

Open Source Software: The South African Government's Struggle to Migrate

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Abstract. *The South African (SA) Cabinet approved an OSS policy in 2007, declaring OSS the preferred government software choice. In spite of all the potential benefits highlighted in the literature, the uptake and migration processes have been extremely sluggish. This paper reports on the possible reasons for the slow uptake. Unstructured interviews were used to construct two case studies on the migration activities and events in two of the departments. It was found that both departments were driven to migrate by the policy; a desire to save on IT costs; the possibility to escape from vendor lock-ins; and the capability of OSS to address the shortcomings of current legacy systems. Challenges faced were user resistance; a lack of adequate skills; a lack of support by the appointed facilitation agency; and a lack of complete OSS product documentation. The paper concludes with practical recommendations on how to accelerate the OSS migration process.*

Keywords: *South African OSS Policy; Open Source Software (OSS); OSS migration, OSS enablers; OSS adoption barriers*

INTRODUCTION

Open Source Software (OSS) is in principle software of which the “underlying source code is ‘open’ and available for others to access and review”, (St.Amant and Still, 2007). Users of OSS can copy the source code, study the inner workings of it and customise it to suit their unique needs. The rationale behind OSS is that of collaboration and co-creation. Individuals share their knowledge to enhance progress and to facilitate the development of better software (Kumar and Singh, 2009).

The OSS movement is increasingly gaining momentum and support world-wide (Subramanyam & Xia, 2008). OSS is fast becoming popular as an alternative solution to predominant Proprietary Software (PS) and has found its way into public administrations across the globe (Drozdik, Kovács and Kochis, 2005). There are many socio-economic challenges prevalent across the continent of Africa and the efforts and resources required to address these often come at the expense of investments in ICTs. This has in many cases caused information “poverty” across the continent, with the larger section of the population having no cheap access to the digital society (Chonia, 2003). Although OSS is often perceived as one of the many possible solutions to bridge this digital-divide, its uptake in developing countries has been very slow (Negash, Carter, Chen and Wilcox, 2007).

To reap the benefits of OSS, the South African Cabinet approved an OSS strategy and policy in 2007, and agreed that all future software developed for government would be based upon open standards and that Government would migrate its current software to OSS (DPSA, 2006). A project office was to be established by an agency which they appointed to facilitate the migration process. The agency was tasked to ensure the smooth implementation of the FOSS policy throughout South Africa. Up to date, the uptake of OSS in the South African public sector has been extremely slow.

To address this problem, this paper starts off by elaborating on the benefits of OSS adoption and the barriers as reported on in the literature, after which the adoption and implementation of OSS in the public sector is discussed, highlighting important lessons learned from previous studies. A brief overview of the SA Government's OSS policy follows, after which the research methodology applied in the study, is elaborated on. The case study findings are subsequently reported on and the paper concludes with practical recommendations for accelerating the uptake of OSS within the South African government.

OSS ADOPTION BENEFITS

Economic benefits

According to Ellis and Van Belle (2009) the cost of ICT is important to most organisations, especially those who regard software as an enabler. Most developing countries are consumers as opposed to producers of software and are forced to import PS from developed countries impacting negatively on foreign country reserves (Kumar and Singh, 2009). Adopting OSS assists developing countries to preserve their foreign currency reserves so that it could rather be directed to other important projects, such as the development and nurturing of local IT skills, and other obligatory highly specialised software (Mtsweni and Biermann, 2008).

The total cost of ownership (TCO) is a contentious issue in the OS debate, where OS supporters assert that the TCO of OS is lower, due to no licensing fees and minimal acquisition costs (Chonia, 2003; Titterton, 2003; Drozdik *et al.*, 2005; Nagy, Yassin and Bhattacharjee, 2010). This makes it ideal for adoption by developing countries such as South Africa, which are expected to pay international commercial license fees (Wong, 2004; Ellis and Van Belle, 2009; Kumar and Singh, 2009). According to Dedrick and West (2007) TCO is directly dependable on the skills and resources available to an organisation and Bruggink (2003) warns that due to the lack of qualified personnel, the cost of technical support could be more for OSS than for the commonly used PS. In research done by Morgan and Finnegan (2007) in 13 companies in Europe, OSS was found to have a low cost in terms of reduced license fees, upgrade costs, virus protection and TCO (including software and service costs).

What makes OSS even more attractive for developing countries, is that the costs spent on development and maintenance could be fed back into the local economy (Drozdik *et al.*, 2005). Adopting OSS could lead to the establishment of a local software industry, creating small businesses to install, configure, deploy and provide OSS support services to institutions running OSS-based systems and applications. This could contribute positively to the economy of such countries (Chonia, 2003; Ellis and Van Belle, 2009; Kemp, 2009). Furthermore, Thakur (2012) states that the diffusion and availability of OSS in most countries results in more competition leading to lower prices, increased productivity and innovation in the software market.

According to Kemp (2009) the availability of OS source code makes it possible for developers to adjust the software to operate on new hardware components when available and also ensures that it is still available if required for use on old-fashioned hardware. It also provides organisations with the opportunity to access and modify the software to suit individual needs, without having to re-invent the wheel (Morgan and Finnegan, 2007). For routine, lower level tasks, the source code availability shortens the software development life cycle, cutting down on development costs, and freeing up internal resources to focus more on the development of strategic software that could provide a competitive advantage (Kemp, 2009).

Allen and Geller (2012) highlight the capability of OSS to allow for experimentation, customisation and the launching of new applications with less or no restrictions. For them the low cost advantage of OSS alone chases a replacement-logic (exchanging a proven PS package with an unproven OSS replacement),

and is not adequate for grasping the organisational effect of OSS in challenging organisational contexts. OSS should also have the capability to solve the business's problems rapidly. Consequently, this could lead to long-suffering IT departments forming a more positive and proactive view of themselves, resulting in improved relationships with IT users.

OSS allows organisations to escape from vendor lock-ins, by facilitating freedom of choice. It gives the organisation a sense of power, freeing it from private vendors (Morgan and Finnegan, 2007). Collaboration and knowledge sharing between organisations is encouraged by OSS. It facilitates joint product development and results in the sharing of expenses, which is beneficial to all partaking parties (ibid.). Ven *et al.* (2008) warn that choosing OSS will not inevitably make organisations fully independent of software vendors, as they might still, to some degree, be dependable on OSS vendors who provide configuration and support services.

Technical benefits

Supporters of OSS describe the software to be highly secure as users relish the opportunity to build in better security into their code (Cassell, 2008). The availability of the source code also reduces the threat of viruses, as they are perceived not to contain hidden features (Morgan and Finnegan, 2007; Ven *et al.*, 2008). Furthermore, as the OSS software passes through a large community of users and developers who collectively assist in identifying and fixing bugs, it gets extensively peer-reviewed, enhancing the quality of the software (Spinellis and Szyperski, 2004; Cassell, 2008). The access to source code makes the turnaround time on OSS bug fixing much shorter, as many developers are able to assist with these immediately. Krishnamurthy (2003) also highlights that the ability to tailor software to fit the specific demands of an organisation, makes it more attractive than the 'one-size-fits-all' scenario of PS. According to Dedrick and West (2007) the ability to modify source code is only viewed as an advantage by organisations with in-house technical expertise, while others see it as a risk to system stability. Ven *et al.* (2008) report that in cases where organisations adopt established infrastructure software, such as Linux and Apache, they rarely use the source code, as even experienced programmers are not able to modify the code of highly matured OSS.

According to Kshetri (2004) a high proportion of developing countries have previously used donated and old computers. Linux (an OSS operating system) seems to be a lot smaller and much more portable than PS operating systems such as Windows, and is able to run successfully on older/slower machines, making it the preferred choice for developing countries (James, 2003). Ellis and Van Belle (2009) state that OSS code could also be adjusted to attend to expandability matters, which cuts the need to expand the existing ICT infrastructure.

OSS ADOPTION BARRIERS

Governments spend billions on PS licensing annually (Comino and Manenti, 2005). This makes OSS an obvious governmental choice. Due to a lack of internal capacity they are though reluctant to incorporate OSS (Cassell, 2008). Paré, Wybo and Delannoy (2009) confirm that a shortage of support and maintenance skills is found to be a barrier to OSS adoption. Negash, Carter, Chen and Wilcox (2007) also assert a lack of technical skills as contributing to the slow uptake of OSS, leading most organisations to avoid or stop mass migration to OSS. Ven *et al.* (2008) concur that the availability of external support is an important adoption factor, and emphasises the fact that services such as the installation, configuration and maintenance of OSS, could be outsourced.

The lack of salespeople to provide information on, references for, and product demonstrations of OSS is also an adoption barrier (Paré *et al.*, 2009). Furthermore, political pressures, as well as 'anti-sharing' cultures, could also have a negative effect on OSS adoption. Existing contracts and well sorted

relationships established with PS vendors could hamper or discourage OSS adoption. Conservative IT decision makers consider the trust in their established relationships with PS software vendors to be much more attractive than OSS of which they normally have less experience and which they suppose offers less support and a lot more uncertainty (ibid.;Goode, 2005).

On the contrary, these fears may be due to a lack of information or knowledge about the availability, immaturity or relevance of OSS (Paré *et al.*, 2009; Nagy *et al.*, 2010). Fitzgerald (2006) declares the description of the OS phenomenon being one of “a collective of supremely talented developers who volunteer their services to develop very high-quality software by means of a revolutionary new approach”, to be an outdated myth, and illustrates how the new OSS, which he labels OSS 2.0, has emerged as a more mainstream software phenomena which is commercially a more worthwhile option. The ‘new’ OSS 2.0 includes more purposeful analysis and design and OS developers are more and more getting paid for their OSS development work. Customers of OSS are also more willing to pay for support services which are provided by a network of interested parties that, as a whole, provide complementary services (ibid.).

Many potential adopters of OSS consider it to have several hidden costs (Paré *et al.*, 2009). Although the source code is available, they believe that the use of OSS still requires one to have knowledge of it, to maintain it, to upgrade it if necessary, and to train the users of it. All of this is needed on an on-going basis and has to be done by either external consultants or internal staff.

According to Cassell (2008) the major challenge to migrate to OSS lies at the connection between desktop operating systems and software applications. He further observes that many governments have moved over to OSS to manage their computer networks, but moving to an OSS operating system has been a tough decision, resulting in technical issues of compatibility, since many popular applications are designed to run on PS operating systems only. This can discourage organisations to migrate to OSS products, and makes for a lot of personnel challenges with regards to training and adjusting to new systems and processes (Kshetri, 2004). Nagy *et al.* (2010) suggest that organisations make use of middleware solutions to assist them in connecting to their existing legacy systems.

According to Drozdik *et al.* (2005) most organisations concur that users intend to be the most challenging facet of migrating to OSS. User skills and the possible discomfort they will experience during the migration process are tough to quantify and additional money disbursed on training may not meaningfully increase the users’ comfort and skills with the new system.

THE ADOPTION OF OSS IN THE PUBLIC SECTOR

Allen and Geller (2012) refer to the on-going debate in the OSS literature on whether OS is adopted due to its innovation enabling abilities, or purely due to the fact that it is either cheap, or costs nothing. According to Cassell (2008), a lot has been said on the benefits and disadvantages of OSS, but with the exception of a few studies, not much research has been done on the process of adoption and the actual implementation of FOSS in the public sector.

Ayala *et al.* (2011) argue that public organisations normally adopt OSS by deploying OSS products in their operational environment. This is mainly done to reduce costs by saving on license fees or hardware requirements (Applewhite, 2003); to comply with standards; and to establish freedom from vendor lock-ins.

Fitzgerald and Kenny (2004) report that the support from top management is critical when implementing OSS. One of the problems encountered in the OSS adoption process, was the resistance from staff who

feared that they faced deskilling due to their adoption of OSS, as this would result in them losing their expertise in popular commercial PS. Furthermore, they warn that support and maintenance should not be expected at a smaller cost than that available for PS, just because the software itself is available at little or no cost.

Government (at all levels) face a funding crisis in the present economic climate (Ward and Tao, 2009), which makes all options to cut on IT operating costs appealing. The elimination of restrictive licensing, vendor lock-in and high switching costs could also contribute to diminish government IT costs. Ward and Tau (ibid.) report, in coherence with the findings of Comino and Manenti (2005), that 'informed' municipal governments will include the possible value of OSS in their adoption decisions, while the 'uninformed' municipal governments will either overlook the existence of OSS or are unaware of PS alternatives.

For municipal governments to adopt OSS, the organisation must change to incorporate and effectively make use of the new technology. According to Ward and Tau (2009) the adoption of OSS is less technical and more organisational. An organisation's IT decision making culture appears to be a significant barrier in OSS adoption and an organisation with a change embracing culture will more effectively adopt new technology, than one with a strong status quo preference. To adopt OSS successfully, an organisation needs to have the necessary capability (echoed by Gallego, Luna and Bueno (2008)), discipline and cultural affinity. For Ward and Tau (ibid.) the main difference between government and the private sector lies in the customer. Government is not driven by profit, but by directive or law, only requiring the service to be implemented, while the quality or level at which it has to be done is sometimes not even indicated.

In a study done by Cassell (2010) on the adoption of OSS by the local governments of three cities in Germany, the following was found to be the lessons learnt:

- Political backing and leadership is essential: A 'shepherd' to lead staff through the adoption process is central and critical.
- Cost arguments should be secondary: an unexpected event, such as a new law, could create the opportunity to redirect an organisation on a different course.
- FOSS is not free: it requires substantial investment in training, implementation, service and maintenance. Other grounds such as increased cooperation among governments; greater independence from software vendors; more flexibility and better security; and an upsurge in local economic development, should also be used to strengthen the case of OSS.
- Take incremental steps but with an overall strategy: 'soft migration' is recommended, gradually phasing in the OSS after initially setting up a clear strategy on how to move forward.
- Practical experience outdoes theory: government officials should spend time in departments that use FOSS to gain first-hand knowledge from line-employees.
- Organisation matters: migration to OSS is reported to be easier with a centralised IT department, as a decentralised IT structure makes for cultural and structural barriers that render a government-wide adoption strategy challenging.

THE OSS POLICY OF THE SA GOVERNMENT

The South African Cabinet approved a OSS policy and strategy on 22 February 2007 and agreed that all future software developed for government would be based upon open standards and that Government would migrate its current software to OSS (DPSA, 2006). Government departments were to include OSS

in their planning. A project office was to be established by a government agency, which was tasked to ensure the smooth implementation of the FOSS policy throughout South Africa.

Important to note is that South Africa has adopted a preferred OSS strategy. This strategy is very different to a mandating strategy, as the latter is a more radical approach in that it commands the use of OSS systems throughout government, which implies replacing the entire existing proprietary infrastructure (Wong, 2004). Similarly important to note, is that there isn't unanimous support for the OSS policy throughout government. Some departments, with the exception of a few, seem to be rather unwilling to jump onto the OSS bandwagon.

RESEARCH METHODOLOGY

An interpretive approach, using two case studies (Walsham, 1993; Barrett and Walsham, 1995; Walsham, 1995) was used to gain an in depth understanding of the OSS adoption challenges facing the SA Government. Two departments were selected for investigation and for confidentiality purposes, the pseudo names "Case A" and "Case B" are used to refer to them. The two departments were selected as they had in some way introduced OSS and thus had adequate experience with the phenomenon under investigation (Yin, 2002).

Data Collection and Analysis

Two qualitative data collection techniques were used, namely semi-structured interviews (Myers and Newman, 2007) and document analysis (Yin, 2002). The interview questions were formulated with the sole purpose of guiding the interviewer during the course of the interviews. The questions were broadly classified under the following themes: OSS adoption background; OSS adoption challenges and motivators; and Government support on OSS adoption.

For Case A, the Chief Information Officer (CIO) was interviewed, while the Project Manager for OSS implementations was questioned for Case B. **These two interviewees were chosen after in depth discussions with the IT division of both departments, in an attempt to find the candidates that could contribute the most to the research.** Interviewing some of the staff members involved in OSS projects within their respective departments, could have been informative, but was not possible as they were not willing to take part, believing that they did not have the authority to speak on behalf of their departments. Each interview lasted about an hour and was tape recorded. These were then transcribed, read through and verified by listening to the tape recordings. Information obtained from existing historical documents, such as project proof-of-concepts and strategic plans, was used to support and supplement the interview data. As recommended by Yin (2002), a case study database was created to store all the relevant case study evidence.

RESEARCH FINDINGS AND DISCUSSIONS

OSS adoption background

Interview results showed that the two government departments have hybrid IT environments, in which both OSS and PS are deployed on desktops and servers. For both departments, PS is still the most dominant in the desktop computing domain, while OSS is widely used in the server computing domain, primarily to provide network infrastructure services. Certain OSS products are installed as standard on every desktop deployed within the two departments. The most common of these include the Mozilla Firefox web browser and the OpenOffice suite. In terms of desktop operating systems, Microsoft Windows still dominates within both departments. Despite this dominance, both departments also run

OSS desktop operating systems, with OpenSuse being predominantly used in Case A and Ubuntu Linux in Case B.

OSS adoption motivators

Complying with the Government's OSS policy was one of the reasons both departments had to adopt and migrate to OSS. Similarly, both departments adopted OSS products where they perceived them to be capable of addressing the inefficiencies of their legacy systems relating to reliability, availability, functionality and other technological and operational shortcomings. In addition, Case B was influenced by the need to implement software solutions which are capable of running on multi-platforms, to enhance compatibility and interoperability between the software and the existing legacy systems. This need was echoed in Case A, in which the need for enhancing the department's interoperability within itself and across other government departments was influential to their decision to adopt OSS. The OSS adoption decision within Case A was further motivated by the desire to escape vendor lock-ins and other restrictions on the use of the software, as well as the need to adopt cost-effective software solutions. Case B was also driven to adopt and implement software products, which would not only satisfy current software needs, but would also meet anticipated future needs.

OSS adoption challenges

Challenges identified by both departments were:

- User resistance: stemming from two sources: the fact that the users had been exposed to PS for significant periods of time made them oppose the change; and the users held the perception that the current legacy systems (largely PS) were superior to the proposed or implemented OSS alternatives.
- A lack of adequate OSS skills within the departments
- A lack of buy-in from top management in supporting OSS adoption was highlighted in Case A.
- Delivering the promised OSS product to the users was challenging in Case B, which struggled to deliver OSS products that effectively address the functionalities and other requirements agreed upon with the users.
- No meaningful support was received from the appointed government facilitation agency and there is no drive to comply with the OSS policy.
- A lack of complete or unavailable documentation for most OSS products with regard to their features, installation and configuration manuals.
- Difficulties in automating the process of mass deployment of the OSS products across the departments.

Government support on OSS adoption

Both departments voiced their frustrations regarding the insufficient assistance gained from the appointed government agency in their adoption and migration efforts. There were no efforts put in by this agency to facilitate or track the migration processes in departments. Although both departments acknowledged the positive influence the policy has had on their decisions to adopt OSS, the fact that the SA Government's OSS policy has a preferred OSS strategy, means that it contains some "back-out" clauses, which could potentially be abused to irrationally avoid OSS adoption.

CONCLUSION

The SA Government's uptake of and migration to OSS has been extremely slow, in spite of the many potential benefits of OSS emphasised in the literature. This study aimed at discovering the reasons for this slothfulness. Case studies were undertaken in two of the government departments and the reasons found were reported to be user resistance to OSS; a lack of adequate OSS skills; a lack of support by the appointed facilitation agency; and a lack of complete OSS product documentation. Apart from these reasons, the Government's OSS policy also provides for a preferred OSS strategy which does not mandate departments to implement or migrate to OSS, offering leeway for backing out on easy terms. To address the slow uptake of OSS, the following practical recommendations are made:

- Government needs to address the "back-out" clauses in the current OSS Policy and increase the accountability of the departments with regard to their adoption of OSS;
- Each of the government departments' CIOs should be required to report periodically on the progress they make with regards to OSS adoption;
- A fully-fledged OSS Centre of Excellence aimed at ensuring the development of the necessary OSS skills within the departments and the country at large, should be considered;
- Government should cogitate having an ICT strategy at national level, in which OSS migration projects should be given a higher priority; and
- Government departments should co-operate with each other with regards to their migration efforts. In this way departments with successful OSS migrations should invite others to share in their knowledge, experiences and lessons learned.

The findings of this study can act as guidelines to the SA Government and policy-makers to draft more effective policies and strategies on OSS implementation, while providing the support necessary to allow for the mass uptake of OSS in government, reaping all the potential benefits offered.

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