Open Source Software Adoption by South African MSEs: Barriers and Enablers

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ABSTRACT
This paper explores the factors which influence the use of Open Source Software (OSS) by small and micro enterprises. OSS has been identified as a facilitator for small enterprises in emerging markets to implement an Information and Communication Technology (ICT) infrastructure at reduced cost. However, its diffusion in South Africa has been rather slow. This research aims to highlight OSS adoption factors applicable to small enterprises. The Technology-Organisation-Environment (TOE) framework was used to guide the data analysis. This research also attempts to identify additional factors which are unique to the context of this research and evaluate their implication on the OSS adoption decision.

Although there are many factors influencing the adoption decision by smaller enterprises, the lack of knowledge and exposure were fundamental to the slow diffusion of OSS. Factors contributing to this lack of product knowledge were the lack of OSS marketing and easily accessible OSS vendors.

Categories and Subject Descriptors  
K.4.3 [Computers and Society]: Organizational Impacts.

General Terms  
Management, Human Factors.

Keywords  

1. INTRODUCTION
The fast pace of new developments in Information and Communications Technologies (ICTs) continuously challenges developing countries to stay abreast in order to function and compete in the global commercial arena. This presents a significant problem because developing countries often lack the financial and human resources which are necessary for enterprises to foster efficient ICT infrastructures. Open Source Software (OSS) presents developing countries with the opportunity to overcome some of the problems and bridge the digital divide at a relatively low cost [13].

Although OSS can offer many benefits in terms of local innovation and revenue, the adoption of OSS within South Africa (SA) has been relatively slow when compared with proprietary software, particularly amongst micro and small enterprises. Previous research suggests that the greatest benefits can be reaped by small enterprises, both in terms of cost reductions as well as generating new enterprises which provide OSS development, implementation and maintenance services [7]. On a national level OSS presents the opportunity for SA to be independent of foreign software corporations [8]. In light of the potential benefits presented by OSS, particularly to small enterprises in developing countries, it is important to understand the factors which enable the adoption of OSS as well as the barriers which are responsible for the relatively slow uptake of the OSS phenomenon in SA.

Although the barriers and enablers of OSS adoption have been previously studied, the focus has been on enterprise organisations which usually have sufficient financial resources to address the high license costs associated with proprietary software license agreements. The aim of this research is to gain a deeper understanding of the factors which have an impact on OSS adoption amongst small enterprises in SA in order to explore the slow diffusion of OSS in a commercial arena which has been theorised to gain the most benefit. This research aims to reinforce known factors applicable to micro and small enterprises as well as uncover additional factors which have not been previously theorised.

The rest of this paper starts with a literature review about the concept of OSS, its relevance to developing countries and some of the theoretical research models. It then explains the research methodology which was used for this paper. The bulk of the paper is then devoted to the discussion of the major findings from the interviews, structured according to the TOE (see below) model.

2. LITERATURE REVIEW

2.1 OSS
OSS can be defined as software which allows a user to modify the source code in an effort to understand the inner workings of the software as well as fix errors and customise the application for specific business requirements [6]. OSS is distributed under a license which allows a user access to the source code, the ability to modify, use, copy and distribute the software. One of the primary requirements stipulated by the license is that the software is distributed along with the associated rights [12]. A popular OSS license is the GNU General Public License (GPL), also known as a ‘copyleft’ license, which was developed by Richard
Stallman, together with the Free Software Foundation (FSF) [3]. The GPL gives users three rights provided these rights are redistributed with the modified software:

- To use, duplicate and redistribute the software.
- To modify the software source.
- To have access to the software’s source code in an effort to understand how it works and adapt it to comply with individual requirements [6].

OSS products include both server and desktop computer applications which cover most business functional areas.

2.2 OSS for Developing Countries

OSS has been identified as a facilitator for bridging the digital divide [15]. OSS can become a catalyst for developing countries to enter the information age creating new business prospects [6]. OSS has received significant interest in emerging markets and this is no surprise since it has a low acquisition cost. However, migration issues have proved challenging and have limited the adoption of OSS. Additionally pirated proprietary software has surfaced as low-cost competition to OSS in emerging markets [11]. Limited Internet bandwidth in developing countries also causes issues with successful OSS adoption as users rely on the Internet for communication with online support communities, documentation and critical software updates. Additionally, the perception within emerging markets that cost is directly related to quality does not assist in the wide spread adoption of OSS [8].

For SA, OSS presents an opportunity for economic development, especially for small businesses. Whereas proprietary software limits the possibility for further innovation by prohibiting access to the source code, OSS allows for the creation of local enterprises to develop existing open source code in order to produce customized software [7]. The potential to promote innovation and transfer programming skills makes OSS a valuable tool for SA to build the local ICT industry [8]. In addition to promoting software development business practices, OSS also presents an opportunity for businesses to offer installation and support services. OSS can further contribute to the development of the SA economy as the costs incurred to implement OSS would circulate within the local economy as opposed to accruing to foreign nations, as is the case with the majority of proprietary license fees [7].

However, developing countries such as SA have problems related to infrastructure which threaten the wide spread adoption of OSS. Unreliable electricity supplies, lack of international network bandwidth and the fact that only a small portion of the population has access to computers and the Internet, are among the factors which negatively influence the adoption of OSS [8].

The SA government has in the past shown support for the implementation of OSS through the drafting of policy documents promoting its use [6]. In September 2002 the Open Source Software Work Group of the South African Government Information Officers’ Council (GITOC) developed a policy document which encourages government to fully support the adoption of OSS for use within its e-Government initiative. Additionally, GITOC also recommends that government supports the development of OSS in SA by encouraging small business to produce and implement OSS as well as provide user training [13]. However, widespread use of OSS is not evident within government. Previous research has shown that it is perceived to be technically complex and lacking product support and with political pressures to reduce risk, this perception has led to reluctance within government to implement OSS on a large scale [6].

Several studies [5; 6; 9; 15] suggested that amongst South African Small to Medium Enterprises, there was a positive interest in OSS. However, feedback from software vendors showed that these enterprises were reluctant to adopt OSS for a number of reasons, such as lack of in-house technical staff, insufficient funding for user training, lack of product representation and awareness as well as the perception that OSS is not user friendly for use on desktop computers.

2.3 Theoretical Model and Factors Influencing OSS Adoption

In order to study what the enablers and barriers of OSS adoption are, it is important to understand what constitutes user acceptance. For a technology to be adopted there needs to be acceptance by the potential user of the technology. Understanding the factors which influence this user acceptance is a well researched area within Information Systems (IS) literature and has resulted in a number of theoretical models which attempt to explain the variables influencing the intention to use a specific technology [14]. However, many of the traditional ‘technology acceptance models’ and theories, such as TAM, TRA, UTAUT or IDT, focus on the individual. In this research, the unit of research was considered to be the small business organisation, thus an organisational adoption model was required.

Dedrick & West’s adoption of the Technology-Organisation-Environment (TOE) framework, originally developed by [4], was used as the primary framework for this research. Dedrick & West’s adoption of TOE was developed specifically to address OSS adoption and was therefore identified as an appropriate framework for this research [3].

TOE defines technology adoption factors under the context of three elements, drawing on the diffusion of innovations (DOI) theory and the standards of economics theory.

- Technology: Major factors which fall under the technology context are cost, perceived reliability and compatibility with existing technologies and skills.
- Organisation: According to the framework the presence of ‘boundary spanners’ is a major factor which falls under the organisation context, other factors are human and financial resources and innovativeness of the organisation.
- Environment: Under the environment context major factors are the availability of complementary assets and the fear of adopting a losing standard. The industry in which the organisation operates is also seen to have an influence on technology adoption [2].

2.3.1 Technology Factors

Software Cost. Cost falls under the relative advantage construct as theorised by the DOI theory [2]. Previous research aimed at ICT professionals on the topic of OSS adoption suggests that the cost of ICT is an important factor to most organisations [3]. Organisations where the software procured directly generates
large amounts of revenue are less concerned about the cost of ICT, whereas organisations which see software only as an enabler are more sensitive to the cost of software procurement. The decision to adopt any technology is influenced by cost [9]. OSS is not tied to a proprietary license and therefore is free or has a low acquisition cost. This presents an immediate reduction in total cost of ownership (TCO) for organisations considering OSS as an alternative. In addition future software upgrades are free [8].

Hardware Cost. Another significant cost reducing benefit associated with OSS is its ability to utilise minimal system hardware resources. In other words applications such as Linux can be installed on legacy computer hardware [1]. The fact that state of the art hardware is not required prolongs the useful life of existing hardware. Another advantage is that the code can be modified to address scalability issues reducing the need to extend the existing ICT infrastructure [15].

Total Cost of Ownership (TCO). It is important to note that the cost of adopting software is not limited to the license fee. Software procurement also incurs a maintenance fee as well as the cost of ensuring compatibility within the existing ICT infrastructure. Additionally, costs such as training and technical support need to be considered when procuring software. As a result the TCO needs to be taken into account when it comes to software in an ICT infrastructure [1; 5]. The fact that OSS is available for free or at low cost makes it a viable option for SA organisations which have to pay international commercial license fees [3]. The question is, are proprietary license fees more expensive than the implementation and support costs associated with adopting OSS [7]. According to [3], TCO is directly related to the skills and resources available to an organisation.

Reliability. As a result of the source code being available with the software, OSS is subjected to far reaching peer review. This results in software that is perceived to be more reliable and superior in quality [8]. Source code transparency not only contributes to better quality software, it has resulted in enhanced security capabilities. Software bugs and security holes are eliminated by the process of peer review. However, proprietary products improve continuously and those that advocate proprietary software suggest that OSS is not as stable and secure as perceived [8; 15]. According to [6], the fact that Linux is perceived as more reliable and secure than Microsoft Windows is a dominating factor for certain organisations when procuring software.

Performance Expectancy. Performance expectancy (not part of TOE but important in UTUAT) relates to the users’ expectations with regards to improved job performance through the use of the technology [14]. One of the essential factors which separate OSS products from proprietary software is the ability to access the source code. However, for the majority of users this is not considered as a major advantage and only appeals to organisations which require specific functionality. According to [3], some organisations view the ability to alter the source code as a risk to system stability whereas other organisations rely on this ability to continue operating. This is largely influenced by the level of technical expertise within an organisation whereby organisations with less in-house technical skills do not see this as an advantage. Products such as Linux are mature and do not require much modification reducing the appeal of being able to modify source code [3].

Facilitating Conditions/Compatibility. This is defined as whether or not the user views the technology as being able to integrate with the existing organisation and infrastructure [14]. Compatibility affects three areas of the ICT infrastructure: technology, skill and task. For a particular technology to be considered for adoption it needs to be compatible with the organisation’s existing technology infrastructure, skill set and must fit the specific task it is required for [2]. Although a large portion of OSS is compatible with other OS platforms such as MAC OSX and Microsoft Windows, there are some applications which only operate within a Linux environment [8].

Many Information Technology (IT) departments are staffed by Microsoft certified technicians, causing a reluctance to adopt OSS systems [8]. According to [6], OSS has more chance of being favoured for adoption if advocates manage to bypass ICT departments and speak directly to senior management, who will be less prone to technical bias and able to address commercial issues with regards to the adoption decision.

Complexity/Difficulty of Administration. Within SA the perception of OSS is that it is complex and problematic to deploy [5; 6]. There is a requirement for OSS technically skilled staff to deploy and maintain OSS. This presents a problem as the majority of ICT training institutions within SA concentrate mainly on popular proprietary products.

Results Demonstrability. According to [2], the fact that OSS is often easy to trial has reduced the perceived risk of adoption. Numerous OSS products are freely available for download and are able to run on commodity hardware simplifying OSS trialability.

2.3.2 Organisational Factors
An organisation’s level of innovativeness is an important factor which affects the timing of adoption as well as the reasons that some organisations consider adopting OSS. The strategic importance of ICT to an organisation also affects the decision to adopt, the more central that ICT is to the business strategy the more significant the affect of ICT is on the organisation’s cost structure [2].

ICT Innovativeness. An organisation’s perception with regards to technology innovativeness is said to be a factor influencing the timing with which a new technology is adopted and also if the new technology is considered for adoption [3].

Boundary Spanners. The presence of staff with previous OSS experience positively influences the adoption decision and increases an organisations confidence in a prospective technology [2].

Slack Resources. Slack resources can be subdivided into two categories, financial and human. It can be defined as the amount of time available to evaluate new technologies and the budget available for ICT expense. Organisations with limited financial resources and slack human resources are more inclined to adopt OSS [2; 9].

2.3.3 Environmental Factors
Due to the nature of OSS there is no single ICT organisation that controls and supports the products. This is theorised to imply a greater level of risk to potential adopters compared to proprietary software products which are controlled by their respective ICT corporations [2].
Availability of Product Skills & Support Services. Proprietary software usually comes with a formal support option provided by a single ICT enterprise. OSS users have to rely on collaborative support from the online community, whose services are not guaranteed to be available [2]. This affects large corporations who have the necessary resources to pay for formal support agreements and has less of an effect on small businesses that often rely on in-house skills and community support.

Legitimacy. Technology users are more confident about products which are endorsed by large ICT vendors such as HP and IBM. Fear of adopting a standard which will be abandoned and no longer supported negatively influences an organisation’s decision about OSS [2].

Availability of External Support Services. As the products are available for free or at low cost there are often no packaged technical support agreements and documentation is limited. The development model which results in some of the benefits of OSS also leads to concerns regarding technical support. [6] show that organisations prefer OSS with service support and as a result many free versions are not considered. The issue of easily accessible product support is worsened by the fact that regular users often do not possess the necessary technical skills to operate OSS. The OSS community does offer a certain degree of online support; however, according to [3], users are often not comfortable dealing with the community for support and feel more comfortable with vendor support. Additionally there is a lack of knowledge about product service and support offered by certain OSS vendors [6].

Platform Long-term Viability. This is an important factor as organisations prefer platforms which are perceived to be the winning standard. Adopting a technology standard which becomes broadly accepted affords the technology user greater vendor support and investment as well as a broader range of complementary products. The opposite is true if adopting a technology standard which does not receive wide spread interest [2].

Product Awareness
A major obstacle to the widespread use of OSS in SA is the lack of awareness by key ICT decision makers. Proprietary software products generate significant turnover and therefore vendors are able to afford extensive marketing campaigns. This has led to a high level of public awareness of proprietary products such as Microsoft Windows [5; 6; 9].

On the other hand the opposite is true for OSS products, with no single organisation able to equal Microsoft’s marketing campaign. As a result the public are not generally aware of the alternatives. This obstacle is amplified by the fact that the SA OSS community generally adhere to a non-commercial business model. For example, within SA Red Hat Linux is distributed by a company called Obsidian who does not actively market the Red Hat brand.

As a result one of the key problem areas when it comes to selecting software is the fact that decision makers are not adequately informed about the alternative software packages available, hidden costs such as hardware required to run the software and ongoing support and maintenance costs [6].

3. RESEARCH METHODOLOGY

3.1 Research Questions
1. Is the TOE framework able to explain the attitude of small enterprises in SA towards the adoption of OSS?
2. Which are the relevant variables when applied to small enterprises and are there additional constructs and variables that need to be included?

The first research question can be concretized using specific variables and their hypothesized impact on the propensity of the organisation to adopt OSS, under the following three headings: Technology (T), Organisational (O) and Environmental (E) as summarized in Table 1 below.

<table>
<thead>
<tr>
<th>T/O/E</th>
<th>Variable</th>
<th>Impact on Propensity to Adopt</th>
</tr>
</thead>
<tbody>
<tr>
<td>T</td>
<td>Software &amp; Hardware Cost</td>
<td>Positive</td>
</tr>
<tr>
<td>T</td>
<td>Compatibility (technology, current skill set and specific tasks)</td>
<td>Positive if compatible</td>
</tr>
<tr>
<td>T</td>
<td>Perception of reliability (quality)</td>
<td>Positive or negative</td>
</tr>
<tr>
<td>T</td>
<td>Perceived Complexity</td>
<td>Negative</td>
</tr>
<tr>
<td>T</td>
<td>Ease of experimenting</td>
<td>Positive</td>
</tr>
<tr>
<td>O</td>
<td>ICT Capital Budget</td>
<td>Negative if budget is large</td>
</tr>
<tr>
<td>O</td>
<td>ICT Staff Time</td>
<td>Positive where slack available</td>
</tr>
<tr>
<td>O</td>
<td>ICT Innovativeness</td>
<td>Positive</td>
</tr>
<tr>
<td>O</td>
<td>Worker experience with new platform</td>
<td>Positive where such workers exist</td>
</tr>
<tr>
<td>E</td>
<td>Product long-term viability (winning standard)</td>
<td>Positive if perceived to be viable</td>
</tr>
<tr>
<td>E</td>
<td>Industry Maturity</td>
<td>Negative</td>
</tr>
<tr>
<td>E</td>
<td>Availability of technical support &amp; skills (External)</td>
<td>Positive where such skills exist</td>
</tr>
</tbody>
</table>

The second research question is inspired by the fact different factors may be relevant for smaller organisations; or their importance may be perceived differently (Brink, Roos, Weller & Van Belle, 2006).

3.2 Research Approach
Our research paradigm is positivist. As technology adoption has been previously researched, theories exist which outline the factors influencing adoption and indicate the formulation of propositions. However, existing theories and literature focus on enterprise organisations and there is not much supporting literature which focuses on micro, small and medium-sized enterprises. Additionally this research attempts to uncover adoption factors which are not included in previous adoption models in an effort to understand why there has been a slow uptake of OSS amongst smaller businesses in SA.

Considering the above factors a combination of deductive and inductive approaches to theory were used, testing existing theory
in a new context and building theory through critical literature review and analysis of research findings [10]. Because of this, we decided that a relatively small number of semi-structured interviews would yield much richer and interesting data than a large questionnaire-based survey.

3.3 Sampling Frame
Non-probability purposive sampling was used to identify suitable organisations to interview. Purposive sampling is suitable when there is a requirement to select interview subjects that will be particularly informative [10]. The sample frame consists of organisations which are classified as micro or small enterprises (50 or less employees) and includes organisations which have either adopted OSS or at least considered OSS alternatives. A particular consideration was to have a spread of industries represented. The sample frame also includes an OSS vendor. A series of semi-structured interviews were carried out with ICT decision makers from these organisations. A total of 8 interviews were conducted spanning 6 organisations. Table 2 shows demographic information on the organisations and interviewees which made up the sample frame.

<table>
<thead>
<tr>
<th>Business Sector</th>
<th>Org Size</th>
<th>Interviewee Job Function</th>
<th>ICT Exp.</th>
<th>Sex</th>
<th>Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mining</td>
<td>15</td>
<td>Managing Director</td>
<td>20 yrs</td>
<td>M</td>
<td>A1</td>
</tr>
<tr>
<td>Procurement</td>
<td>20</td>
<td>IT Manager</td>
<td>8 yrs</td>
<td>M</td>
<td>B1</td>
</tr>
<tr>
<td>Food</td>
<td>45</td>
<td>Technical Director</td>
<td>26 yrs</td>
<td>M</td>
<td>C1</td>
</tr>
<tr>
<td>Education</td>
<td>30</td>
<td>Head Mistress</td>
<td>10 yrs</td>
<td>F</td>
<td>D1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>CompSci Teacher</td>
<td>10 yrs</td>
<td>F</td>
<td>D2</td>
</tr>
<tr>
<td>Insurance</td>
<td>50</td>
<td>Director</td>
<td>12 yrs</td>
<td>M</td>
<td>E1</td>
</tr>
<tr>
<td>Information Technology</td>
<td>25</td>
<td>Director</td>
<td>15 yrs</td>
<td>M</td>
<td>F1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Linux Administrator</td>
<td></td>
<td>M</td>
<td>F2</td>
</tr>
</tbody>
</table>

Semi-structured interviews were selected in order to gather a greater depth of data and attempt to understand the individual circumstances of the interviewees. This enabled the selection of appropriate questions depending on the organisation being interviewed. This versatility was required since both pre- and post-adopters as well as an OSS vendor were questioned in an effort to initially gauge awareness and subsequently the factors influencing the particular organisation’s intention to adopt.

3.4 Data Gathering and Analysis
The interview protocol is available from the researchers. Interview questions were informed by the theoretical models previously discussed as well as previous research on the topic of OSS adoption. Interviews have also been structured according to contexts derived from previous models to assist with data classification. Interview data was analysed to identify the applicable variables previously theorised to have an affect on OSS adoption as well as build on existing theory and gain new insights. In order to concretize OSS, the interviewees were specifically probed about their adoption of/attitude towards Linux OS, Firefox, OpenOffice, MySQL and ERP/CRM.

Interview data was captured using a simple digital voice recorder. The audio-recordings were transcribed allowing for easier analysis. Data was analysed using standard qualitative data analysis practices. Transcribed data was broken down into units and classified into categories which were primarily based on the variables as identified in various theoretical models and previous research. Template analysis was used by creating a template outlining the categories or codes deductively derived from existing literature and theory. This method allows for a deductive as well as an inductive approach whereby the template can be amended and added to as data are collected and analysed.

3.4 Limitations
The small sample size admittedly presents limitations in that it is difficult to draw definite conclusions about certain factors. To counter this to a certain extent, two interviews were conducted with an ICT vendor which offered OSS services. This assisted in highlighting factors which applied to their entire client base of approximately 400 organisations.

4. FINDINGS
This section summarizes the main findings from the interview data analysis. The discussion is structured according to the TOE framework. However, not all of the TOE factors (as summarized in Table 1) appeared to be applicable to small businesses. The interview analysis required us to delete, split, rename or reconceptualise some of the original factors. Due to space limitations, only the (final) factors which emerged as important factors are discussed below. On the other hand, some additional factors were found to play a role in the OSS adoption decision. These additional factors have been classified under the appropriate TOE heading.

In the analysis as well as discussion, certain moderating factors must be considered. Table 3 outlines moderating OSS factors that were taken into consideration during data analysis. (The Organisational code corresponds to the first character in the interviewee Code in table 2.) In some cases, job function and the industry were also found to be influencing the interviewee’s views.

<table>
<thead>
<tr>
<th>Org</th>
<th>Free MS software</th>
<th>Use OSS</th>
<th>Use Desktop OSS</th>
<th>Intend to Use OSS</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>B</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>C</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>D</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>E</td>
<td>No</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>F</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
</tbody>
</table>

4.1 Technology Factors
The majority of the technology factors appear to be able to explain the attitude of small businesses towards the adoption of OSS. However, certain factors are more relevant to small
businesses than others. The major technology factors affecting OSS adoption amongst small businesses are software cost and compatibility. Maintenance cost and performance were identified as additional technology factors not covered by TOE; however, these are not considered to have a major influence on the adoption decision.

4.1.1 Hardware cost
For small businesses this factor has a positive influence over their attitude towards OSS adoption, although not exactly as theorised by TOE. Small businesses place value in the fact that OSS requires less space of the art computer hardware, especially with regards to servers: “This is a huge factor because; again the hardware is cheaper...” [F1] Although OSS offers a benefit in terms of computer hardware expenses, for some of the organisations interviewed the cost of computer hardware in general was of minor concern: “Computers are the heart of the business; one can’t take any chances with that.” [A1] Hardware cost is an enabler of OSS adoption; however this factor does not have a major influence over the decision to adopt OSS amongst small businesses in SA.

4.1.2 Software Cost
The cost saving which OSS presents in terms of software license costs positively affects organisations intention to use it. The majority of those interviewed expressed that this factor played a major part in their intention to use OSS. For small businesses this factor plays a major role when procuring more expensive applications such as RDBMS and CRM software. However, key industries are afforded Microsoft software at reduced or no cost so this factor has little or no influence over their propensity to adopt OSS. Software cost is an enabler of OSS adoption and is seen to have a major influence over its adoption, especially where proprietary alternatives are expensive: “Basically it is a cost factor. It helps us get in the door with clients at a lower cost.” [F1]

4.1.3 Maintenance Cost
Maintenance cost is seen to influence the adoption decision amongst small businesses. The data reveals that although OSS technical services are more expensive, the software requires less maintenance than proprietary versions and therefore the overall cost is less: “So I think at the moment in South Africa the cost of implementing and maintaining a Linux server, the unit or hourly cost is more, but long term costs are less because it is more reliable.” [F2] Maintenance cost is seen to positively influence organisations attitude; however this depends on the perception about the cost to maintain OSS.

4.1.4 Reliability
Varying perceptions of OSS’s reliability have an influence on adoption. For organisations with previous OSS experience this factor is seen to positively affect their propensity to adopt OSS. Reliability is an enabler of OSS adoption; however, it has a greater influence over the OSS adoption decision for organisations with prior OSS experience and therefore is not seen to have a major influence on OSS adoption.

4.1.5 Performance
OSS and especially Linux are seen by organizations with prior OSS experience to offer better performance and functionality than proprietary versions: “Performance, yes this does influence my decision and I find Linux is far superior...” [C1] The fact that OSS does not require expensive hardware resources emphasizes this factor for certain organisations. This is especially true for server side applications and operating systems. This factor is seen to have a positive influence on OSS adoption; however is more applicable to organisations with prior OSS experience.

4.1.6 Compatibility
Application compatibility appears to have more of a significant effect on adoption than skills of existing ICT workers, this is largely due to the fact that workers can be trained but solving technical compatibility issues is more of a challenge. Overall compatibility, or rather in the case of OSS non-compatibility, is seen as a key barrier to the adoption of OSS.

Application. This factor is of paramount importance to the organizations interviewed and is seen to have a major impact on OSS adoption: “Everyone we deal with is on MS, would they be able to read our documents.” [D1] Application compatibility is fundamental to the ongoing operations of a business. Application compatibility is divided onto two areas; compatibility with applications available and used in the general business environment and compatibility with an organization’s existing applications and ICT infrastructure. In general, the need for compatibility with proprietary standards is still a major OSS inhibitor for small businesses propensity, although this can be addressed by OSS which can demonstrably deal with documents in proprietary formats.

Skills of Existing ICT Workers. This factor has a negative influence on an organisations propensity to adopt OSS unless such skills exist. From the data it is apparent that organisations which have used OSS and intended to make further use of OSS had more confidence in their employee’s ability to navigate and use it. Organisations which were less inclined to use OSS were concerned about their employees’ ability and highlighted the fact that having to train staff was a costly disruption to business operations and negatively affected their attitude towards OSS.

Task Fit. Task fit does not appear to play a major role in the OSS adoption decision amongst small enterprises.

4.1.7 Perceived Complexity
This factor is seen to play a role in the adoption decision and organisations who perceived OSS as being complex were less likely to make use of it. Although this was confirmed by the data, it should be noted that organisations who were less familiar with OSS in general perceived it as being complex whereas those familiar with open source products viewed it as being easy to use and administer. The real issue with complexity appears to be that there is a lack of knowledge about OSS. This factor is a barrier for organizations which are less familiar with OSS.

4.1.8 Results Demonstrability
Although the ability to use software in a test environment prior to deploying in the production environment is of paramount importance to the organisations interviewed, this factor is not seen to be a major influence over the adoption decision. Some of the organisations viewed OSS as easier to trial; however, in this instance OSS does not have a major advantage over proprietary software.
4.2 Organisational Factors

Of the organisational factors covered by TOE only innovativeness and boundary spanning were seen to have an influence on the adoption decision. Additional factors were identified to play a role in the adoption decision, of which lack of product knowledge is identified as a major barrier to OSS adoption.

4.2.1 ICT Capital Budget

With the exception of one of the organisations interviewed, this factor did not appear to have an influence on the decision to adopt OSS. Although the data reveals that larger budgets allow for more expensive options this factor is not seen to influence the adoption decision.

4.2.2 ICT Staff Time

Staff time required to evaluate new technologies is more relevant to larger enterprises with in-house ICT departments. For small businesses this factor does not appear to have an influence over their attitude towards OSS adoption. However, it does appear to have an influence over its promotion by vendors whereby OSS is perceived to be time consuming to research and evaluate.

4.2.3 Innovativeness

This factor did appear to influence organisations propensity to adopt in that those organisations which perceived themselves as being more innovative were more inclined to make use of OSS and intended to make further use of it.

4.2.4 Boundary Spanning

Boundary spanning was seen to have an influence on OSS adoption whereby organisations with workers who had previous OSS experience were more likely to make use of it. This appears to be true for vendors as well whereby vendors with such staff are more likely to promote the use of OSS to their clients.

4.2.5 Product Knowledge

The data revealed that amongst the organisations interviewed there was a lack of in-depth product knowledge and awareness of OSS: “Everyone is so used to Windows; maybe we are conditioned that way. All I know is Windows.” [E1]. This results in a lack of confidence in the product: “I know the product is reliable but not knowing the product makes one feel insecure, what if something goes wrong who is going to help. And is it user friendly?” [D2] Although organisations have heard of OSS and most of those interviewed understand what it is, the level of awareness is superficial. There appears to be a lack of knowledge and awareness when it comes to specific OSS products and the benefits which these products can offer to small businesses. The lack of product knowledge is a factor which is seen to negatively influence OSS adoption.

4.2.6 Idealism

All of the organisations with the exception of one shared the belief that the monopoly held by Microsoft was harmful to the software industry. Additionally some felt that supporting OSS was the correct thing to do due to the fact that it is developed by a community of programmers for the purpose of producing better software as opposed to profit. This factor was only seen to have an influence over the adoption decision where organisations strongly identified with these beliefs. This is seen to positively affect an organisation’s propensity to adopt where such beliefs exist.

4.2.7 Resistance to Change

The fact that there is a lack of OSS awareness amplifies the fear of change. Resistance to change was seen to be a factor negatively affecting organisations’ propensity to adopt and most organisations are satisfied to continue using what they currently have due to a lack of OSS product knowledge.

4.3 Environmental Factors

Not all environmental factors are seen to have an influence over the adoption decision. However, some new environmental factors were identified, of which vendor recommendation was seen to have the greatest influence over an organisation’s choice of software.

4.3.1 Industry Maturity

This factor does not seem to play a major role in the adoption decision for the organisations interviewed.

4.3.2 Support Infrastructure

Availability of Skilled ICT Workers. This factor applies to larger enterprises that have a requirement for in-house ICT support staff and therefore is not considered a factor which influences small businesses’ decision to adopt or not adopt OSS. Interestingly, some felt that support from the OSS online community was superior to formal support received through proprietary product support agreements: “OSS support personnel seem to have a lot more integrity” [C1]

Availability of External Support Services. Most organisations perceived there to be a lack of technical support services for OSS. According to the data this factor plays a major role in deterring organisations from using OSS. Technical support is identified as a facilitator to the ongoing operation of the ICT infrastructure and therefore the functioning of the business itself, most organisations felt they could not function without reliable ICT support services: “I think it is cardinal, at the end of the day ICT is a tool which makes the business operate, if you are stranded because you cannot find support, the business suffers.” [A1] The availability of OSS technical services is seen to negatively influence adoption and result in people perceiving OSS adoption as costly with high switching costs and support fees.

4.3.3 Legitimacy

Most organisations were confident in the platform long-term viability of OSS; however, these organisations were inclined to use OSS. What emerged from the data was that some people feel that because the software is available for free it will not work correctly or expire. An interesting point was made about the difference in culture between the OSS community where the software is developed and mainstream corporate business where the software will be implemented. The general notion is that many managers are suspect of OSS due to the non-commercial idealism which is associated with it. This factor is seen to have an influence on the adoption decision and depends on the perception of OSS’s legitimacy.

4.3.4 Vendors
Small and micro enterprises can directly perceive proprietary software as essential for employment in such a way that they are not so greedy for the liquidity of the software cost and compatibility have a major affect on small businesses decision to adopt. Of these factors Table 4 summarizes the factors from TOE which have an influence on small businesses decision to adopt. Of these factors software cost and compatibility have a major affect.

4.3.5 OSS Marketing

Lack of Marketing. The lack of competitive marketing by OSS producers decreases adoption. The data reveals that organisations in general feel more confident about software products which they have had more exposure to. This factor feeds directly into product knowledge and is a fundamental barrier to the widespread use of OSS.

Lack of Product Consolidation. The data reveals that the fact that OSS comes in so many different versions leads to confusion amongst consumers and this negatively affects competitive marketing as well as OSS adoption.

4.3.6 Business Environment

Proprietary software is entrenched in South African society and school curriculums are generally based on popular proprietary software such as Microsoft Office. The fact that learning proprietary software is perceived as essential for employment in the business world negatively affects OSS product awareness and in turn negatively affects OSS adoption.

4.3.7 BSA

Organisations like the BSA are seen to have an effect on OSS adoption for certain organisations. However, only one organization seemed to be influenced – though quite vocally so: “Thanks to your guys practices and the people who are backing you, like MS, you are actually loosing massive market share, go back to your employers and tell them if they were not so greedy we would be happy to pay significant sums of money to MS.” [C1] Thus it appears that for most small businesses in this research piracy is not an issue and therefore organisations such as the BSA are not of major relevance.

4.4 Summary of Findings

Table 4 summarizes the factors from TOE which have an influence on small businesses decision to adopt. Of these factors software cost and compatibility have a major affect.

<table>
<thead>
<tr>
<th>TOE</th>
<th>Factor</th>
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<th>Enabler</th>
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<td>Difficulty in administration</td>
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5. CONCLUSION

On a macro level OSS holds many advantages for South Africa such as economic growth by reducing dependence on foreign software corporations and increasing opportunities for innovation and business creation. Small and micro enterprises can directly benefit from this as well as the fact that OSS presents a possible reduction in ICT costs.

Although there may be advantages to adopting OSS, especially for smaller organisations in emerging markets, there exist a number of barriers. The lack of knowledge and exposure are fundamental to the slow diffusion of OSS. The key factors which contribute to the lack of product knowledge are the lack of OSS marketing and easily accessible OSS vendors.

The fact that there is a general lack of OSS knowledge influences the availability of technical staff skilled in OSS which is seen as a major factor decreasing the adoption of OSS amongst small enterprises. Vendors are seen to play an important role in what there clients implement. The lack of available technical skills affects what vendors recommend to their clients ultimately decreasing OSS adoption. Another important factor was compatibility with an organisation’s existing infrastructure. Since OSS is not as widely used as proprietary software, compatibility issues are seen to deter small enterprises from using it.

The cost benefits and performance offered by OSS are strongly supported as enablers although a measure of idealism also plays a role. In addition, if some of the barriers such as lack of vendor support and product knowledge can be addressed, these barriers can be turned around into enablers.

It was interesting to note that TOE served well as an organising framework, especially in its OSS-specific formulation. However, despite its comprehensiveness, a number of new factors were uncovered; so it is suggested that TOE should be viewed as an organising framework rather than a prescriptive theory.

Future research could focus on why there is a lack OSS product awareness and marketing in SA. It would appear that, until OSS vendors employ the same marketing tactics as popular proprietary vendors, OSS may not be more widely adopted by small organisations in South Africa.

Another avenue for future research is to increase the validity of the findings by using a larger sample. This could possibly be
achieved by means of a more quantitative survey approach. It is likely that OSS will continue to make headway and increase its market penetration and thus this study can also serve as a baseline study for more longitudinal research.

6. REFERENCES


