The State of Open Source Software (OSS) In South Africa

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Abstract

This paper explores the state of Open Source Software (OSS) in South Africa. The use of OSS in the business and government environment, as well as the supply and demand of OSS professionals in the South African environment are investigated. This research can also provide businesses with an objective tool with which to help them evaluate OSS in their businesses.

The results depict a growing trend in the use of OSS in South Africa. Only a small percentage of SA organisations have significant usage levels of OSS, with the majority of OSS users planning on maintaining their current levels of usage. It was observed that 67% of non-OSS users are considering OSS use in the future, with the majority of these respondents having made preliminary investigations into the viability of OSS use.

Further results show an association between the size of an organisation and the usage of OSS, with smaller and medium sized enterprises using OSS more than larger organisations. It was also observed that the majority of training institutes perceive that there will be a growth in demand for OSS training within the next 5 years, which correlates with findings that the number of training workshops and institutes are increasing to accommodate the increase in demand.

Keywords: Open Source, Training, Supply, Demand

1. Introduction
All businesses should decide on the type of software they will use, Propriety or Open Source. This decision can not only impact on business performance but could also impact a business finances, and potentially have the ability to affect the business on a strategic level.

Open Source Software (OSS) has become a viable option to an increasing cross section of businesses in South Africa (SA) (NACI 2004; Mortali 2003). This is due to the ever changing business environment coupled with the increasing cost of proprietary software. As a result of these factors, many South African organisations have had to look at alternatives to buying software from proprietary software vendors (NACI 2004).

OSS is still not as popular as Propriety Software (PS), but is gaining credibility in businesses (NACI 2004; Mortali 2003). The main reasons for this is that OSS is available for little or no cost (Schutz et al. 2005), whereas Proprietary Software (PS) is not free and its use, redistribution or modification is prohibited. In most cases, a license is needed for each copy of the PS that is installed (Groeneweg & Kuper 2002).

Perhaps most importantly, users have access to the “source code” of the OSS allowing them to view the inner workings of the code, as well as allowing them to modify the code (NACI 2004; Bruggink 2003). All OSS has to comply with a number of criteria relating to redistribution, inclusion of source code, integrity of the author's source code and discrimination against persons or groups (Perens 2003). These criteria are frequently refined and updated and available at the Open Source Institute (OSI). A contributing factor to the use of OSS is the Open Standards. These are the agreed upon conventions for the writing of software to ensure compatibility with other software (NACI 2004; Schwartz 2003), and are aimed at allowing users to select different software applications from different vendors and be confident that the software will work together.

Even though OSS is deemed free and not protected by copyright licensing, it does however still fall under specific licensing laws (Free Software Foundation 2006). There are a number of licenses in use, which in effect do the opposite of copyrighting, by ensuring the freely distributable nature of the software. An example is the General Public license (GPL). This is a license that makes it obligatory to redistribute the license in its original form (Free Software Foundation 2006). Linux is distributed under this license which according to Wheeler (2002) is the most widely used license used by open source and free software.

With all its attractions, adopting OSS in a business context is a strategic choice (Carr 2000). Carr (2000) states that although OSS offers freedom and flexibility, companies should not expect OSS to match the features offered by proprietary software. Doyle (2002) in turn argues that the OSS products are currently too fragmented or scattered to be taken seriously by the corporations, making companies cautious about using OSS.

**1.1 Trends in the use of OSS**

Over 75 governments have either expressed interest in OSS or implemented the use of OSS (NACI 2004; Groeneweg & Kuper 2002). These governments include South Africa,
Germany, China, Thailand, Brazil, Argentina, France and the United Kingdom (NACI 2004; Groeneweg & Kuper 2002).

Microsoft alienated many of its large and medium clients with its Licensing 6 and Software Assurance programs (Galli 2002) which came into effect in 2002. This has made OSS more attractive as licensing costs for Microsoft products increased (Galli 2002).

A few large South African organisations have invested in OSS technologies. One of the largest retailers in South Africa, Pick ‘n Pay, recently decided to start adopting Linux in some of their systems (CNet 2003; NCR 2003). Other South African retailers such as JD Group, Pep Stores, Bears and Lewis Stores and 25 other furniture and clothing chain stores also use Linux-based applications (Thomas 2003).

At the onset of this study, the South African government was finalizing the adoption of an OSS policy that promotes the use of OSS in South Africa (NACI 2004; GITO 2003). SITA (State IT Agency) admitted that the government network is run predominantly on OSS, utilizing Apache (Web Server), FreeBSD (Operating System) and Exim for e-mail (Otter 2003).

1.2 Areas of OSS Use
There has been an ongoing debate about the use of OSS between Microsoft proponents and those who are convinced about the abilities of OSS lead by Linux (Aboul-Hosn et al. 2000; Godden 2000). However, Wheeler (2002) maintains that there is excellent evidence to support the claim that Linux has a significant market share in several key areas.

Since April 1996 Apache has been the leading web server having a greater market share than its closest competitor which is Microsoft’s IIS (Wheeler 2002). Prior to 1996 Apache’s OSS ancestor (NCSA web server) was the most popular web server since August 1995. The Apache Web Server held almost two-thirds (65.94%) of the global market share in 2003, with over 25 million servers worldwide which was an increase from an approximate 50% market share in January 2000 (Netcraft 2003). In comparison, Microsoft’s IIS held 24.30% of the market share in 2003, (E-Soft 2003) with 11 million web servers worldwide at the time (Netcraft 2003). In 2006, Apache servers are holding 72% of the global market share in comparison to Microsoft, which holds 21.48% of the market share (E-soft 2006).

1.3 Advantages of OSS
OSS is extremely cheap, or free of charge. Linux or Apache, for example, costs a fraction of comparable PS (OSDL 2005; Bruggink 2003). Total Cost of Ownership (TCO) is a very important aspect for competitive organisations to consider, as it comprises all the costs associated with the deployment of a new Information System (NACI 2004; Mortali 2003). OSS has many cost advantages and therefore has a smaller TCO (OSDL 2005). The purchasing and updating of licenses for constitute a large portion of the TCO for South African organisations, as they have to import their software (NACI 2004; GITO 2003). Using OSS would therefore reduce such costs.
Another advantage of OSS is that the underlying code can be accessed, allowing users to modify the code according to their specific needs and build new systems (Arendse et al. 2002; Stones 2003). Since the public is able to access the source code of OSS, there is constant interaction amongst developers, leading to greater innovation, as many experts from different countries and cultures are collaborating their ideas (Festa 2003). The motivation behind developing code in the OSS community is also very different, in that it is purely for the programmer’s recognition, and not for monetary reason (Oz 2002). As a result, the overall quality of the product improves as well as its functionality, causing more users to attempt and possibly use it regularly (OSDL 2005).

Organisations need to be able to extend their systems as needed, while keeping costs to a minimum (Wheeler 2002; Mortali 2003). The free availability of the source code allows organisations to discover the scalability issues and make the necessary modifications to their platforms. Organisations are thus, able to extend their systems, replacing hardware with higher speed or parallel processors or different architectures without having to replace their operating systems (Wheeler 2002; Hughes 2003). This benefit is the chief reason for IBM using GNU/Linux as the main operating system for their “blue gene” supercomputers (IBM 2003). OSS, unlike proprietary software, is able to run on older hardware (Godden 2000; Wheeler 2002; Hughes 2003). Modifications are possible with OSS, removing the problem of software becoming obsolete (Schutz et al. 2005).

Support for OSS has also been enhanced. There are call centres and support companies such as Red Hat, C2net and Linux Care who offer 24/7 support to OSS users. Organisations can even go online for support, making it advantageous as the organisations are often able to contact the developer or other users who use the same software. This in turn improves the quality of the product (OSDL 2005; Phillips 2003).

Another benefit of OSS is security. There have been several authors (Arendse et al. 2002; Wheeler 2002; GITO 2003) who have shown OSS security to be superior to PS security. In agreement Fisher (2002), states that organisations’ move towards OSS has not only been stimulated by its low cost and adaptability but rather due to it security. The reason OSS security is said to be more secure is that the code is available to many more people to review it and find errors, and therefore most errors in OSS are found before they are released. Proprietary software relies on a far smaller group of developers to secure the software and find vital flaws (Fisher 2002; Gillespie 2000; Reynolds & Stair 2001). Gillespie (2000), Wheeler (2002), Fisher (2002) and GITO (2003) agree that OSS is more secure than PS.

The Shuttleworth Foundation are facilitating, supporting and funding initiatives which will aid in the awareness, uptake and growth of open source in South Africa (Shuttleworth Foundation 2006). In addition to working on an ‘edubuntu’ classroom version of its linux distribution, the Shuttleworth Foundation also works with South African schools to set up FLOSS-based thin client networks through its ‘tuXlabs’ initiative (Zehle 2005).
To date, these initiatives had not had the desired adoption impacts, due largely to Microsoft’s offer to supply 32000 South African schools and universities with free software (Otter 2003). However, SITA is currently collaborating with universities and private companies and set up a resources centre with the Council for Scientific and Industrial Research (CSIR) to help develop OSS programming skills (CSIR 2005).

1.4 The Disadvantages of OSS
Allison et al. (2001) and Arendse et al. (2002) state that proprietary software is more secure for economic reasons, as customers are paying for secure systems and therefore tight security must exist, and that people are employed specifically to control the security. Another argument against OSS’s security, according to Allison et al. (2001) and Arendse et al. (2002) is that due to its nature anyone is able to modify the source code, and therefore a potential attacker has full knowledge of the system.

One of the biggest concerns when purchasing OSS is the support organisations will receive (Reynolds & Stair 2001; Mortali 2003). According to Rotow, (2003) if an organisation adopts OSS, they are on their own, with no organisation backing the product. In agreement Gonzalez-Barahona (2000) states that due to the “open” nature of open Source software, no one holds exclusive rights on a given code. Rotow (2003) and Network News (2001) claim that OSS is no different to proprietary software in that the request for enhancements or support.

One of the biggest obstacles in adopting OSS is lack of familiarity, as the unknown often breeds resistance (NACI 2004). The introduction of change or an unfamiliar process into an organisation, results in the likelihood of employee resistance. (McLeod & Smith 2001; Creasey & Hiatt 2003).
1.5 Research Objectives

1.5.1 Research Model
The Reformulated IS Success Model has been used as a basis to formulate the objectives and hypotheses (DeLone & McLean 2002).

![Diagram of the Reformulated IS Success Model](image)

Figure 1: The Reformulated IS Success Model (DeLone & McLean 2002).

The DeLone and McLean (2002) model has been widely used and referenced to measure the success of Information Systems. For the purpose of this research, the model was adapted as follows:

![Diagram of Adaptation of the Reformulated IS Success Model](image)

Figure 2: Adaptation of the Reformulated IS Success Model

Information quality, system quality and service quality from DeLone and McLean (2002) were replaced by users’ perceptions of the advantages and disadvantages of OSS. These perceptions affect the use or intention to use, as well as the user awareness, and the supply and demand for OSS skills. The use or intention to use remains, and user satisfaction replaced with user satisfaction or user awareness to include those who are not currently OSS users. The supply and demand of OSS skills was added as a third factor which could affect the state of OSS in South Africa. The State of OSS in South Africa will be determined by the market reasons, the use or intended use of OSS, the demand and supply of OSS skills and the market awareness of OSS.
1.5.2 Objectives
The main objective of this study was to determine the state of OSS in South Africa. This was achieved by examining the perceived advantages and disadvantages of OSS, and then using the model developed to: (1) examine the use or intention to use Open Source Software in South Africa within organisations and the government by (a) determining a profile of OSS Users, by (b) identifying the industry segments predominately using OSS, (c) examining the areas of business in which OSS is being used, (d) observing which OSS operating systems are being used and (e) noting which OSS applications are being used. (2) determine the user satisfaction or user awareness of OSS by examining the perceived advantages and disadvantages of OSS. (3) determine the supply and demand of OSS skills both currently and in the future.

2. Methodology

2.1 Sample Selection
The focus of the research was on these main areas, namely the use of OSS at an organisational level, the degree to which training institutes are matching the supply of OSS expertise with the industry demands, and user satisfaction and awareness. Two groups of participants were targeted. The ‘usage’ and ‘awareness’ research was aimed at any business, organisation or governmental department whereas the ‘training’ research targeted any educational or training institute that offered information technology training in software, hardware, networking and the like.

The final sample comprised of 291 South African organisations, 280 South African schools, 44 training institutes and 70 Computer Science and Information System Lecturers throughout South Africa.

Since the research study was focused towards participants in Cape Town, and Johannesburg, the results from the survey may not be a true reflection of the situation throughout South Africa. However, because these areas are considered the major business areas, the results from the study are used to make a generalization about the state of Open Source Software in South Africa.

2.2 Data Collection Techniques
Data collection was done via a website which provided respondents with access to online questionnaires. Data was stored directly into a database which was connected to the site, saving time and eliminating the possibility of transcription errors. In addition to this, the data entered by the respondent was validated before being stored in the database, ensuring data integrity.

Once the data had been successfully stored in the online database, which in this case was an XML data structure, it could be remotely downloaded and exported either into Microsoft Excel, Microsoft Access or SQL Server for analysis.
In addition to the hosted website which allowed participants to complete the questionnaire online, hardcopies were distributed to Computer Science and Information Systems lecturers at the South African Computer Lecturers Association. These responses were collected and the data was entered manually.

2.3 Development of the Instrument
The two questionnaires were derived from the FLOSS-Free/Libre Open Source Survey (2002), and a survey undertaken by Groeneweg and Kuper (2002) and based on the research model. After testing and finalising the questionnaires, they were approved by the University Ethics Committee before being loaded onto the web, or distributed.

One questionnaire targeted any organisation (including the government) in South Africa and was intended to provide information regarding the use of Open Source Software. Demographic details were gathered, use or non-use of OSS confirmed, the extent of OSS use determined, Information about the use of specific operating systems and supporting applications was gathered. The perceived advantages and disadvantages of OSS were ascertained.

For those participants who did not use OSS within their organisation, it was determined whether they had considered using Open Source Software in the past and whether they planned to investigate it in the future. This information allowed the researchers to determine the likelihood of a growth in the use of Open Source Software in the future. The participants were asked to select their reasons for not using Open Source Software so that correlations could be observed between the current OSS user’s previous reasons for not using OSS and the non OSS users’ reasons for not using OSS.

The second questionnaire targeted educational and training institutes that offered information technology training in software, hardware, networking etc. The training questionnaire obtained information regarding the institutes demand and supply of trainees and their perception of their future capacity. It also attempted to ascertain from the institutes whether or not they plan on growing their OSS/Linux training over the next 3 years. This allowed the researchers to determine growth in training capacity and link the supply of OSS to the demand for OSS skills.

2.4 Data
A low response rate of 7.6% was received from the training and educational institutes, possibly because most schools served with the questionnaire did not respond. The response rate from the organisation and government questionnaire was 29%. The researchers found that the quality of the respondents was high as a large proportion of the respondents were IT professionals or at least in an IT related field and the remainder of the respondents were all in relatively high positions within the organisations. A realistic view of the organisations situation with regard to the use or non-use of OSS with adequate and reliable reasoning was therefore possible.

In terms of the quality of the data collection method, it was felt that it was both appropriate and effective in achieving the responses that were required.
2.5 Profiling the Respondents
The purpose of profiling the respondents was to ensure that the findings have a certain degree of reliability and validity in their representation of the situation in South Africa. The actual results received from the respondents were graded in terms of significance, as well as the respondents themselves. The respondents were classified in terms of their geographic location, age, language, position in the organisation, and department.

2.6 Respondents by geographic location
The majority of the respondents were based in the Western Cape (57%) and Gauteng (34%), with other provinces accounting for 9%. This distribution was predicted as the Western Cape and Gauteng are the major business hubs within South Africa. However, it was unexpected that the Western Cape would have more respondents than Gauteng as the Western Cape is a smaller business centre than Gauteng.

2.7 Respondents by age
The majority of respondents were between the ages of 25 and 35 years. If the ranges ‘25 – 35’ and ‘35 – 45’ were combined into one range of ’25 – 45’ accounted for 62% of the respondents. It is possible that younger respondents may not hold very high positions within organisations. It is thought that the higher the position in the organisation the more significant the data may be. Secondly, it may be possible that the younger to middle-aged respondents may be more familiar with the specifics of OSS than respondents over the age of 45 as OSS according to NACI (2004) and Mortali (2003) has only reached high popularity in recent years.

The majority of respondents were IT managers, IT professionals, managers and directors. However, a large proportion of the respondents could not be categorized and were thus grouped into an ‘other’ category. The IT managers and IT professionals accounted for 43% of the total number of respondents. A large proportion of the respondents (54%) originated from the IT departments of their organisations. This made the data more reliable.

3. Analysis and Results
3.1 Objective 1: The Use or Intention to use Open Source Software
3.1.1 OSS usage by industry
Due to the manner in which the questionnaires were distributed, it allowed for greater exposure to industries that made extensive use of information technology to promote themselves and conduct their business activities i.e. a retail organisations may have more advanced IT infrastructure (e.g. website or email circulation) than an agricultural organisation, therefore the industry characteristics are a factor which needs to be considered.

It was observed that the OSS users came from four industries namely finance (23%), manufacturing (21%), retail (35%) and government (21%) The manufacturing industry
has the highest OSS usage level per respondents with a 77% usage level, finance with a 48% level and government and retail with a 67% and 64% use level respectively. This information does not show the extent of usage, but represents only those organisations that use OSS regardless of the degree to which it is used.

### 3.1.2 Areas of OSS use in the organisation

OSS respondents were asked to select from three areas of OSS use, namely business applications, desktop environments, and web services.

It was evident from the data collected that the most common business area of OSS use is web services, with 60% of respondents saying they use OSS web servers such as Apache. This result is in accordance with E-Soft (2003), where Apache accounts for 65.94% of the market. The findings for web services also match the general popularity of OSS when running http servers, ftp servers, mail servers and other network services.

Thirty-two percent of organisations use OSS for business applications. This area is concerned with the applications that assist organisations in performing specific activities that are critical to the success of the organisation. This correlates with the popular trend towards using OSS for business critical applications in the retail industry of South Africa, as cited by Thomas (2003) where retailers such as Pick ’n Pay, Lewis Stores and 25 other furniture and clothing chain stores in South Africa all use OSS applications.

### 3.1.3 The use of OSS operating systems and applications

Red Hat Linux is the most commonly used operating systems amongst organisations using OSS in South Africa. According to the sample, Mandrake Linux and FreeBSD have the same popularity within these organisations. The combined proportions of Linux operating systems used suggest that 71% of organisations use one or more of the Linux flavours. These percentages support the claims that Linux accounts for the largest proportion of OSS operating systems being used as either server or client machines (Wheeler 2002).

MySQL, a database management application, is the most commonly used (65%) supporting application. OpenOffice which is an alternative to Microsoft Office is one of the more popular (36%) applications. The numbers for most of the categories are relatively small which can be attributed to the abundance of built-in features of Linux and FreeBSD. Most networking applications come with both types of operating systems as well as printing and file applications. Thus it is often difficult to make a distinction between what is a supporting application and what is part of the operating system itself.

### 3.1.4 The trend in the use of OSS in South Africa

#### 3.1.4.1 Growth of OSS Use

In this study, there were a greater number of OSS users (63.51%) than non OSS users (36.49%) in South Africa. This perceived growth in OSS usage is supported by NACI (2004) who state that there has been a growth of OSS in South Africa. The sample may be biased as those who use OSS are more likely to respond to this type of research topic as they have a greater interest and knowledge in this particular area.
3.1.4.2 The current use of OSS

The majority (65%) of South African organisations have insignificant usage levels of OSS. Nineteen percent of the organisations who responded have an average usage level and 8% of the organisations use OSS significantly within their organisation. Finally, a small percentage (4%) use OSS for strategic reasons i.e. in business critical situations.

The results indicate that the majority (54%) of OSS users plan to maintain their level of use without increasing or decreasing their usage level significantly. Almost a third (31%) of users plan to gradually increase their usage level, while 15% have plans for significant levels of use. It can therefore be observed that the usage of OSS is likely to remain the same or increase, as no surveyed organisations currently using OSS are planning on reducing their future OSS use.

In addition, two thirds (67%) of non-users are considering using OSS in the future. Of the 67% who are considering using OSS, 83% have undergone preliminary investigation into the viability of OSS in their organisation. With a high percentage (67%) of non-users considering OSS as an option, coupled with none of the South African organisations who currently use OSS planning to reduce their future use, it suggests that there is the potential for future growth in the use of OSS in South Africa.

3.2 Objective 2 – User satisfaction and awareness

The majority (64%) of users regard the cost savings on licensing as the greatest benefit of OSS, with the second most popular (47%) advantage being the total cost of ownership (TCO), which is supported by Wheeler (2002) who states that OSS has the greatest cost benefit and therefore the lowest TCO.

However, 63% of users felt that the lack of support for OSS was the primary disadvantage, lack of employee skills (54%) and lack of liability (46%) were the next two biggest disadvantages. These reasons for not using OSS correlate with the perceived disadvantage of current OSS users. This correlation could therefore suggest an increase in awareness and that the non-OSS user’s reasons for not using OSS are valid.

According to Groeneweg & Kuper (2002) and Phillips (2003) there are many training courses that offer OSS training. The Shuttleworth Foundation is an institute who are assisting in this area by facilitating, supporting and funding initiatives which will aid in the awareness, uptake and growth of open source in South Africa (Shuttleworth Foundation 2006). In addition the South African governments move to Open Source Software and the associated cost savings will create an opportunity to develop a local skills base within South Africa (NACI 2004; Stones 2003).

3.2.1 Organisational Size and OSS Use

The results show that there are more small and medium sized organisations using OSS in South Africa, as opposed to the larger organisations. A significant association was observed between the size of an organisation and the use of OSS (p= 0.000478). It is then suggested that the majority of organisations that use OSS in South Africa are the small and medium sized organisations.
3.2.2 Organisational Size, OSS Use and IT Expenditure
It was observed that the majority of the small organisations (75%) have an annual IT expenditure of < $160k, as opposed to the larger organisations where the majority (41%) have an annual IT expenditure of > $1.6m. It was evident from the statistical analyses that there is a significant association (p=0.000186) between the size of an organisation and their annual IT expenditure. It can therefore, be suggested that it is likely that smaller organisations will use OSS due to the cost benefit.

3.3 Objective 3 – The supply and demand of OSS skills in South Africa

3.3.1 Growing Requirement for skills
The majority of the training institutes perceive that there will be a growth in demand for OSS training in the next five years. This observation correlates with Phillips (2003), who states that due to the growing trend of OSS, the number of training institutes and workshops are increasing in order to lessen the skills shortage gap and accommodate the increase in demand.

3.3.2 The supply of OSS Skills
It was found that there is an insignificant association between the past number of qualified trainees to the future growth in the institutes capacity (P = 0.494621) Although the statistical analyses suggests an insignificant association between the total number of qualified trainees and the future growth of the training institute’s capacity, the constant increase in the means suggests that growth is possible. This suggestion of growth is further supported in results which show the majority (61%) of Institutes plan to grow or significantly grow their capacity, despite their previous number of qualified trainees. This perceived growth in capacity compliments the growth in demand for OSS skills and training in order to reduce the current shortage of OSS skills in South Africa as cited in the literature by Bruggink, (2003) and Phillips (2003).

A consideration that must be taken into account is that the response rate for this particular question is very low, making the statistical analysis for this section explorative. As a result no concrete conclusion could be drawn. However, it is suggested from the above analysis that the institute’s perception is that the capacity of OSS training courses will increase over the next three years.

4. Conclusions
According to the National Advisory Council on Innovation (2002) there is a growth in the use of OSS in South Africa. This growth can be attributed to the move towards OSS by a number of major organisations, such as Pick ’n Pay and other retail stores such as Lewis and Bears (Thomas 2003). The South African government’s plan to adopt Open Source will further impact the growth of OSS in South Africa. OSS is available for many business areas, with the main area being the server environment (Wheeler 2002; Netcraft 2003), and a small growth in the desktop environment (Mortali 2003). There are a number of factors which influence the adoption or use of OSS, namely the cost savings on licensing, support, TCO and the availability of OSS skills (OSDL 2005). Finally a
lack of qualified IT experts exists in the South African industry which could retard the current growth of OSS in South Africa (Bruggink 2003; Phillips 2003).

4.1 Implications for theory
From the data received and the analysis conducted, support is demonstrated for the existence of the following significant relationships:

- Organisational size and use of OSS.
- Organisational size and annual IT expenditure

There is also evidence to support each of the following statements:

- Organisations are currently using OSS in South Africa.
- There is a growing trend in the use of OSS in South Africa.
- There future use of OSS in South Africa will increase.
- Smaller companies are more likely to use OSS due to the cost benefit.
- There is a growing requirement for OSS skills in South Africa.
- The training institute’s perception is that the capacity of OSS training courses will increase over the next three years.

After thorough analysis of both a statistical and exploratory nature, it appears as if there is a growing trend in the use of OSS in the future, as well as an increase in the amount of OSS training which will aid in decreasing the current shortage of OSS skills, in South Africa. The authors intend to repeat the study and compare trends in the near future.

References


