120 workstations to OpenOffice.org and the Mozilla suite. Red Hat was installed on 11 servers. To evaluate OpenOffice.org a group of employees volunteered to evaluate the suite. To facilitate the use of OpenOffice.org a web application “Doc transformer” was developed internally to convert MS Office into OpenOffice.org documents.

Table 38 presents the migration costs and effort for PP during COSPA project.

¹⁵ GNU General Public license (GPL)

Category	Intangible?	Effort (man/months)	Cost (€K)	Subtotal (€K)
Software				99
Pilot projects	Y	-	4	
Data conversion tools		-	25	
Software add-ons		-	5	
Security tools		-	45	
Upgrades		-	20	
Support				32,5
Search for alternatives	Y	-	7,5	
External support fees		-	25	
Training				61
IT personnel self-learning	Y	5	11	
Employees' self-learning	Y	22	50	
Lack of productivity	Y		-	
Staffing				7
Installation and deployment	Y	3	7	
Overheads and bonuses	Y			

Table 38: Summary of Migration Effort and Costs for PP

12.2 General Overview on Hidden Costs

Figure 14 shows the comparison of tangible and intangible costs in the four categories of costs for the province. The histogram displays a high value for software costs, with little percentage of intangible costs. The percentage on hidden costs is due to the COSPA pilot project run for the introduction of OpenOffice.org. The high value of costs for software is related to several tools implemented as add-ons, plug-ins, and security tools.

The little cost for staffing (all hidden) is unexpected at first instance. Namely, PP implemented lots of in house software, but the effort declared is not so high. This apparent contradiction may be due to the previous degree of knowledge and skills of the IT staff. Search for alternatives and documentation is the real hidden expenditure within “support” together with an ad hoc and peer to peer training – as it shows the bar of “training/learning” costs.

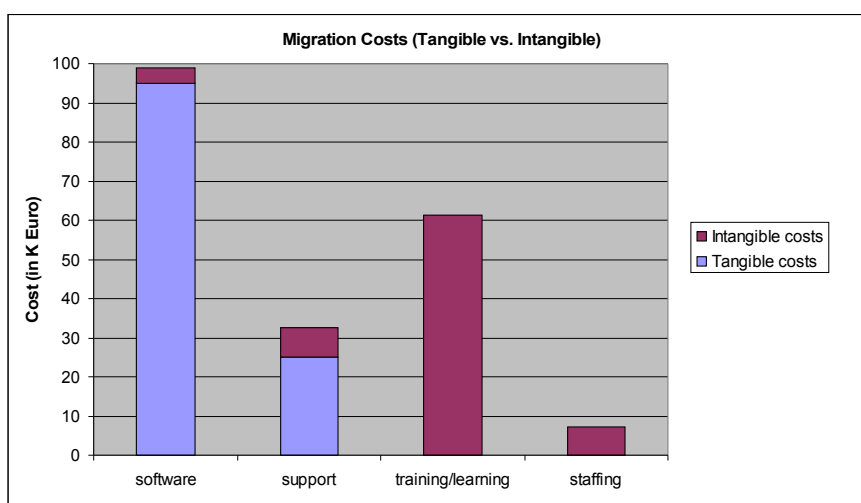


Figure 14: Tangible and Intangible Costs for PP

12.3 Analysis of the Costs by Category

As mentioned in the adoption/assimilation analysis, COSPA experimentation in PP has focused on three types of software migration. Table 39 presents the break down of costs and effort per type of software. The category support is omitted as it was not possible to retrieve this information separated for each software type. However, in total €32.5K were spent for searching for alternatives and for external support fees for the three software categories.

Cost category	Software type	Costs (€K)	Effort (hours)
Software	Operating System desktop (Linux)	4	-
	Office Automation (conversion tools and integration tools, thunderbird)	30	-
	Mozilla	-	-
Training/Learning	Operating System desktop (Linux) – IT self training	11	800
	Office Automation (OpenOffice.org) – Employee’s self training	50	3600
	Mozilla – Employee’s self training	0.3	25
Staffing	Operating System desktop (Linux)	1.5	152
	Office Automation (OpenOffice.org)	2.5	240
	Mozilla	3	225

Table 39: Summary of Migration Effort and Costs for PP by Software and Category

In the table also the expenses for security tools and upgrades are omitted, because they could not be split clearly into the software types considered. The total sum of those expenses is of €65K that also should be considered between the three software.

12.3.1 Software

The migration has involved three major migrations to the mail application Thunderbird, from Microsoft Office to OpenOffice.org and from MS Access to MySQL. Costs for software is mostly due to in-house implementation of conversion tools (Microsoft Office/OpenOffice.org, MS Access/MySQL), plug-in for operating system tools for file conversion (Thunderbird), spike solutions, and upgrades due to proprietary tools still in use in the PP. No hardware costs due to the migration have been reported. No costs for interfacing legacy systems are reported. It appeared impossible to clearly split between the software categories the costs for security tools and upgrades during the migration, thus they are omitted in Figure 15.

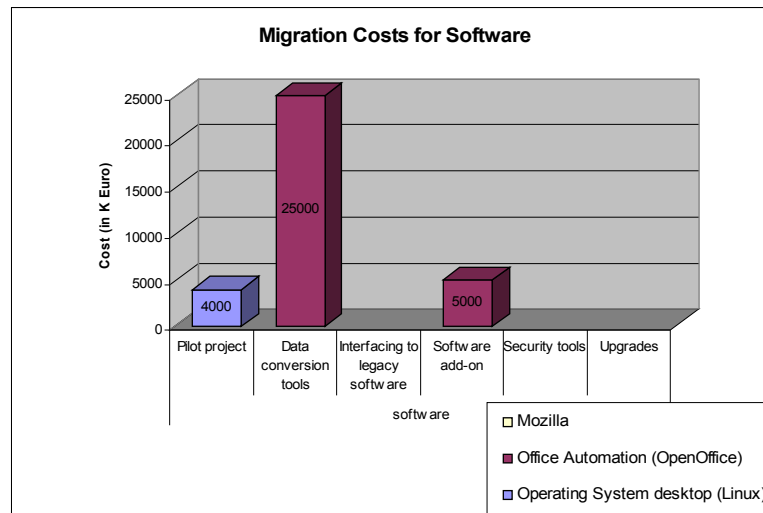


Figure 15: Migration Costs for Software in PP

12.3.2 Support

The major cost for support concerns two temporary employees that have provided consultancy on the migration. The total cost in this case is €25K for two consultants temporarily hired for 6 months. Two members of the IT staff and the consultants have also worked in searching for alternatives. The internal staff sums up to €7.5 K in this case. There was no cost for searching for new support contracts as external consultants enrolled in this project have already had several contracts with PP.

12.3.3 Learning/Training

Training for non-IT personnel is provided in three different ways:

- 1) For generic requests, technicians try to solve users' problems. If the problem is due to inadequate use of software, the technician explains the problem using examples in a one-to-one training session. The cost of this training is estimated at one day per month;
- 2) Internal manuals and short references guide are written by IT staff. For example, to manage the introduction of digital signatures in some business processes, the IT staff wrote 10 different references guides to help employees to use smart cards with certificates;
- 3) The training for software developed by external suppliers is provided by an external instructor. The maximum cost allowed is between €500-800 a day (plus national sales tax of 20%).

PP was able to quantify internal self-training with a total of about €62K. The majority of the costs are due to OpenOffice.org self-training estimated with 30 hours of effort per person. This makes the Learning/Training costs intangible, as can be seen also in Figure 14.

No lack of productivity due to the introduction of the three types of software has been detected.

12.3.4 Staffing

Cost for staffing is low and limited in time. This is because, after the initial self-training, the

internal personnel in PP was skilled enough to support the migrations with little effort. No costs for bonus or extra office hours have been reported. Costs are mainly for deployment and installation. OpenOffice.org has been self-installed by users in about 30 days. The total time for this installation has been estimated (considering the average salary of the employees) to be about €2.6K. Thunderbird has been installed on about 450 PCs by the IT staff, requiring 30 minutes per installation with a total cost of €3K. Linux desktop has been installed in 5 PCs in two days by the IT staff in collaboration with the external consultants. The cost for internal staff corresponds to €1.5K.

PP has no cost to report for the transition to Linux server. This operation was supported by software vendors, as part of the contract for maintenance, which was dated before the transition. This cost concerns the periodical update of the servers of PP.

12.4 Cost of ownership

The following table presents the cost comparison for the chosen by PP Open Source software and the existing up to now proprietary solution.

Software	Open Source Software Solution		Comparable Closed Source Software Solution	
	Initial Cost	Annual Cost over 5 years	Initial Cost	Annual Cost over 5 years
OpenOffice.org	€3000	€0	€15000	€2000
RedHat server	€3120	€2400	€10000	€0
Mozilla thunderbird	€1000	€1000	€600	€40
TOTAL	€7120	€3400	€25600	€2040

Table 40: Cost Comparison of OSS versus Comparable Closed Solution for PP

The calculations are made considering the migration of 120 PCs to OpenOffice.org and Mozilla Thunderbird and five servers. It shows clearly gain from the adoption of automation tools of €22K including the initial expenses (for installation and training) and the expenses expected to appear within five years.

In long term, there are expected savings from the maintenance of OpenOffice.org. On the other hand considering the server side solution the gain is not that obvious, as the new open solution is expected to bring higher costs within five years for upgrades and additional applications.

12.5 Cost of Use of OpenOffice.org

“The use of OpenOffice.org in the Province of Pisa was extensive; the application was more tried than deeply used though. But, it was tried to perform usual office tasks. Comparing individual usage, the use of OpenOffice.org does not impact on the overall workload and effort of the daily office routine. No negative attitude toward OpenOffice.org has been detected.”

In the Province of Pisa the collection of data with PROM continued for a rather long period. For about eight months – between 18.01.2005 and 13.09.2005 there is a meaningful data for the usage of both Microsoft and OpenOffice.org applications.

During this period there is just one user which used only MSO, so we can conclude that all the users have actively taken part in the experiment of migrating from OOo to MSO. On the other hand, there were only 8 users (possibly comprising the 6 IT members) that used only

OOo in the whole period. The rest (more than 100 people) was switching from one application to the other. The adhesion was high for all the period and comprises a variety of non-expert users. No adverse attitude toward OOo is therefore recorded.

By the heterogeneity of the group of employees and similar pattern of documents' workload (omitted¹⁶) we may assume that users perform similar tasks both with OOo and MSO.

12.5.1 Effort and Productivity with the Two Applications

The average time (effort) worked per day is always higher for MS than for OOo, which was to be expected as MS was always more used than OOo. The proportion of the average time worked per day is more than double.

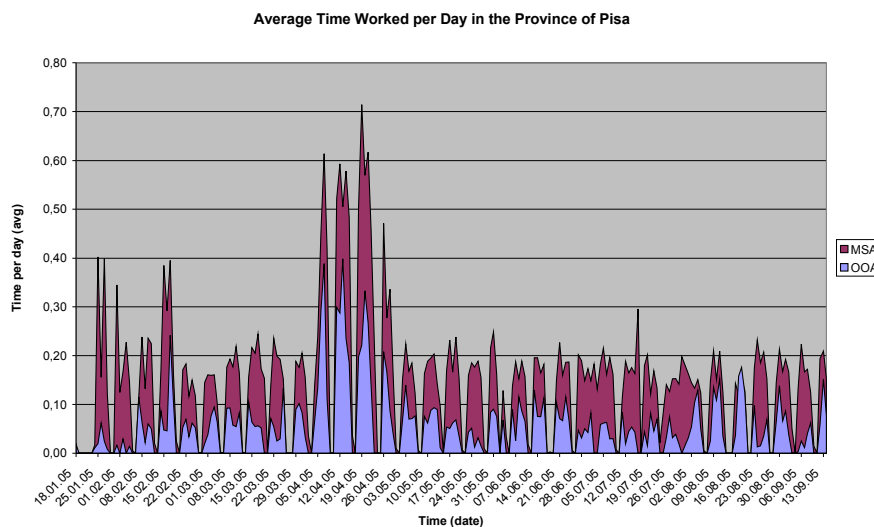


Figure 16: *Average Time Spent on Documents per User by Day for PP*

The peak in March corresponds to a period of intense work similar in the use of both applications (confirmed by the omitted graphs on number of documents worked).

The users' productivity – the number of documents opened divided by the time spent on them – gives an insight on the “speed of working” with both the applications.

¹⁶ A curiosity: the lifespan of a single document - that is the time from the document's creation to its last saving - with both the applications is in average 12 days. The majority of the documents has daily time of work less than one minute with both the applications

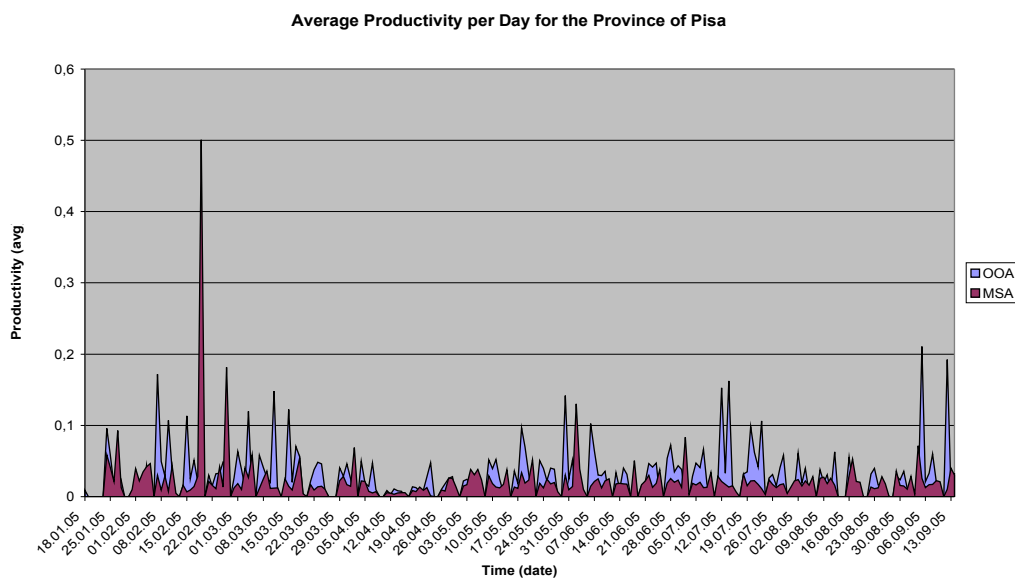


Figure 17: Average Productivity by Day for PP

The OpenOffice.org productivity is generally higher than the MS productivity or very close to this one. Trends of peaks show that users are getting more experienced in using OpenOffice.org than they were at the beginning. Thus we may conclude that the people are working faster with OpenOffice.org than they are working with MSO.

At this point, the overall conclusion leads to the fact that the use of OpenOffice.org does not impact on effort and speed of work.

There are some considerations to add at this point. The productivity is higher for OpenOffice.org while the time spent on the OpenOffice.org files is very low. This may mean that the users just tried OpenOffice.org, opening lots of files for small amounts of time, which increases productivity and implies a smaller daily effort for the OpenOffice.org users (both using only OpenOffice.org and using both applications). Anyway, we have seen that its use was to perform usual office tasks similar to the ones performed with MSO. Moreover, no negative attitude toward OpenOffice.org has been detected.

13 Public Administration of City of Skopje (SK), Macedonia

13.1 General Overview of the Migration

In the year 2005 a three month pilot project took place within the Public Administration of the City of Skopje with the goal to test the possibility to migrate to Open Source software. For the experimentation OpenOffice.org was installed on about sixty employees' computers together with Microsoft Office. The IT staff (7 people) also participated in the testing. During the first days of the experiment certain problems were encountered with some computers' configurations (i.e. small amount of RAM memory on old machines that triggered unexpected crashes of the software). As a consequence this part of the participants was dropped from the project and OpenOffice.org and the PROM tool were uninstalled. The rest of the personnel were happy to switch to Open Source products, as they were aware that such migration will solve many problems with software licenses and related costs. The users were aware that with OpenOffice.org they can open and save documents also in MS Office format, while the vice-versa is not possible.

Category	Intangible?	Effort (man/months)	Cost (€)	Subtotal (€)
Software				10
Interfacing to legacy software		0,05	10	
Support				830
Search for alternatives	Y	2	400	
Search for documentation	Y	1	200	
Data compliance		1	200	
External support fees		-	30	
Training				3,070
IT personnel self-learning	Y		1,400	
Employees' training for the new solution			825	
Employees' self-learning	Y		125	
Lack of productivity	Y		720	
Staffing				75
Installation and deployment	Y	0,38	75	
Overheads and bonuses	Y	-	-	

Figure 18: Summary of the Migration Effort and Costs for SK

13.2 General Overview on Hidden Costs

Within the costs we can identify explicit costs that are easily tracked in contracts with partners or consultants and paid with invoices. However other costs are hidden and more difficult to discover. Our analyses show that during the migration the hidden costs are actually a bigger fraction of the whole cost than the explicit ones.

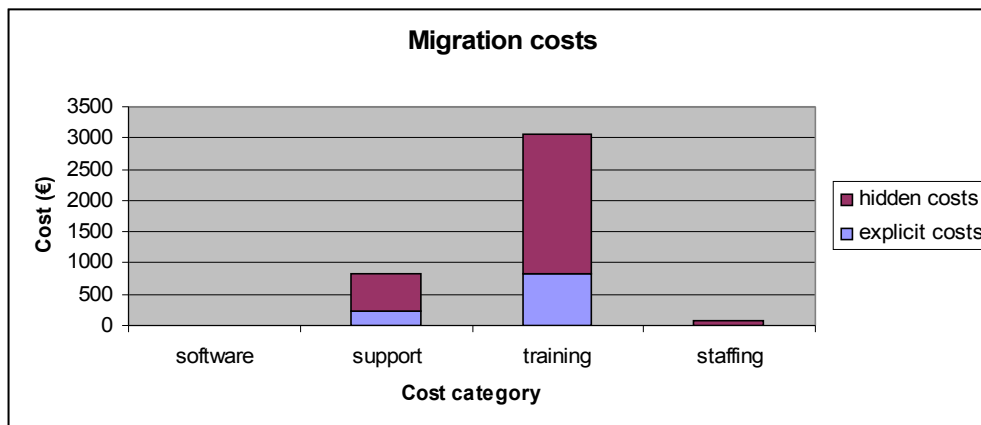


Figure 19: Tangible and Intangible Costs in SK

Further in this report we give a more detailed description of the expenses within the separate categories. However, we should mention that although hardware upgrades were not done during this experimentation's period such upgrade will be necessary for many of the workstations, if a total migration is intended.

13.3 Analysis of the Costs by Category

The costs of ownership in the case of SK, just refer to the OSS. In fact, it seems that no local policy supports the acquisition of licenses and for maintenance of proprietary software. This implies a de facto use to copy software without a great attention to the number of legal licenses. Therefore it is also hard to access to the historical IT budget. For OSS costs have been monitored during the project. In any case the costs of software are limited. This can also be seen in the case of the OSS.

Cost		Effort (man/months)		Costs (€)	
		Linux	Open Office	Linux	Open Office
Software	Interfacing to legacy software	0,05		10	
Support	Search for alternatives	1	1	200	200
	Search for documentation		1		200
	Data compliance	1		200	
	External support fees			30	
Learning/ Training	IT personnel self learning				1400
	Employees' training for the new solution				825
	Employees' self learning				125
	Lack of productivity				720
Staffing	Installation and deployment		0,375		75

Table 41: Summary of the Migration Effort and Costs for SK by Software and Category

13.3.1 Software

Almost no costs were introduced for software, as no conversion tools or add-ons were needed. A one-day work of one of the IT department members was spent for writing some scripts for interfacing some legacy software, but the estimated costs is negligible.

13.3.2 Support

The migration process usually starts with a search for alternative software solutions and comparison of the available options. For the IT department of the City of Skopje this initial phase was facilitated by couple of factors. More concrete for choosing the operating system for the server side only one man-month was spent which is equal to €200 (i.e. the average monthly salary of an IT staff member). The chosen alternative was proposed by an external firm which cooperated with the PA in a previous project. On the other hand the choice of Office automation tools was eased by the COSPA requirement. Only some functionalities and versions of the same product were tested by the IT staff which can be estimated to a one man-month effort.

Searching for documentation and other sources of information for the chosen Open Source software was needed only for the OpenOffice.org, as the previously mentioned external firm took care of the installation and further support of the server products. The total of one man-month and €200 were spent. Additionally, for achieving technical and data compliance and interoperability on server-side another man-month (i.e. €200) were added to the migration costs.

External support was needed only for the server software. As mentioned general support was provided by an external company, but was free of charge in the form of donation to the PA. Nevertheless after a certain period the company started to charge the visits in case of problems. Such cases were very rare and in fact happened only once for the whole period.

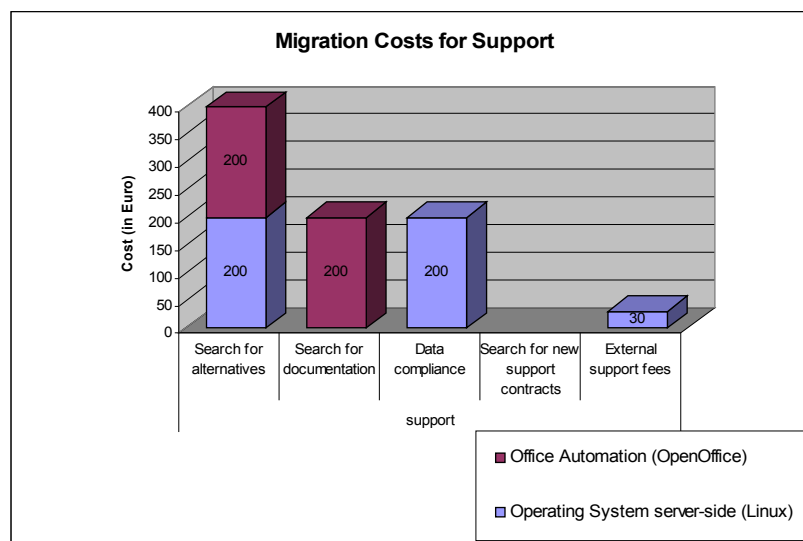


Figure 20: Migration Costs for Support in SK

Summing up for SK the support expenses were mainly for searching for alternative solution to the proprietary software used, as such cost appeared for each product, as shown on the Figure 20.

13.3.3 Learning/Training

The specific situation in the Macedonian software field is that Microsoft based products are used by almost all the population. Although in the recent years there is an increased effort to promote Open Source products they are not utilized in practice. At the beginning of the COSPA project neither the IT personnel (7 people), nor the employees participating in the

tests (initially 60 people) were prepared, i.e. properly trained, to work with OSS, namely with OpenOffice.org. As mentioned, the server-side support was fully provided by external experts so almost no training of the IT staff was needed.

The training for the OpenOffice.org work was done fully within the PA. The IT staff spent a rather long period for in-depth self-learning – one month per person, before installing the software to the other employees. The training consisted in reading documentation and forums plus testing the available functionalities of product.

The training of the rest of the personnel was with a combination of approaches. One day training was provided to all personnel in each participating department. In total this training caused a 0.5 man-month (10 days) for the IT staff. During the whole test period and even afterwards (in total 4-5 months) also a helpdesk was available. The help-desk was available before the introduction of Open Source software. However, after the deployment of OOO one IT department member was spending one hour a day to help the employees deal with OpenOffice.org issues.

At the same time the lack of productivity of the employees, which is an important hidden cost, was estimated by the IT members to 10-20% for the first month. This is estimated to €720.

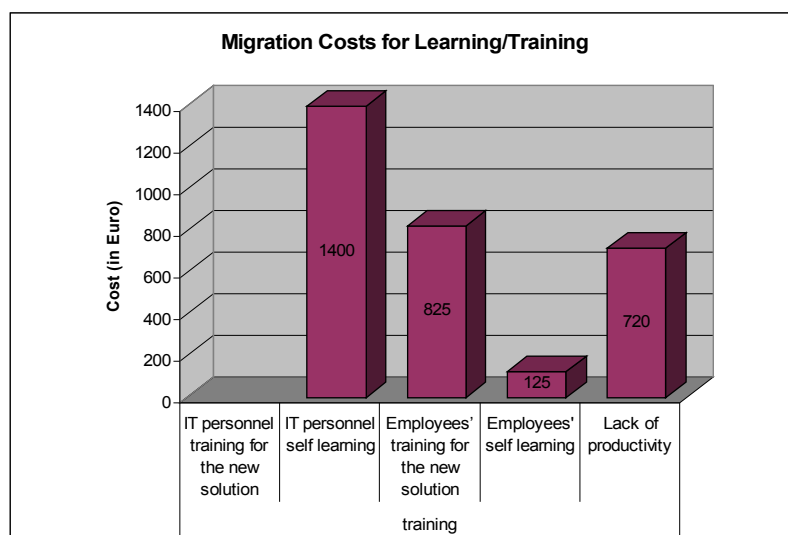


Figure 21: Migration Costs for Learning/Training in SK

All these make the training/learning with the biggest share of all categories within the total costs for migration. Only part of the IT staff training was a tangible cost. Much bigger was the intangible share, due to self-learning and internal support provided.

13.3.4 Staffing

The expenses of SK during the migration period for the staffing for the installation of the new software solutions were estimated to €75. The number of client-side machines to which the OpenOffice.org and PROM were installed is sixty, however, on many of them both software were removed due to problems. During the migration no temporary employees were required. Also there were no additional costs for regular employees extra hours or bonuses caused by the migration to Open Source software.

13.3.5 Summary of Costs by Software Category

On Figure 22 we show the relative shares of migration costs for the 1 server migration and for the migration of 60 employee's PCs.

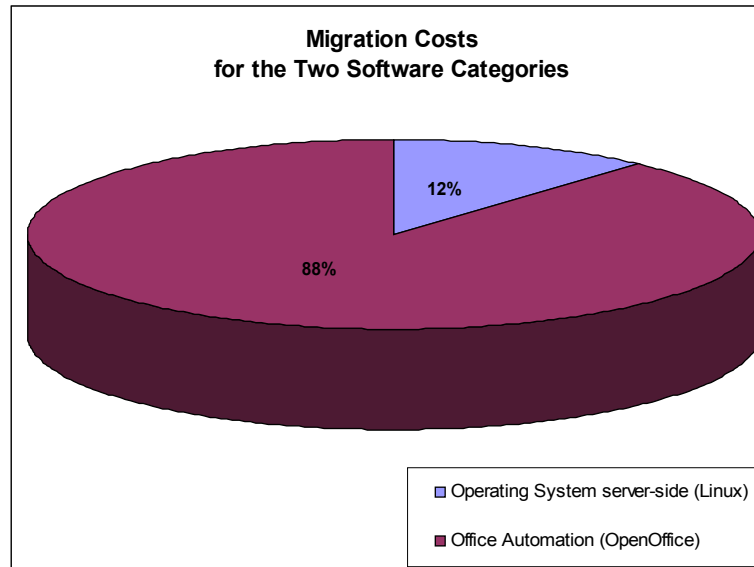


Figure 22: Migration Costs for the Two Software Categories in SK

As shown on the chart below (Figure 23) for the migration of the server only costs for support appeared, while for the Office automation tools the costs for training were relatively bigger than the other costs types.

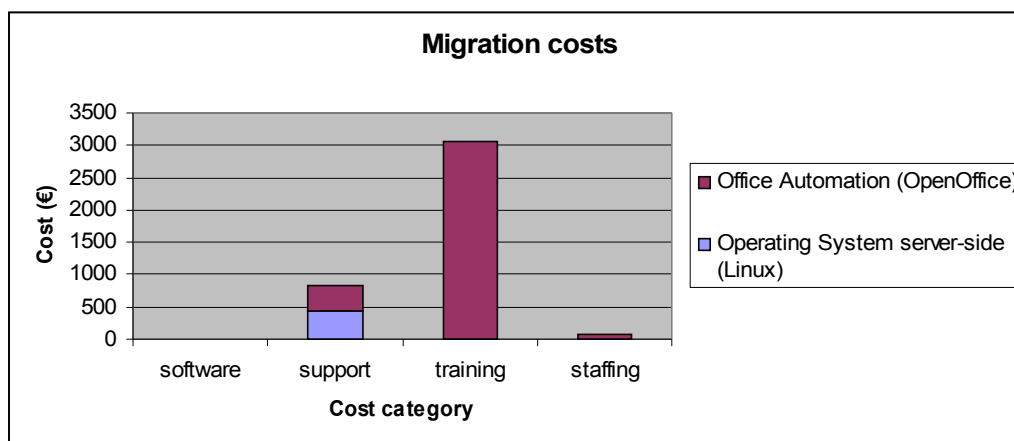


Figure 23: Migration Costs Divided by Category in SK

13.4 Cost of ownership

The following table presents the cost of ownership comparison for the chosen by SK Open Source software. Note that the costs are predicted, based on the pilot project that took place within COSPA project. In the table below initial costs are almost not included, as the installation and deployment has been done during the assimilation trial. It is considered that some additional training will be needed for the regular employees, which will help avoiding the lack of productivity.

Cost of ownership	Open Source Software Solution		Comparable Closed Source Software Solution		Notes
	Initial Cost	Annual Cost over 5 years	Initial Cost	Annual Cost over 5 years	
Acquisition	0	-	€23176	-	€373 x 60 WinServer2003 €796
Software add-on	-	-	-	€100	With MS Office there was a need for a conversion tool to support Macedonian lang.
Maintenance (internal)	-	€250	-	€250	10h. x 1 person in a month
Consultancy	-	€100	-	-	Linux €30-50 per visit
Employees' training	€700	-	-	-	Training for OOo
IT staff regular training	-	€2000	-	€2000	Mainly free (donated) Budget: €2000 per year for the ITs
Lack of productivity	-	-	-	-	
TOTAL	€700	€2350	€23176	€2350	

Table 42: *Cost Comparison of OSS versus Comparable Closed Solution for SK*

The cost of licenses for the close solution is taken in the current moment. As mentioned before in this PA the software is installed mainly without having licenses. Free of charge licenses are expected to be received by Microsoft due to a strategic government contract that has been already signed. However, if such licenses are not received in the near future the PA will be constrained to either buy them or migrate to OSS. The calculations are made considering the migration of 60 PCs to OpenOffice.org and one server on which the operating system and other OSS software are installed. The predictions show that the main gain comes from the absence of licenses costs in the open solution, which is estimated to about €22K. Within five years, however, the costs are estimated to be comparable.

13.5 Cost of Use of OpenOffice.org

“The pilot project for migrating to OpenOffice.org in PA of the City of Skopje showed very stable behavior in the employees’ work. Moreover, the absence of a drop of OpenOffice.org usage towards the end of the period suggests that OpenOffice.org was quite capable in substituting Microsoft Office in the appointed tasks, whatever their complexity might have been.”

The period of experimentation from which the data was analysed for the PA of the City of Skopje is about two months. More specifically PROM data is available from 08.04.2004 to 01.06.2005. However, only the second half of this period, which was about a month, could be considered for comparing the behaviour of the users of the two platforms. This happens as the data before it was rather scarce, probably due to the fact that in this first period the tracking tool was not installed on all the machines¹⁷.

Totally 48 users were monitored during the above mentioned period, but more than half of them were removed from the further analysis, as they never utilized OpenOffice.org programs. One user was utilising only OOo during the whole analysed period, while the others (20) were switching from one application to the other.

¹⁷ Note: The presented in the Figures data is for the one-month period with comparable data.

13.5.1 Effort and Productivity with the Two Applications

The average time spent (effort) on working with documents each day was generally bigger for MS than for OOo. Figure 24 shows that the average value is about three times higher for MSO.

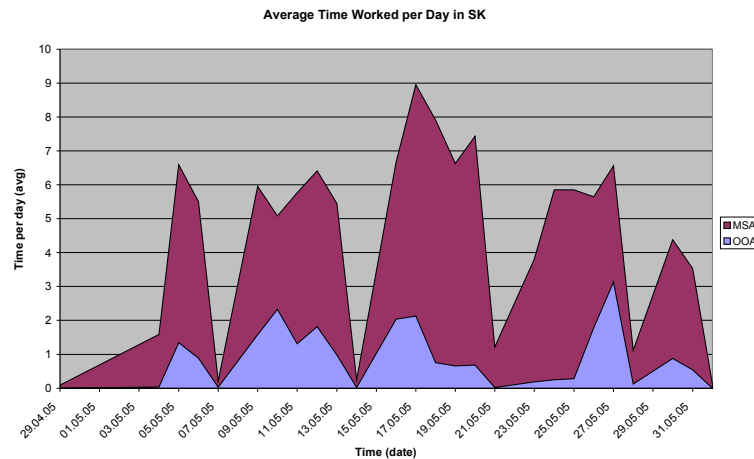


Figure 24: Average Time Spent on Documents per User by Day for SK

We can see that the effort was generally higher for MSO than for OOo, however, the shapes of the two charts are very similar. This, together with the omitted analysis for the number of users and documents per day, suggests that both applications were used in similar manner for doing everyday's work.

The productivity - the number of documents produced divided by the time spent working on them – shows the “speed of working” with each application.

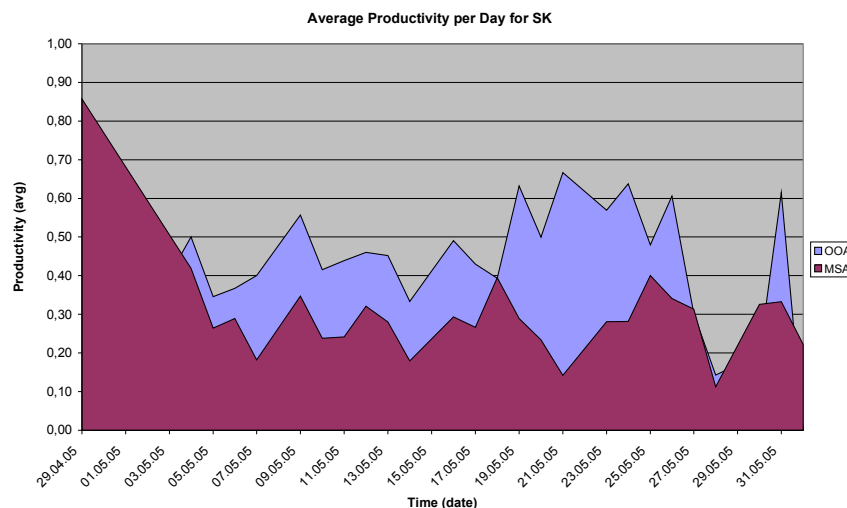


Figure 25: Average Productivity by Day for SK

The productivity for OOo is higher than that for MSO (with a few exceptions). In the figure, a productivity value of zero means that on that particular day no document events (for Microsoft Office or/and OpenOffice.org) were captured. From this we can conclude that the people are working faster with OOo than they are working with MSO.

The overall conclusion is that while the analysed period is too short to determine if

OpenOffice.org could effectively replace Microsoft Office, the absence of the drop in OpenOffice.org usage suggests that OpenOffice.org was quite capable in substituting Microsoft Office in the appointed tasks, whatever their complexity might have been.

There are certain considerations that should be mentioned.

The fact that the productivity is higher for OOo while the effort is very low can be explained with the supposition that the users were merely trying the OOo while relying on the MSO for the actual work. The existence of a big number of users that did not take part of the experimentation, but being monitored coexists with the fact that most of the personnel were using quite old PCs. The ITs of the PA have reported that OpenOffice.org was crashing on these machines, so it was uninstalled short after the installation. However the crashes in those earlier versions of OpenOffice.org might be the reason for employee's to switching often to MSO.

14 Törökbálint Nagyközség Polgármesteri Hivatala (TO), Hungary

14.1 General Overview of the Migration

TO is a small Hungarian PA of nearly 40 employees, organized in few departments.

Employees are using rather old computers, based on Microsoft Windows. The network is present but its use is mainly for incoming and outgoing communication, not for internal communication inside the PA. The network is not used to exchange files between computers, for example, that are exchanged using floppy disks. Two servers are used, but users do not have access to a network file system.

TO decided to participate to the COSPA project for economical motivations. The fact that European funding would cover most of the costs was a very important decision factor.

Several desktops have been already migrated to use OpenOffice.org instead of the previously used proprietary one. There has not been much resistance to the change from the users. The users do not have advanced requirements and OpenOffice.org is covering them. Users can call the technical support when needed, but no extensive need for such support has been experienced. No external support is needed at the moment, and all the work related to the COSPA project can be done by the personnel of the PA.

Category	Intangible?	Effort (man/months)	Cost (K€)	Subtotal (K€)
Software				20
Pilot projects	Y	-	20	
Support				53
Search for alternatives	Y		13	
Search for documentation	Y		7	
Data compliance			33	
Training				233.5
IT personnel self-learning	Y		100	
Employees' training for the new solution			133.5	
Staffing				33
Installation and deployment	Y		33	

Table 43: Summary of the Migration Effort and Costs for TO

14.2 General Overview on Hidden Costs

Figure 26 displays the intangible part of the costs at TO. Total costs were very low and almost all relates to internal personnel. Costs for internal personnel are mainly intangible and often not budgeted. This conclusion perfectly fits with the histogram in Figure 26 where more than half of the costs are hidden.

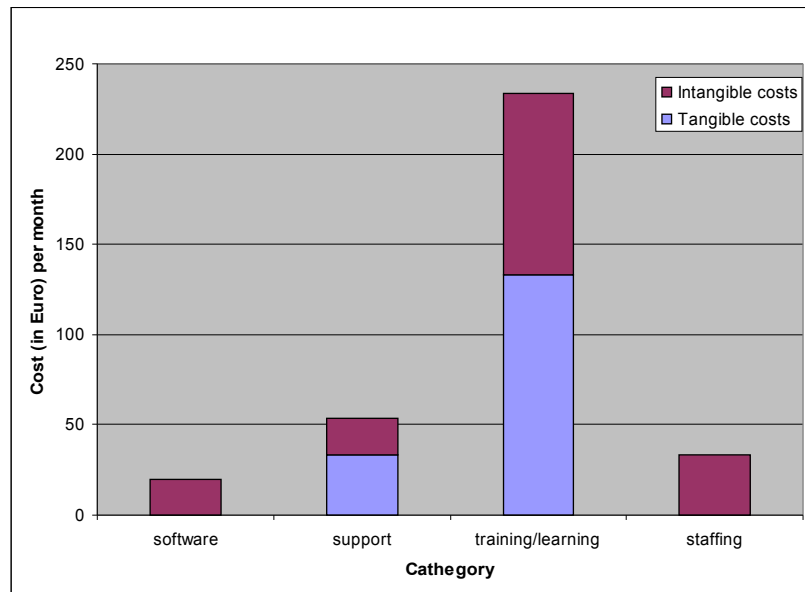


Figure 26: Tangible and Intangible Costs in TO

14.3 Analysis of the Costs by Category

14.3.1 Software

Cost of software is very low. This includes the purchasing of Fast Ethernet for network of different sites of the council, for upgrade of the memory, and replacing of old PCs. No costs of security tools, upgrades etc have been reported.

14.3.2 Support

Support for the transition in TO is done mainly internally. In Figure 27 the percentage of internal support is reported. The total time spent is not high.

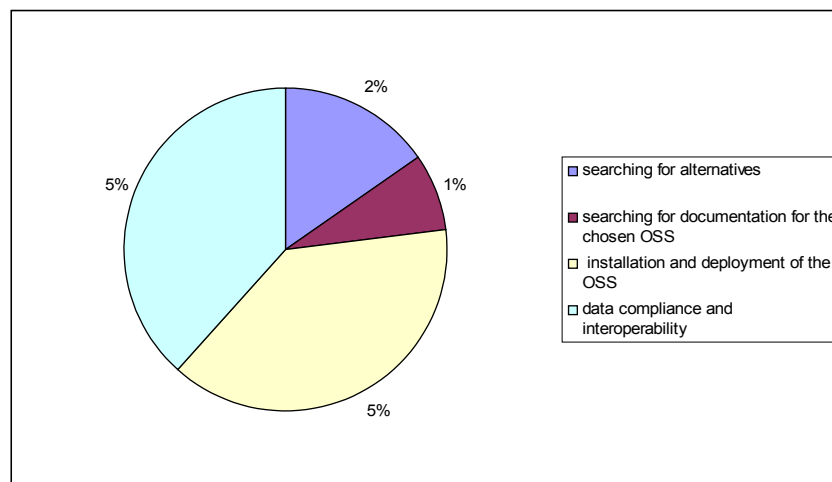


Figure 27: Percentage of Costs Spent in Internal Support in TO

No external contract has been established and consequently no search for such contracts or external support has been performed.

14.3.3 Learning/Training

For the IT staff there has been only self-learning. The IT staff spends about 15% of its work time on that. This makes a big share of intangible costs within the Training/Learning subcategory. For the rest of the employees there has been internal teaching and a help desk run by IT staff. The IT staff spends about 10% of the work time to supply the service, whereas the non-IT staff has dedicated 2% of its time to using the help-desk. As the help desk was a planned service for the introduction of OSS it is considered a tangible cost.

14.3.4 Staffing

Cost for staffing consist only of the internal IT staff (3 people) costing €2K Euro per month. There were no costs for external personnel temporary hired for the transition, neither bonuses or extra hours have been caused by the transition.

14.4 Cost of Ownership

The two software settings before and after a transition are put in comparison in Table 44. In the single cells the costs are presented also per single computer, while in the total the calculation is done for fifty computers that TO is migrating to OSS.

Software	Open Source Software Solution		Comparable Closed Source Software Solution		Notes (optional)
	Initial Cost	Annual Cost over 5 years	Initial Cost	Annual Cost over 5 years	
OpSys	free	free	€16,5K (€330 per PC)	€5,6K	Linux Windows (€560 per PC in 5 years)
Office program	free	free	€14,5K (€290 per PC)	€4,9K	OpenOffice.org MS Office (€490 per PC in 5 years)
Virus defensive	do not need, but Clamav		-	€0,8K	Clamav (included in UHU-Linux) McAfee (€80 per PC in 5 years)
Firewall			There was none before		OpenBSD
web server	free	free	There was none before		Apache
mail server	free	free	There was none before		Cyrus
TOTAL	free	free	€31K	€11,3K	

Table 44: *Costs of Ownership in the Settings for TO*

The PA's estimates the initial costs of OSS as zero - there will be no initial costs, as the products are already deployed during the pilot project within COSPA. Meanwhile the predicted cost of maintenance is also zero. This, compared with the closed solution will bring significant savings, equal to €620 per PC initially and €1,130 per PC in five years' maintenance. Savings come from the zero licenses costs, but also from the fact that with the OSS the PA will not be forced to change the old hardware available at the moment.

14.5 Cost of Use of OpenOffice.org

“The analysis of the software usage in TO show that the general pattern of use is similar for the two applications and that the productivity is also comparable in the two cases. Since

there were a significant number of switchers, meaning that users are actually participating in the experiment, we can also conclude that the use of OOo could not have a negative impact on the work of the organisation.”

The meaningful data for the PROM analysis are for more than a three months period, starting on 17.03.2005 and up to 27.06.2005. During the first days of the period, the number of OOo users increases fast and, afterwards stabilizes in an average. The number of MSO users suffers a small decrease during the period. The significant number of switchers – users that utilized both products within the period that is analysed – demonstrates that the experiment is being carried out and that the users are trying both platforms. The number of users using only OOo increases during the period, passing the number of user using only MSO.

14.5.1 Effort and Productivity with the Two Applications

The average effort on documents per day is generally slightly higher for OOo than for MSO. Excluding one-event documents does not change the picture significantly.

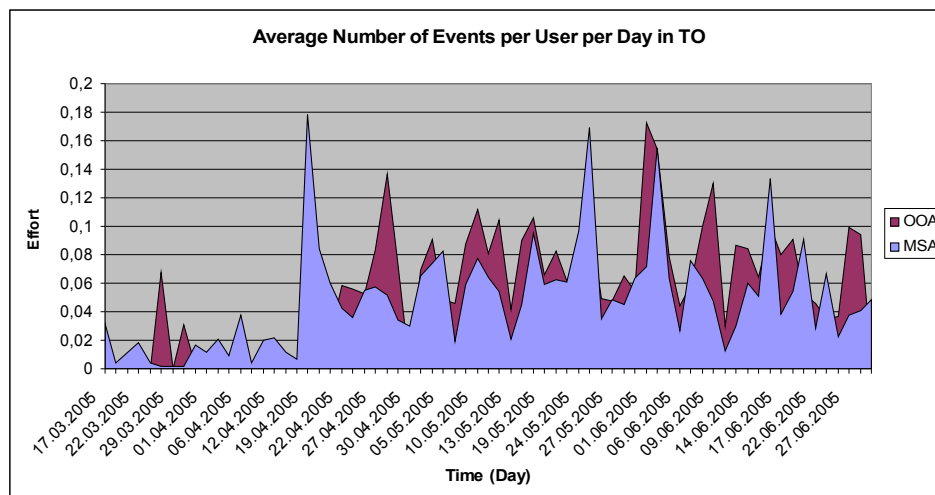


Figure 28: Average Number of Events on Documents per User by Day for TO¹⁸

Considering that the number of events could be used as a proxy for the time spent on documents, we can conclude that the effort of working with OOo is slightly higher than MSO.

The users' productivity – the number of documents produced divided by the number of events – gives us the idea of the “speed of working” with each application.

¹⁸ The effort is calculated as the average number of events per day per user divided by the maximum number of events per user in one day for the whole period.

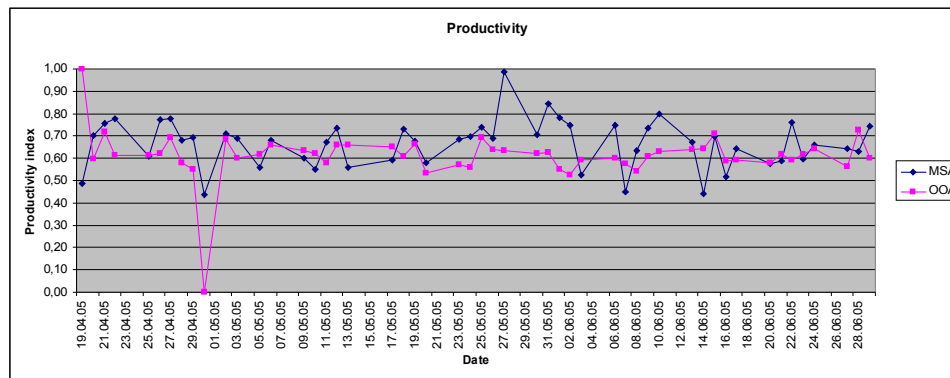


Figure 29: Average Productivity by Day for TO

The analysis show that the productivity associated with the use of OOO is higher than the productivity of MSO. Throughout the whole period the productivity of both platforms is regular, with the exception of a high peak on the MSO productivity in the beginning of May that is simultaneous to the absence of activity associated with OOO.

We have found that for both applications there were similar number of users, similar number of documents, similar workload and productivity and only some difference in the documents lifespan.

Considering all this we might conclude that the way of working with the two applications is comparable and OOO does not have negative impact on the way of work.

One concern should be mentioned at this point - the number of one event documents which was quite big in TO (36-40%). Even though this percentage is big, the workload is not very much affected, but the productivity is. Considering the one-event documents, the productivity of OOO was much higher than that of MSO while after having excluded the one-event documents, the productivity of MSA got slightly higher than that of OOO. One conclusion might be that in this case, the large number of one-event documents compromises the correlation between the number of events for a file and the time spent on that file. We can get to this conclusion because, having excluded the one-event documents increased the productivity instead of decreasing it.

We should point out that no generally negative attitude towards the use of OOO was found.

15 Beaumont Hospital (BH), Ireland

15.1 Cost of Ownership in the First Phase

The extent of savings possible with OSS caused it to be considered as a possible strategic investment option within Beaumont. Table 45 identifies the OSS components implemented in Phase 1 (see section 2.1 for details), and clearly shows the actual cost savings in the move to OSS were significant. The once-off savings over proprietary alternatives are in the order of €667K. Furthermore, given that annual maintenance costs are typically about 20% of purchase price, when viewed over a 5-year period, the savings are more striking, leading to an overall saving of almost €1.3 million from the first phase of OSS infrastructure – operating system, utilities and desktop applications.

Calculating Total Cost of Ownership (TCO) of software is quite complex, as it requires consideration of a vast number of areas, including software purchase, maintenance and upgrade costs, hardware purchase and maintenance costs, personnel training, legal and administrative costs. Given this complexity, it is perhaps not surprising that comparisons of the TCO for open source versus proprietary software have varied enormously across studies (Wheeler, 2005). In this study, we chose to focus more on the total cost of acquisition of software. This includes software purchase, maintenance and upgrade costs, and we calculated these total costs over a five-year period. Also, in these calculations, every effort has been made to compare like with like. The estimate of the comparable costs for proprietary alternatives is based on prior experience in Beaumont or on two alternative estimates. However, it is also worth noting that Beaumont receives academic pricing discounts for many of these applications, thus the costs for a typical commercial organization implementing such proprietary packages would be even higher, and the deployment of OSS alternatives could thus result in even greater savings.

Application	Open Source Software Solution		Comparable Closed Source Software Solution ¹⁹	
	Initial Cost (€)	Annual cost over 5 years (€)	Initial Cost (€)	Annual cost over 5 years (€)
Operating System	- (Linux)	30K ²⁰	77K	61,4K
Desktop Systems	28K (StarOffice)	1,4K	120K (e.g. MS Office)	33,8K
Content Management	20K (Zope)	2,4K	126K (e.g. Lotus Notes)	2,8K
Application Server	10K (JBoss)	10,2K	302K (e.g. Websphere)	58,6K
Email	10K POSTFIX	1K	110K (e.g. Lotus Domino)	13K
TOTAL	68K	45K	735K	169,6K

Table 45: Cost Comparison of OSS versus Comparable Closed Solutions for BH Phase 1

15.2 Cost of Ownership in the Second Phase

Table 46 shows the estimated initial cost and the cost savings that would accrue over a five-year period from the deployment of the Phase 2 OSS solutions. Again, the initial savings of

¹⁹ Beaumont Hospital avails of academic discounts for most of these applications.

²⁰ Red Hat provides support for both desktops and servers for €30K p.a.

€6.45 million and the overall savings over a five-year period of €11.34 million are very significant. Even in the scenario where proprietary financial systems are implemented, the savings from Vista adoption alone would be almost €10M over 5 years.

Application	Open Source Software Solution		Comparable Closed Source Software Solution	
	Initial Cost (€)	Annual cost over 5 years (€)	Initial Cost (€)	Annual cost over 5 years (€)
Vista (Based on 1,000 concurrent users)	1.700K ²¹	160K	7.400K ²² IDX	1000K
Compiere	10K	10K	760K ISOFT	148K
TOTAL	1.710K	170K	8.160K	1148K

Table 46: Cost Comparison of OSS versus Comparable Closed Solutions for BH Phase 2

15.3 Cost of Use of OpenOffice.org

“Adoption of Open Source software started well before COSPA experimentation. Employees have gained some experience with open formats. The expert employees of BH work similarly and produce more documents with OOo than with MSO. Therefore no extra cost but perhaps an intangible return on the investment is experienced in BH. We found that Beaumont Hospital has still to maintain proprietary format for the purpose of document exchange. As top management decision Beaumont Hospital is considering though to partially migrate back to proprietary software.”

The migration to Open Source software (Star Office in fact) at Beaumont Hospital started long before the data collected with the PROM tool. There are more than five months of data that was collected in 2005. We selected a representative period from 08.06.2005 – 03.08.2005. Our analysis precedes the top management decision on migrating back to proprietary solutions.

The total number of employees monitored is 210. Very few participants have used MSO at least once during the whole period and about half of those used only MSO. The other half (less than 10% of all participants) were switchers – users who utilized both products within the period that is analysed. The analysis of the daily use of the applications reports of a constant increase of the daily use of OOo.

Type of users	Number
Users who used MSO at least once during the whole period	37
Users who used OOo at least once during the whole period	192
Users who used only MSO during the whole period	18- 8.57% of all; 48.64% of MSA
Users who used only OOo during the whole period	173 (82.38%)
Users who used both MSO and OOo at least once during the whole period	19 (9.05%)

Table 47: Users at BH

Using events on the documents (office activities performed to work on the document, like “save as,” “print,” etc.) as a proxy for time we could trace the trend of use of both the application. With the monitoring of the events we can deduce that the usage of both applications is comparable, that is complexity of use and time spent are similar with a little

²¹ The costs for Vista and Compiere assume the use of proprietary databases. If OSS databases were used the savings would be even greater.

²² These costs were quoted to another agency, and have been adjusted so as to apply to Beaumont.

predominance of OOo.

15.3.1 Effort and Productivity with the Two Applications

Figure 30 shows that measuring the productivity, that is the “speed of working”, as the number of documents produced divided by number of events, there is a predominance of OOo.

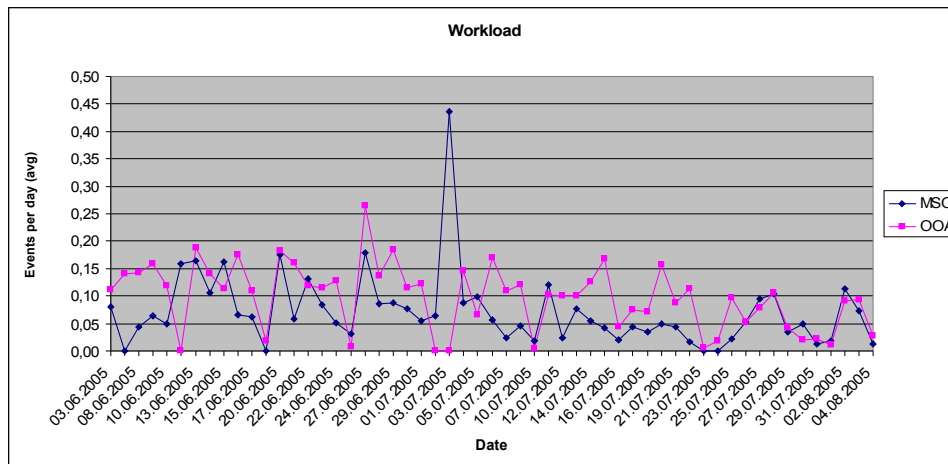


Figure 30: Average Number of Events on Documents per User by Day for BH

In conclusion the expert employees of BH work similarly and produce more documents with OOo than with MSO.

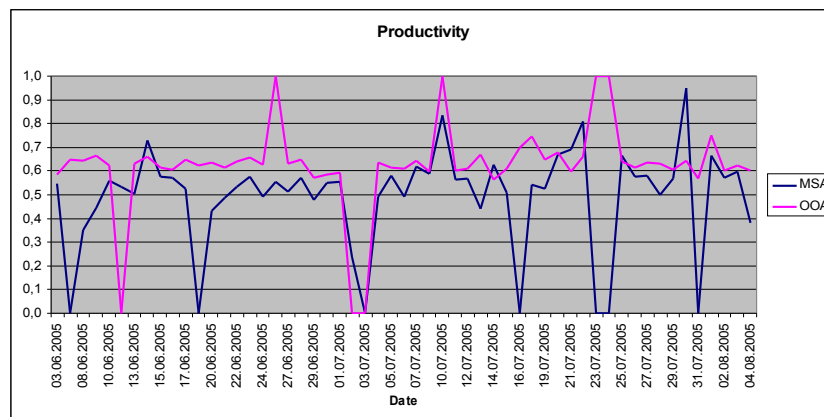


Figure 31: Average Productivity by Day for BH

Although zero values represent Saturdays for OOo (Figure 31), for MSO zero values are really negative peaks of use, that is no one is using MSO in that working day.

To check that users of different samples had similar tasks we performed an analysis on the distinct documents opened per user per day. This analyses the way to work on single documents. We have found that the way to work is pretty similar with a major trend of activities with OOo. As employees are experienced in using OOo, this implies that they use OOo for tasks with documents requiring more activities (like print, save as, print all, etc.). To support the claim that users have similar tasks we restricted the analysis on documents that are shared by two or more employees. We found that the trend of events is similar in the two applications.

We also found that a substantial number of MSO documents are opened in OOo. A possible explanation is that those files are meant to be exchanged between the two platforms. This may mean that BH has to exchange documents with external organizations, which do not use open formats.

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Appendix 1: Template for investigating the degree of assimilation of OSS

The questionnaire is based on the Framework for OSS Assimilation (WP3.1)*. It was used to collect the data about the OSS assimilation in the PAs and presented in this document. The collection of the data, however, was not straightforward. In many cases suggestions example and hints were needed so that to extract the whole information.

Public Administration:

* Questionnaire created by FUB

General Information about the Organization - Age and Size

1. How old is the PA?
 - ☐ Very old
 - ☐ Old
 - ☐ Young
 - ☐ Very young
2. How many employees does it have?
3. What is the PA size for the country standards?

- ☐ VPA-T1
- ☐ VPA-T2
- ☐ VPA-T3
- ☐ VPA-T4

growth	High economic resources	VPA-T1 PAs that enjoy the availability of economic resources and are fairly large in size when compared to most other PAs in the project's population. VPA-T1 PAs are optimal innovation generators, in terms of both process innovation and technology innovation.	VPA-T2 PAs which are relatively small, but enjoy high growth in economic resources. Problem children are optimal innovation users; and are willing to take the risk in their ambition to become stars.
	Low economic resources	VPA-T3 PAs which are relatively large, but experiencing low growth in economic resources. Cows are expected to deliver services to the citizens, without requiring continuous access to external resources.	VPA-T4 PAs which are relatively small and are low growth in economic resources. Lack of available resources means that they find it difficult to innovate in their processes and technology.
		High relative size	Low relative size

4. Industry type:
5. Short Description of PAs activities:

.....

.....

.....

.....

.....

.....

.....

* Questionnaire created by FUB

Extent of Experience and Knowledge Barriers

6. At the beginning of the COSPA project was the personnel prepared/ properly trained to work with OSS?

If 'Yes', please specify what part of it? If you can give a number or percentage.

- ☐ No ☐ Yes,
☐ Yes, only the IT staff
☐ Yes, only few people
☐ Yes, about half of the personnel
☐ Yes, almost all

7. How long did it take to train the personnel? (total)

	IT	Others
- through guided learning / courses		
- through seminars		
- through external consultants		
- through bulletin boards		
- through mailing lists and forums		
- through other methods, please specify		
- self-guided learning		

Please, specify the metric (e.g. manmonths, h./days per person, etc.)

8. Have you experienced the need of external consultancy?

- ☐ No
☐ Yes, for the following products:

.....

9. Did the number of IT personnel changed because of the introduction of OSS?

- ☐ No
☐ Yes, increased with
☐ Yes, decreased with

10. Was the personnel happy about learning a new tool?

- ☐ No ☐ Yes

Why?

(fear of being de-skilled; perception of work being undervalued)

11. How do they feel after a period of OSS utilization?

.....

12. How much time was spent for choosing which OSS to adopt?

Software Category	Time	Notes (optional) * name the concrete OSS; other notes
Desktop		
Server		
Office Automation		

13. What were the criteria to select?

(evaluation of the possibility to access source code VS zero (low) cost; additional functionalities provided)

Software Category	Criteria
Desktop	
Server	
Office Automation	

14. What time was needed to test the OSS?

Software Category	Time	Notes (optional) * name the concrete OSS; who did the tests; etc.
Desktop		
Server		
Office Automation		

15. Who installed the OSS?

- ☐ Users
☐ IT stuff
☐ External experts

16. What time was needed for installation and integration with other products?

Software Category	Time for installation	Time for integration	Notes (optional)
Desktop			
Server			
Office Automation			

17. Was there a need to buy new hardware or to upgrade the infrastructure?

- ☐ No ☐ Yes,
 please specify what and why?

18. Were there any references and needs for support that influenced the choice of OSS?

- support intensity: ☐ intensive ☐ some ☐ not important
 - support provider: ☐ specific organization ☐ not important
☐ network or community cooperation

		Comparable Closed	
--	--	-------------------	--

Software	Open Source Software Solution		Source Software Solution		Notes <i>(optional)</i>
	Initial Cost	Annual Cost over 5 years	Initial Cost	Annual Cost over 5 years	
TOTAL					

Increasing Returns of Adoption

☐ Not satisfied ☐ Partially satisfied ☒ Very satisfied

1	1	1
---	---	---

1 / : 1

1 1 1 1

☐ No ☐ Yes, costs.....

☐ Yes, savings.....

if possible, please specify for what and how much.

1: **1** **6**: **1** **1** **1** **1** **1**

☐ No ☐ Yes.....

— 145 —

if possible, please specify what.

☐ No ☐ Yes

.....

If possible, please specify which unit how important they are:

Top Management Championship

☐ No ☐ Yes.....

Please specify in what degree

12

☐ No ☐ Yes.....

Please specify in what degree

— *Journal of Ecology* 1999, 87, 1023–1036

Extent of Coordination

26. Did the stuff started to communicate more often between each other in order to share experiences about the OSS?

- ☐ No ☐ Yes.....

Please give some details

27. Did the stuff started to communicate more often with the IT stuff in order to share experiences about the OSS?

- ☐ No ☐ Yes.....

Please give some details

28. Did the stuff started to communicate more often with similar departments of other institution in order to share experiences about the OSS?

- ☐ No ☐ Yes.....

Please give some details

Sophistication of IT infrastructure

29. Do you think that the IT infrastructure became more sophisticated because of the introduction of OSS?

- ☐ No ☐ Yes.....

Please explain

Degree of OSS Assimilation

Before the start of the project:

- How many proprietary software tools were used?
- How often?
- Who was using them?
- How many open source tools were used?
- How often?
- Who was using them?
- How many in-house made tools were used?
- How often?
- Who was using them?

After the start of the project:

- How many proprietary software tools are being used?
- How often?
- Who was using them?
- How many open source tools are being used?
- How often?
- Who was using them?

- How many in-house made are being used?
- How often?
- Who was using them?

- Currently who knows about the possibility to use OSS?
- Currently who is eager to use OSS?

Please, rank the degree of OSS assimilation of this PA:

- | Levels: | Description |
|--|--|
| <input type="checkbox"/> <i>Awareness/Interest</i> | Key decision makers in the organization are aware of OSS and actively committed to learning more |
| <input type="checkbox"/> <i>Evaluation/Trial</i> | Organization has aquired specific OSS products and has initiated evaluation or trial |
| <input type="checkbox"/> <i>Limited Deployment</i> | Organization has established a program of regular but limited use of the OSS product |
| <input type="checkbox"/> <i>General Deployment</i> | Organization is using OSS product for at least one large and mission critical system |

Software Category	Date of Acquisition	Current Level of Assimilation	Date of Current Level Achieved	Notes (optional)
Desktop				
Server				
Office Automation				
GroupWare				

Appendix 2: Template for investigating OSS migration costs and costs of ownership

The questionnaire is based on the Framework for OSS Assimilation (WP3.1)*. It is an elaborated and customized version of the questionnaire presented in Appendix 1 of D3.1. It was used to collect the data about the OSS assimilation in the PAs and presented in this document. The collection of the data, however, was not straightforward. In many cases suggestions example and hints were needed to extract the whole information.

Public Administration :

** Questionnaire created by FUB*

Support

** everything that is NOT software!*

30. What was the cost for searching for alternatives?

** OSS alternatives for the proprietary software and comparing possible options*

.....

.....

31. What was the cost for searching for documentation for the chosen OSS?

.....

.....

32. What was the cost for installation and deployment of the OSS?

Hint: installation might be done on the server side, while deployment involves work on place/on client machines

.....

.....

33. What was the cost for achieving technical and data compliance and interoperability of the OSS?

Hint: might be provided by external consultancy or in house, but is not a tool!

.....

.....

34. What was the cost for searching for new support contracts?

.....

.....

* Questionnaire created by FUB

35. What was the cost for external support during the migration?

.....

.....

Software

36. What was the cost of the pilot project(s) (Spike solutions, feasibility analysis)?

.....

.....

37. What was the cost for data conversion tools?

.....

.....

38. What was the cost for interfacing to legacy software?

.....

.....

39. What was the cost for software add-ons?

.....

.....

40. What was the cost for security tools?

.....

.....

41. What was the cost for upgrades (if easily traceable in the contract)?

.....

.....

42. Were there other costs caused by the introduction of OSS?

Hint: increased internet traffic, necessity for new hardware, infrastructure upgrades, acquisition of books, etc.

.....

.....

Staffing

43. What are the salaries of employees (by categories)?

.....

.....

44. What was the cost for salaries of temporary employees?

.....

.....

45. What was the cost for staff extra hours and bonuses caused by the migration?

.....

.....

Learning/Training

46. What was the cost for the IT personnel training for the new solution?

** please distinguish between guided and self learning and specify times*

.....

.....

47. What was the cost for employees' training for the new solution?

** please distinguish between guided and self learning and specify times*

.....

.....

48. What was the cost caused by the lack of productivity?

** if possible specify the reasons (e.g. caused by the courses attendance; caused by the unfamiliarity with the product, etc.)*

.....

.....

Cost of ownership	Open Source Software Solution		Comparable Closed Source Software Solution		Notes (<i>optional</i>)
	Initial Cost	Annual Cost over 5 years	Initial Cost	Annual Cost over 5 years	
Acquisition					
Updates					
Upgrades					
Software add-on					
Security					
Maintenance (internal)					
Maintenance support contracts					
Consultancy					
Salary of employees					
Employees' regular training					
IT staff regular training					
Lack of productivity					
TOTAL					