An investigation of the adoption barriers of
Open Source Software Enterprise Resource Planning Systems
for South African Organisations

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University of Cape Town

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Masters of Business Administration Degree

by
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Supervised by: Professor Kevin Johnston
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ABSTRACT

Enterprise Resource Planning (ERP) Systems improves competitiveness through raising business productivity and cost reduction. Organisations in South Africa and other developing countries are not maximising the use of ERP Systems. The costs associated with an ERP system implementation have always been a major barrier to many organisations. Open Source Software (OSS) ERP systems are available offering the benefits of an ERP system at a reduced cost to organisations.

There appear to be adoption barriers of OSS ERP Systems for organisations in developing countries. Despite the cost benefits of OSS ERP systems adoption of OSS ERP Systems have been estimated to be as low as 1% of the market share. The adoption barriers of OSS ERP systems for developing countries were investigated by focussing on the barriers for South African organisations.

Using online surveys and a focus group it was established that the adoption barriers differ noticeably from those traditionally associated with OSS, and that there is little difference to the technology adoption barriers faced by proprietary ERP systems.

The research undertaken suggests that knowledge barriers, the lack of sizable providers (or vendors), and ironically low costs are the adoption barriers that apply to OSS ERP systems for South African Organisations. The research further suggests that many of the adoption barriers traditionally associated with OSS might be inherent to all software. Adoption barriers might be more inherent to the industry related to a specific application type rather than the development and licensing methodology.

The possibility of low costs being an adoption barrier is a novel idea that was identified in this research, and further research to endorse this concept is suggested.

Understanding the dynamics of the market requirements is crucial for OSS ERP vendors to be able to develop effective strategies. OSS ERP vendors, and OSS vendors in general, can use this study as a starting point to question some traditionally held notions regarding the OSS business model and its contrasting nature to that of proprietary software.
# TABLE OF CONTENTS

1. INTRODUCTION
   1.1 RESEARCH AREA AND PROBLEM
   1.2 RESEARCH QUESTIONS AND SCOPE
   1.3 RESEARCH ASSUMPTIONS AND ETHICS
   1.4 STRUCTURE OF THESIS

2. LITERATURE REVIEW
   2.1 LITERATURE REVIEW METHODOLOGY
   2.2 OPEN SOURCE SOFTWARE (OSS)
   2.3 OSS IN SOUTH AFRICA
   2.4 ENTERPRISE RESOURCE PLANNING (ERP) SYSTEMS
      2.4.1 DEFINITION OF AN ERP SYSTEM
      2.4.2 OSS ERP SYSTEMS
      2.4.3 ERP ADOPTION FACTORS IN SOUTH AFRICA
   2.5 THEORETICAL FRAMEWORKS FOR TECHNOLOGY ADOPTION
      2.5.1 FRAMEWORK OF INHIBITING FACTORS BY GOODE (2005)
      2.5.2 MULTI-LEVEL FRAMEWORK OF OSS ADOPTION BY QU, YANG AND WANG (2011)
      2.5.3 TECHNOLOGY-ORGANISATION-ENVIRONMENT (TOE) FRAMEWORK BY DEDRICK AND WEST (2003)
      2.5.4 SOCIAL IDENTIFICATION AND THE INDIVIDUAL ADOPTION FRAMEWORKS BY GWEBU AND WANG (2010)
   2.6 ADOPTION BARRIERS FOR OSS
   2.7 CONCLUSION
An investigation of the adoption barriers of OSS ERP Systems for SA Organisations

3. RESEARCH METHODOLOGY
   3.1 RESEARCH APPROACH AND STRATEGY
   3.2 RESEARCH DESIGN, DATA COLLECTION METHODS AND RESEARCH INSTRUMENTS
   3.3 SAMPLING
      3.3.1 LITERATURE REVIEW
      3.3.2 QUESTIONNAIRE SURVEY
      3.3.3 FOCUS GROUP
   3.4 DATA ANALYSIS METHODS
   4. RESEARCH FINDINGS, ANALYSIS AND DISCUSSION
      4.1 SAMPLES
      4.2 UNDERSTANDING OF OPEN SOURCE SOFTWARE (OSS)
      4.3 ENTERPRISE RESOURCE PLANNING (ERP) SYSTEMS
      4.4 ANALYSIS OF OSS ERP ADOPTION BARRIERS
         4.4.1 TECHNOLOGY
         4.4.2 ORGANISATION
         4.4.3 ENVIRONMENT
         4.4.4 INDIVIDUAL
      4.5 SUMMARY OF FINDINGS
         4.5.1 SURVEY FINDINGS
         4.5.2 FOCUS GROUP
      4.6 RESEARCH LIMITATIONS
   5. RESEARCH CONCLUSIONS
      5.1 SUMMARY OF MAIN FINDINGS
      5.2 SIGNIFICANCE OF FINDINGS
      5.3 FUTURE RESEARCH
LIST OF FIGURES AND TABLES

Figure 1: The multi-level model of OSS adoption and analysis results (Qu, Yang, & Wang, 2011) ......................................................................................................................................... 14
Figure 2: TOE Framework (Miscione & Johnston, 2010) ......................................................................................................................................................... 15
Figure 3: Research design—Inhibitor Determination Methodology (IDM) (Debreceny et al., 2002) ......................................................................................................................................... 38
Figure 4: Industries Represented .......................................................................................................................................................................................... 46
Figure 5: Industry Correspondence of respondent groups ......................................................................................................................................... 47
Figure 6: Gross Domestic Product: SOUTH AFRICA 1995 & 2009; constant 2005 prices, seasonally adjusted (dti: Economic Statistics) .......................................................................................................................... 47
Figure 7: Age of organisations represented ................................................................................................................................................................. 48
Figure 8: Number of employees in organisations .......................................................................................................................................................... 48
Figure 9: B-BBEE Category of Organisations .......................................................................................................................................................... 48
Figure 10: Gender .................................................................................................................................................................................................................. 50
Figure 11: Age .................................................................................................................................................................................................................. 50
Figure 12: Level of IT expertise .................................................................................................................................................................................. 50
Figure 13: Level of IT expertise per age group .......................................................................................................................................................... 50
Figure 14: Awareness of OSS packages ................................................................................................................................................................. 54
Figure 15: Number of organisation where a specific ERP system is present .......................................................................................................................................................... 55
Figure 16: OSS ERP’s known by respondents .......................................................................................................................................................... 56
Figure 17: Percentage of respondents that knew of a OSS ERP .......................................................................................................................................................... 56
Figure 18: Perception of OSS ERP quality ................................................................................................................................................................. 57
Figure 19: Average ratings for technology adoption barriers .......................................................................................................................................................... 59
Figure 20: Support Cost .................................................................................................................................................................................................. 59
Figure 21: Switching Cost .................................................................................................................................................................................................. 60
Figure 22: Maintenance cost .................................................................................................................................................................................................. 60
Figure 23: Sunk Costs .................................................................................................................................................................................................. 61
Figure 24: Reliability .................................................................................................................................................................................................. 62
Figure 25: Compatibility .................................................................................................................................................................................................. 63
Figure 26: Bias .................................................................................................................................................................................................................. 64
Figure 27: Complexity .................................................................................................................................................................................................. 64
Figure 28: Lack of Knowledge .................................................................................................................................................................................................. 65
Figure 30: Financial Resources .................................................................................................................................................................................................. 66
Figure 31: Human Resources (IT staff time) ................................................................. 67
Figure 32: Innovativeness of IT in the organisation ...................................................... 67
Figure 33: Boundary spanners .................................................................................... 68
Figure 33: Average ratings for environmental adoption barriers .................................... 69
Figure 34: Support Infrastructure ................................................................................ 70
Figure 35: Availability of skilled IT workers ................................................................. 70
Figure 37: Platform and long-term viability ................................................................. 72
Figure 38: Average ratings for individual adoption barriers ......................................... 73
Figure 39: Perceived Usefulness ................................................................................. 74
Figure 40: Perceived Ease of Use .............................................................................. 74
Figure 41: Personal innovativeness in technology ....................................................... 75
Figure 42: Social identification with OSS ................................................................. 76
Figure 44: Adoption Barrier Ranking process of Focus Group using Delphi method ...... 80

Table 1: Framework of inhibiting factors by Goode (2005) ........................................... 13
Table 2: Factors impacting adoption of open source platforms (Dedrick & West, 2003) 17
Table 3: Individual level constructs and questions (Gwebu & Wang, 2010) ............... 19
Table 4: Individual level constructs and questions (Gwebu & Wang, 2011) ............... 20
Table 5: Summary of the technology adoption factors and questions ......................... 24
Table 6: Summary of the organisational adoption factors and questions ...................... 27
Table 7: Summary of the environmental adoption factors and questions ...................... 29
Table 8: Summary of the individual adoption factors and questions (Gwebu & Wang, 2011) 34
Table 9: T-Test on Organisational Variables .................................................................. 47
Table 10: Potential Adoption Barriers ......................................................................... 57
Table 11: Technology adoption barriers summary ..................................................... 77
Table 12: Organisational adoption barriers summary .................................................. 78
Table 13: Environmental adoption barriers summary .................................................. 78
Table 14: Environmental adoption barriers summary .................................................. 79
Table 15: OSS ERP vendors in South Africa ................................................................. 107
<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>B-BBEE</td>
<td>Broad-Based Black Economic Empowerment</td>
</tr>
<tr>
<td>CAQDAS</td>
<td>Computer Assisted/Aided Qualitative Data Analysis</td>
</tr>
<tr>
<td>CIO</td>
<td>Chief Information Officer</td>
</tr>
<tr>
<td>CRM</td>
<td>Client Relationship Management</td>
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<tr>
<td>DOI</td>
<td>Diffusion Of Innovations</td>
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<td>EME</td>
<td>Exempt Micro Enterprise</td>
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<td>ERP</td>
<td>Enterprise Resource Planning</td>
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<td>GDP</td>
<td>Gross Domestic Product</td>
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<td>GDSS</td>
<td>Group Decision Support Systems</td>
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<td>ICT</td>
<td>Information and Communication Technology</td>
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<td>IDM</td>
<td>Inhibitor Determination Methodology</td>
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<td>IT</td>
<td>Information Technology</td>
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<td>NIC</td>
<td>Newly Industrialised Country</td>
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<td>NGO</td>
<td>None Government Organisation</td>
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<td>OSS</td>
<td>Open Source Software</td>
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<td>PEOU</td>
<td>Perceived Ease Of Use</td>
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<td>PIIT</td>
<td>Personal Innovativeness in Information Technology</td>
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<td>PU</td>
<td>Perceived Usefulness</td>
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<td>QSE</td>
<td>Qualifying Small Enterprise</td>
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<td>SA</td>
<td>South Africa</td>
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<td>SEDA</td>
<td>Small Enterprise Development Agency</td>
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<td>SI</td>
<td>Social Identification</td>
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<tr>
<td>Abbreviation</td>
<td>Full Form</td>
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<td>SIM</td>
<td>Society for Information Management</td>
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<td>SIT</td>
<td>Social Identity Theory</td>
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<td>SMEs</td>
<td>Small and Medium sized Enterprises</td>
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<td>TAM</td>
<td>Technology Acceptance Model</td>
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<tr>
<td>TOE</td>
<td>Technology, Organisation, and Environment</td>
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<tr>
<td>TCO</td>
<td>Total Cost of Ownership</td>
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<td>UCT</td>
<td>University of Cape Town</td>
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1. INTRODUCTION

1.1 RESEARCH AREA AND PROBLEM

Organisations in South Africa (SA) and other developing countries seem to not be maximising the use of Enterprise Resource Planning (ERP) Systems (Johansson & Sudzina, 2008). The costs associated with an ERP system implementation have always been a major barrier to many organisations (Madapusi & D’Souza, 2005). Open Source Software (OSS) ERP systems are available offering the benefits of an ERP system at a reduced cost to organisations (Ellis & Van Belle, 2009). This thesis investigated the adoption barriers of Open Source Software Enterprise Resource Planning Systems for developing countries by focussing on the barriers for South African organisations.

An ERP is an integrated software package composed of a set of standard functional models which include, but are not limited to, production, sales, human resources, and finance (Koh, Gunasekaran, & Cooper, 2009). Koh, Gunasekaran, and Cooper (2009) argued that an ERP can potentially impact costs by reducing inventory levels, decreasing lead-times, increasing productivity, facilitating corporate communication, improving information and decision making capabilities, and improving customer service.

ERP Systems were ranked as the third (3rd) most important information technology (IT) application in the 2010 Society for Information Management (SIM) membership survey. This was also the case in the 2009 SIM membership survey. This ranking was up from being respectively ranked as the 14th and 6th most important IT application in 2008 and 2007 (Luftman & Zadeh, 2011). The main reason given for this trend was the associated cost reductions with an ERP system through automation, given that business productivity and cost reduction were the biggest management concerns according to the survey (Koh, Gunasekaran, & Cooper, 2009; Luftman & Zadeh, 2011; and Madapusia & D’Souza, 2011).

Globalisation entered the top ten management concerns for the first time in the 2010 SIM membership survey (Luftman & Zadeh, 2011). Factors such as increasing global competition, integration of worldwide markets, and advances in information and communication technologies (ICTs) have seen the emergence of smaller multinational enterprises (Madapusi & D’Souza, 2005). A study conducted in India by Bhagwat and Sharma (2007) showed that many organisations have world-class manufacturing capabilities required to compete in a global market, yet these organisations, particularly small and medium sized enterprises
(SMEs) were not seeing sufficient economic returns from this. The absence of integrated information systems (ISs), e.g. an ERP system, is seen as a major contributor to the situation (Bhagwat & Sharma, 2007). According to Bhagwat and Sharma (2007) an information system is a tool that can aid companies in maintaining a competitive edge in the era of globalisation.

Large multinational enterprises have increasingly invested in ERP systems to address the information requirements needed to be competitive in an increasingly globalised environment (Madapusi & D’Souza, 2011). According to Madapusi and D’Souza (2005) information management is a particularly powerful driver of business performance in an international market where globalisation is changing the rules of the game.

OSS, and by implication OSS ERP systems, offers an opportunity to implement an ICT infrastructure at a reduced cost (Ellis & Van Belle, 2009). OSS was defined as software that is freely available, and grants the rights to read, use, modify and distribute the source code for the software under the same conditions, without being discriminatory in any way (Rose, Johnston, & Van Belle, 2006).

Johansson and Sudzina (2008) conducted an initial review of OSS ERP systems in which they found that there seemed to be an increase in interest in OSS ERP systems globally. It was, however, estimated that the international market share for OSS ERP systems was between one (1) and four (4) per cent (Nagy, Yassin, & Bhattacherjee, 2010). This would suggest that even though there seemed to be a relative increase in the interest in OSS ERP systems as an alternative, there was still relatively little uptake of the software. An estimate market share for Apache, an OSS Web Server application, of between 55% and 66% makes the OSS ERP market share statistic more telling (Nagy, Yassin, & Bhattacherjee, 2010). This suggests that the low ERP OSS market share is rather a characteristic of the ERP application type than OSS in general.

There is a high emphasis placed on ERP systems as a means to increase business productivity and cost reduction, to be more competitive in a global business environment (Luftman & Zadeh, 2011; and Madapusi & D’Souza, 2005). Johansson and Sudzina (2008) indicated that most of the research undertaken with regard to ERP systems and OSS has been for developed economies, and suggested that research be conducted into whether there are any differences in open source ERP systems adoption by SMEs in developed and under developed or developing countries.
1.2 RESEARCH QUESTIONS AND SCOPE

This research forms an explorative investigation with the intention of providing further insight to ICT professionals and academia into the adoption barriers of OSS ERP systems for underdeveloped or developing countries as was suggested by Johansson and Sudzina (2008). This may enable for-profit and volunteer OSS development organisations to improve their offerings and software dissemination.

The scope of the research was limited to South African organisations. Within this scope the primary research question derived from the literature was:

1. What are the barriers to adopting Open Source Software Enterprise Resource Planning Systems for South African Organisations?

This primary research question may be broken down into several secondary questions,

2. What are the barriers to the adoption of Open Source Software?

3. Are the barriers to the adoption of Open Source Software different for South African organisations?

4. Are the barriers identified for Open Source Software also applicable to Open Source Software ERP systems in South Africa and to what extent?

1.3 RESEARCH ASSUMPTIONS AND ETHICS

This thesis depended very strongly on the support of the professionals and decision makers in South African organisations. The information gathered was subject to the respondents’ perceptions and cannot be formally and objectively proved or confirmed. In order to counteract potential flaws this research sample focused on a relatively large sample of 158 respondents.

Ethical considerations as required by the University of Cape Town (UCT) have been taken into account. Surveys were conducted without prejudice and with objectivity.

The questionnaires were anonymous. The nature of the questions was technical and related to ERP Systems. It is not possible to identify any individual or definable group from the published data.
The research was conducted through voluntary surveys which were collected through a written internet based questionnaire and a focus group. There was no distinction in terms of race or gender.

It was assumed that OSS and proprietary software ERP systems offer similar functionalities.

1.4 STRUCTURE OF THESIS

In the following chapter the relevant literature is discussed. It covers how the literature was selected, questions derived, and a conceptual framework developed.

Chapter three describes the research approach that was followed and the research strategy that was used. In addition, there is a detailed explanation of why the particular approach and strategy were selected. The research design, data collection, research instruments, sampling methods, and data analysis methods are also discussed in chapter three and the underlying assumptions to the various methods and strategies are highlighted where necessary.

The collected data was analysed and discussed in chapter four against the selected framework. The findings of the research are discussed relative to the research questions posed in section 1.2.

Chapter five summarises the research undertaken in this study and reflects on the various aspects of the research and suggests possible future research.
2. LITERATURE REVIEW

2.1 LITERATURE REVIEW METHODOLOGY

A systematic approach to researching the available theoretical models covering technology adoption in the literature was taken and Kitchenham’s guidelines for systematic literature reviews were used (Hauge, Ayala, & Conradi, 2010). The systematic literature review process included:

Stage 1 – Selecting a clearly defined set of publication sources;

Stage 2 – Identifying the publication through database searches;

Stage 3 – Reviewing titles and abstracts;

Stage 4 – Review by skimming the text, and;

Stage 5 – Review by reading the full text.

Stage 1 – Selecting a clearly defined set of publication sources

Initially the 11 A+ journals proposed as journal targets by the Department of Information Systems at UCT were selected. An A+ journal is recognised world-wide as one of the top peer reviewed journals in its field by publishing rigorous original research that shapes the field. The relevance of these journals to the ICT field was a criterion. The 11 journals were Communications of the ACM, Decision Support Systems, European Journal of Information Systems, Information & Management, Information Systems Journal, Information Systems Research, Journal of Information Technology, Journal of Management Information Systems, Journal of Strategic Information Systems, Journal of the Association for Information Systems, and MIS Quarterly.

Stage 2 – Identifying the publication through database searches

Three digital libraries were searched, namely Emerald, EBSCO Host, and Science Direct. Only papers published in English from 2000 onwards were considered.

To ensure a comprehensive search, a strategy with relatively high sensitivity was decided upon. As a result searches for “Open Source” and “ERP” were conducted rather than more specific searches such as “Open Source Software ERP adoption barriers”. While conducting
a similar study Hauge et al. (2010) found that the term Open Source was inclusive of all relevant publications.

The searches were conducted between July and October 2011.

Stage 3 – Reviewing titles and abstracts

To identify publications that were relevant to the research and did not merely contain the keywords, search results from stage two were individually reviewed based on their titles and abstracts. Only papers on OSS topics such as OSS business models, adoption, rejection, communities and ERP were further explored.

Stage 4 – Review by skimming the text

Papers with relevant titles and abstracts on adoption, barriers to adoption or rejection of OSS by organisations were identified, and the text of these articles was skinned.

Stage 5 – Review by reading the full text

The final selection of publications was conducted according to three criteria. The criteria were research publications dealing with OSS adoption or barriers to adoption with a theoretical framework, research publications dealing with OSS adoption or barriers to adoption with a theoretical framework, and research publications dealing with OSS and ERP Systems. These articles were read in full, and their bibliographies led to the identification of further articles and books. The process then looped back to stage three for these articles and books.

The literature was then sorted into themes which are discussed in the remainder of the chapter.

2.2 OPEN SOURCE SOFTWARE (OSS)

OSS is defined as software that is freely available, and grants the rights to read, use, modify and distribute the source code for the software under the same conditions, without being discriminatory in any way (Rose, Johnston, & Van Belle, 2006).

OSS applications offer multiple areas of potential technological superiority which include high quality, security, reliability, flexibility, stability, low acquisition cost, no vendor lock-
ins, and regular upgrades (Gwebu, & Wang, 2011; Mutula & Kalaote, 2010; Nagy et al., 2010; and Zaffar, Kumar, & Zhao, 2011). In addition to these short term advantages, the longitudinal benefit is one of developing an internal knowledge base and skills set that reduces the reliance on foreign software and services; resulting in cost savings on purchase and maintenance of software and creating IT jobs (Miscione & Johnston, 2010; and Mutula & Kalaote, 2010). It is generally accepted that there has been an increase in the interest shown in OSS, both in the private as well as public sectors (Ellis & Van Belle, 2009; Gwebu & Wang, 2011; Mutula & Kalaote, 2010; Nagy et al., 2010; and Zaffar, Kumar, & Zhao, 2011).

Whilst the cost benefit was stated numerous times as a reason for adoption (Gwebu & Wang, 2011; Nagy et al., 2010; Watson, Boudreau, York, Greiner, & Wynn, 2008; and Subramanyam & Xia, 2008), other scholars argued that the adoption of OSS is dependent on strategic factors other than price (Johansson & Sudzina, 2008; Johnston & Seymour, 2005; Miscione & Johnston, 2010; and Zaffar et al., 2011) and that the barriers for OSS adoption are significant (Nagy et al., 2010). What are these barriers to the adoption of Open Source Software?

2.3 OSS IN SOUTH AFRICA

South Africa is a developing country. Though no single definition could be found for a developing country, South Africa is classified as a newly industrialised country (NIC) (Mankiw, 2007). Mankiw (2007) defines NICs as nations with economies more advanced and developed than those in the developing world, but not yet with all the characteristics of a developed country. On 24 December 2010 South Africa officially became the fifth member of the BRICS group, with the other members being Brazil, Russia, India, and China (South Africa joins BRICS, 2011).

The South African Government has communicated a strong intent to use OSS since 2001 (Miscione & Johnston, 2010). This was formalised in 2003 when the South African Government became the first African country to develop a policy document which encouraged government to fully support the adoption of OSS (Ellis & Van Belle, 2009; and Miscione & Johnston, 2010). Limited OSS usage was, however, found within South African Government departments (Ellis & Van Belle, 2009; and Miscione & Johnston, 2010). Johnston and Seymour (2005) found that political influences and the risks associated with the scale and complexity of large government organisations nullified strategic usage intent of
OSS of the South African Government. This was similar to the findings of Camara and Fonseca (2007) who found that organisations, which include governments, in developing countries had a relatively conservative attitude towards risk, and considered it less risky to stay with proprietary products as opposed to building or customising OSS applications.

Ellis and Van Belle (2009) found a number of OSS adoption barriers amongst smaller South African organisations. The barriers were the lack of knowledge and exposure of OSS, the paucity of technical staff skilled in OSS, and OSS compatibility with the existing ICT infrastructure of an organisation (Ellis & Van Belle, 2009). Johnston and Seymour (2005) endeavoured to identify the factors that influence and limit the usage and intended usage of OSS within the private and public sectors in South Africa. The research by Johnston and Seymour (2005) considered organisations ranging from large listed companies to small non-government organisations. Further to the political and risk aversity, Johnston and Seymour (2005) identified the following barriers; lack of awareness, resistance to change within IT, cost, a user friendly and standardised product, training and skills availability, and after sales service and support.

There appears to be adoption barriers that are specific to developing countries with factors such as a conservative attitude towards risk. This leads to the question of whether the barriers to the adoption of Open Source Software are different for South Africa organisations.

### 2.4 ENTERPRISE RESOURCE PLANNING (ERP) SYSTEMS

#### 2.4.1 DEFINITION OF AN ERP SYSTEM

An ERP is an integrated software package composed of a set of standard functional models which include, but are not limited to, production, sales, human resources, and finance (Koh, Gunasekaran, & Cooper, 2009). Koh, Gunasekaran, and Cooper (2009) argued that an ERP can potentially impact costs by reducing inventory levels, decreasing lead-times, increasing productivity, facilitating corporate communication, improving information and decision making capabilities, and improving customer service. According to Madapusia and D’Souza (2011) intra-firm ERP systems enable firms to standardise, integrate, and streamline their data and process flows.
2.4.2 OSS ERP SYSTEMS

The following three reasons were given by Serrano and Sarriegi (2006) for why OSS benefits are greater for ERP systems than for other kinds of applications:

**Increased adaptability:** ERPs always need an implementation project to match the business processes and local regulations. Having full access to the source code benefits this typical requirement.

**Decreased reliance on a single supplier:** Businesses that acquire a proprietary ERP are highly dependent on the product builders and distributors, in particular the owner of the source code. Should any of these agents disappear, upgrading and maintaining the ERP can be challenging.

**Reduced costs:** Proprietary ERP licenses are expensive. OSS ERPs avoid this cost. The required hardware is also typically less expensive.

Industry experts estimated the cost of ERP implementations are between one (1) and six (6) percent of a firm’s revenue (Nagy et al., 2010). The costs associated with an ERP system implementation have always been seen as a major barrier to SME companies (Madapusi & D’Souza, 2005). Johansson and Sudzina (2008) found that the costs appear to have a secondary role in the adoption decision of open source ERPs despite the high level of attention the cost perspective received regarding the adoption of open source ERPs.

ERP systems are complex, and as a result difficult and time consuming to implement. The average implementation period of a typical ERP system is estimated at about 20 months, and the time-to-benefit averages about 27 months (Madapusi & D’Souza, 2005; and Zaffar et al., 2011). Previous research has shown that OSS is perceived to be technically complex (Ellis & Van Belle, 2009). The complex nature of ERP systems in general could be seen to nullify complexity as an OSS barrier in the case of OSS ERP systems.

Johansson and Sudzina (2008) studied the status of OSS ERP systems by investigating the activity of OSS ERP projects on the Sourceforge.net distribution channel. Sourceforge.net is a free service that holds the most sizable database of OSS projects globally (Sen, Subramaniam, & Nelson, 2011). It was found that the adoption rate was increasing, and that the key activity was limited to a core group of ERP projects namely Compiere, OpenBravo, WebERP, OpenERP, and Opentaps (Johansson & Sudzina, 2008).
Despite the stated advantages of OSS, an apparent increase in the adoption rate of OSS ERP systems, and the high costs of proprietary ERP systems, the adoption of OSS applications has been relatively limited in general (Gwebu & Wang, 2011) and an even slower uptake is seen in South Africa (Ellis & Van Belle, 2009; and Miscione & Johnston, 2010). Contrary to OSS ERP uptake (Gwebu & Wang, 2011; and Nagy et al., 2010), investment in proprietary ERP systems has continued strongly on the back of proven operational improvements and streamlined data and process flows as a result of ERP system implementations (Madapusi & D’Souza, 2005).

Serrano and Sarriego (2006) suggested that OSS ERP applications are different from other OSS applications. This leads to the question of whether the barriers to adopting Open Source Software Enterprise Resource Planning Systems are different from those that apply to OSS software in general?

Johansson and Sudzina (2008) to a large extent provided counter arguments for the OSS ERP benefits suggested by Serrano and Sarriego (2006). This in turn leads to the question of what the barriers to adoption of ERP systems by organisations in South Africa are?

2.4.3 ERP ADOPTION FACTORS IN SOUTH AFRICA

Das Neves, Fenn and Sulcas (2004) investigated the selection process for a ERP System by South African organisations, and developed a benchmark selection criteria checklist for the ERP selection which can be viewed in Annexure A.1.

A total of 11 implementations were considered which included organisations in the banking, medical supplier, insurance, petroleum, food and beverage, mining and plastics industries. The ERP systems that were implemented in the 11 cases were Oracle’s JD Edwards, Great Plains, Oracle, SAP HR, and SAP R/3. A SAP product was implemented in approximately 55%, and an Oracle product in 36% of the cases (das Neves, Fenn, & Sulcas, 2004).

The criteria considered by each of the cases were recorded and the results can be viewed in the tables in Annexure A.2.

Four of the vendor criteria were considered in all of the cases. The criteria were the Number of installations, the Market rating, the Demonstration, and Local representation.
Only the Functional requirements and whether the ERP system offered increased transparency and information flow were considered in terms of the functionality of the ERP in all of the cases.

In terms of the technical aspects of the proposed ERP only adaptability and flexibility and robustness and ease/cost were considered in all of the cases.

Das Neves et al. (2004) observed that the total cost of ownership was not an important criterion, and that the need to implement an ERP system was based on strategic grounds. It was further found that customisation of the source code frequently caused problems and that it was the best to select a system with most or all of the required functionality. All of the ERP systems did, however, offer the option for source code customisation. There was a perceived lack of skills and technical support for all the vendors except SAP. It was further found that vendors have minimal influence on the adoption decision in a direct capacity as the selection is often made prior to the vendor being approached (das Neves et al., 2004).

The findings of Das Neves et al. (2004) suggest that the reasons for OSS ERP adoption above proprietary ERP adoption as stated by Serrano and Sarriegi (2006) are potentially not that relevant. Whether the adoption barriers for OSS ERP systems are materially different from those faced by proprietary ERP system it a further research opportunity. It, however, falls outside of the scope of this research that focuses on determining the barriers to adopting Open Source Software Enterprise Resource Planning Systems for South African Organisations.

2.5 THEORETICAL FRAMEWORKS FOR TECHNOLOGY ADOPTION

According to Ellis and Van Belle (2009) it is important to first understand what constitutes user acceptance in order to study the barriers to adoption of OSS ERP systems. For a technology to be adopted there needs to be approval by the possible user of the technology (Ellis & Van Belle, 2009). The factors influencing user acceptance of a technology have been thoroughly researched and a number of theoretical frameworks attempting to explain the variables influencing the intention to use a specific technology has been developed (Venkatesh, Moris, Davis, & Davis, 2003).

A total of five relevant frameworks were identified from the literature review, and these are discussed in this section. Frameworks offer various variables to the mainstream adoption of
OSS. There was some overlap in the factors identified, and there did not seem to be a general consensus as to the exact variables relating to OSS adoption. The aim was to incorporate all the variables to OSS adoption into a single framework which comprehensively covered all the barriers to OSS adoption.

2.5.1 FRAMEWORK OF INHIBITING FACTORS BY GOODE (2005)

Goode’s (2005) framework was designed by merging concepts that have a noteworthy influence as a barrier to adoption of OSS. The framework was constructed by conducting a literature review to identify principal barriers to technology adoption. Searches covered key publications such as MIS Quarterly, Information Systems Research, Information and Management, Journal of Management Information Systems and Communications of the ACM. In addition, key word searching, citation indexing, and textual analysis were used to develop a list of inhibitors, which was subsequently sorted into appropriate categories given in Table 1.

It was highlighted by Goode (2005) that most of the published research originated in North America, and that there was some risk in assuming that management theory can be generalised across geographical borders and cultural regions.

The framework was developed to assess why firms do not adopt open source software and was targeted at Australia’s top 500 firms.

The framework aligns to the research being focussed on in this study in the sense that it also focussed on the barriers to adoption.

It was not considered to be the ideal framework for the research on the barriers to adoption of Open Source Software Enterprise Resource Planning Systems by South African Organisations. One of the reasons being that Goode’s (2005) research only considered studies that specifically discussed the factors as a barrier or inhibitor to adoption which potentially renders the framework non-exhaustive. The purpose of the framework was also not directed at a specific technology, e.g. ERP, or emerging economies, but rather at barriers to OSS adoption within relatively large organisations.
2.5.2 MULTI-LEVEL FRAMEWORK OF OSS ADOPTION BY QU, YANG AND WANG (2011)

Qu, Yang, and Wang (2011) proposed and tested a multi-level framework. The multi-level framework considered five country-level variables and two under-explored firm-level factors on firm OSS adoption. Figure 1 shows the multi-level framework of OSS adoption and the analysis results.

The findings of Qu et al. (2011) suggested that a country's uncertainty avoidance orientation has a positive impact on OSS adoption, whereas the power distance orientation and economic development have a negative impact on OSS adoption. In addition, uncertainty avoidance at the country level sets boundaries for the effect of firm-level IT-based networks in a way that the impact of proprietary IT-based networks becomes stronger, but that of open IT-based networks becomes weaker when uncertainty avoidance is high rather than low (Qu, Yang, & Wang, 2011).
The multi-level framework by Qu, Yang, and Wang (2011) did not appear to be an appropriate framework to research the adoption barriers of Open Source Software Enterprise Resource Planning Systems for South African Organisations. The reason for this rejection was that the multi-level framework by Qu, Yang, and Wang (2011) is at a country-level rather than on an organisational level.

Whilst the cultural aspects within a country are outside of the scope defined in section 1.2, Qu, et al. (2011) does show through their research that in making an OSS adoption decisions, cultural values form an important focus, together with other firm-level variables.
2.5.3 TECHNOLOGY-ORGANISATION-ENVIRONMENT (TOE) FRAMEWORK BY DEDRICK AND WEST (2003)

Technology, organisation, and environment (TOE) are three (3) dimensions along which an organisation functions. These three (3) dimensions influence the ability of the organisation to adopt or reject new technology. The TOE framework was adapted by Dedrick and West (2003) to address OSS adoption. The three dimensions or categories include a number of contextual factors which are illustrated in Figure 2 (Miscione & Johnston, 2010). The TOE framework draws on the diffusion of innovations (DOI) and the standards of economics theory (Dedrick & West, 2003).

![Figure 2: TOE Framework (Miscione & Johnston, 2010)](image)

**Explanation of dimensions**

Technology: Cost, perceived reliability, complexity and compatibility with existing technologies and skills.

Organisation: Human and financial resources, innovativeness and competitiveness.

Environment: Industry, competition, suppliers, customers.

Dedrick and West (2003) developed Table 2 that provides a summary of the framework. Table 2 lists the various factors under the respective categories and indicates which factors are inherent (Product) and which are not in the first three columns. The various factors are then linked to the relevant theoretical concept. The impact the factor has on adoption (positive or negative) according to the research of Dedrick and West (2003) is indicated in the
second to last column. The last column gives context to the factor with an explanatory example.

Given the fact that Dedrick and West (2003) adapted the Technology-Organisation-Environment (TOE) framework from the original framework of DePietro, Wiarda and Fleischer (1990) to specifically focus on OSS adoption, it was seen as a good framework for researching the adoption barriers in the research.

The lack of focus in the TOE framework on the individual user level did stand out with reference to Goode’s framework that also considered the user level with factors such as personal rejection, personal resistance or fear, and insufficient skills or experience (Goode, 2005). Cultural factors considered by Qu, Yang, and Wang (2011) at a country level namely uncertainty avoidance, power distance and individualism, and the results obtained by Qu, Yang, and Wang (2011) further emphasised the need for the individual to be considered. The study by Gwebu and Wang (2011) of the perceptions of users of free open source software, and the role of social identification looks at the human element of the adoption of OSS. Glynn, Fitzgerald and Exton (2005) extended the TOE model to include an individual factor in their study of the commercial adoption of OSS. The concept of individuals who champion the adoption of OSS for some ideological motivation for using OSS introduced by Glynn et al. (2005) is similar to the concept of a boundary spanner (Ellis & Van Belle, 2009; Qu et al., 2011).
<table>
<thead>
<tr>
<th>Context</th>
<th>Factor</th>
<th>Attribute of</th>
<th>Relevant concept</th>
<th>theoretical impact</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Technology</td>
<td>Hardware cost</td>
<td>Product</td>
<td>Relative advantage</td>
<td>+</td>
<td>Lintel runs on commodity hardware</td>
</tr>
<tr>
<td></td>
<td>Software cost</td>
<td>Innovation</td>
<td>Relative advantage</td>
<td>+</td>
<td>OSS operating systems are “free”</td>
</tr>
<tr>
<td></td>
<td>Reliability</td>
<td>Product</td>
<td>Relative advantage</td>
<td>+/-</td>
<td>Varying perceptions of OSS platform reliability</td>
</tr>
<tr>
<td></td>
<td>Availability of 3rd party apps</td>
<td>Product</td>
<td>Compatibility</td>
<td>+</td>
<td>Prerequisite to adoption, depends on platform popularity</td>
</tr>
<tr>
<td></td>
<td>Portability of own apps</td>
<td>Product</td>
<td>Compatibility</td>
<td>+/-</td>
<td>Increases adoption where such apps exist</td>
</tr>
<tr>
<td></td>
<td>Skills of existing IT workers</td>
<td>Product</td>
<td>Compatibility</td>
<td>+/-</td>
<td>Increases adoption if and only if existing skills are compatible</td>
</tr>
<tr>
<td></td>
<td>Fit to task</td>
<td>Product</td>
<td>Compatibility</td>
<td>+/-</td>
<td>Increases adoption for certain tasks</td>
</tr>
<tr>
<td></td>
<td>Difficulty in administration</td>
<td>Product</td>
<td>Complexity</td>
<td>-</td>
<td>Perceived complexity decreases adoption</td>
</tr>
<tr>
<td></td>
<td>Ease of experimenting</td>
<td>Innovation</td>
<td>Trialability</td>
<td>+</td>
<td>Reduces risk</td>
</tr>
<tr>
<td>Organization</td>
<td>IT capital budget</td>
<td>Innovation</td>
<td>Stack</td>
<td>-</td>
<td>Large budgets allow choice of more expensive options</td>
</tr>
<tr>
<td></td>
<td>IT staff time</td>
<td>Innovation</td>
<td>Stack</td>
<td>+</td>
<td>Slack required to evaluate new technologies</td>
</tr>
<tr>
<td></td>
<td>Innovativeness of IT org</td>
<td>Innovation</td>
<td>Innovativeness</td>
<td>+/-</td>
<td>More innovative firms take more risks, want to be “cutting edge”</td>
</tr>
<tr>
<td></td>
<td>Worker experience with new platform</td>
<td>Product</td>
<td>Boundary spanning</td>
<td>+</td>
<td>Linux knowledge that workers bring to organization prior to adoption</td>
</tr>
<tr>
<td>Environment</td>
<td>Industry maturity</td>
<td>Innovation</td>
<td>Industry life cycle</td>
<td>-</td>
<td>Infant industries not committed to old ways</td>
</tr>
<tr>
<td></td>
<td>Availability of skilled IT workers</td>
<td>Product</td>
<td>Support infrastructure</td>
<td>Network effects</td>
<td>+ Availability essential to adoption, more likely with popular platforms</td>
</tr>
<tr>
<td></td>
<td>Availability of external support services</td>
<td>Innovation</td>
<td>Support infrastructure</td>
<td>Sponsorship</td>
<td>+ Support needed to run in critical environments and to reassure management</td>
</tr>
<tr>
<td></td>
<td>Platform long-term viability</td>
<td>Product</td>
<td>“Angry orphan” (switching costs)</td>
<td>+</td>
<td>Organizations avoid (re)investment in technologies that may become unsupported</td>
</tr>
</tbody>
</table>

*Legend:*
+ increases propensity for adopting open source platform
- decreases propensity for adopting open source platform
0 has no effect

Table 2: Factors impacting adoption of open source platforms (Dedrick & West, 2003)
2.5.4 SOCIAL IDENTIFICATION AND THE INDIVIDUAL ADOPTION FRAMEWORKS BY GWEBU AND WANG (2010)

It is critically important that studies are not only organisation centric in focus, but that the perspective from an individual level is also considered (Gwebu & Wang, 2010). This was also recognised by Glynn, et al. (2005) who investigated the process of OSS adoption using a framework derived from innovation adoption theory. The framework by Glynn, et al. (2005) comprised four macro-factors - external environment, organisational context, technological context and individual factors.

Gallego, Luna and Buena (2008) developed a model for user acceptance towards OSS applications based on the technology acceptance model (TAM) by Davis (1989). The TAM advocated that two behavioural constructs; perceived usefulness (PU), and perceived ease of use (PEOU), determine the intention of an individual to use a specific technology and the subsequent usage behaviour of the technology (Gwebu & Wang, 2011).

According to Gwebu and Wang (2011) the TAM has some shortcomings when it is applied to OSS rather than proprietery software which it was originally designed for. One such difference is the fact that OSS adoption is less likely to be influenced by subjective norm pressure and is more often than not voluntary. As such, Gwebu and Wang (2011) argued that sociology theories that encompass the effect of the community on OSS adoption be incorporated into the model.

Gwebu and Wang (2010) identified Perceived usefulness (PU) and Perceived ease of use (PEOU) as the most widely used perception indicators in the literature influencing an individual’s adoption and usage decision. Perceived compatibility and perceived risks were also identified as perception constructs in the literature on OSS (Gwebu & Wang, 2010). The final factor identified, in addition to perception constructs, was satisfaction (Gwebu & Wang, 2010).

Gwebu and Wang (2010) summarised the identified constructs in Table 3 with questions and the sources from which the questions were adopted for OSS research.
Drawing on the Social Identity Theory (SIT) Gwebu and Wang (2011) argued that behavioural intention to adopt is a key variable in determining future behaviour around OSS adoption and introduces social identification and personal innovativeness as additional behavioural constructs.

Personal Innovativeness in Information Technology, social identification with OSS and behavioural intention to adopt replaced perceived compatibility, perceived risk, and satisfaction as constructs. The framework and associated and verified questions are listed in Table 4.

<table>
<thead>
<tr>
<th>Construct</th>
<th>Item</th>
<th>Question</th>
</tr>
</thead>
<tbody>
<tr>
<td>Perceived usefulness</td>
<td>PU1</td>
<td>Using open source software would give me greater control over my tasks than using proprietary software.</td>
</tr>
<tr>
<td></td>
<td>PU2</td>
<td>I am more productive if I use open source software compared to if I use proprietary software.</td>
</tr>
<tr>
<td></td>
<td>PU3</td>
<td>I perform tasks more effectively if I use open source software compared to if I use proprietary software.</td>
</tr>
<tr>
<td></td>
<td>PU4</td>
<td>I perform tasks more efficiently if I use open source software compared to if I use proprietary software.</td>
</tr>
<tr>
<td>Perceived ease of use</td>
<td>PEOSU1</td>
<td>It is easier to perform most tasks when using open source software than when using proprietary software.</td>
</tr>
<tr>
<td></td>
<td>PEOSU2</td>
<td>Generally, I find it easy to get open source software to do what I want it to do.</td>
</tr>
<tr>
<td></td>
<td>PEOSU3</td>
<td>It is easy for me to become skilled at using open source software.</td>
</tr>
<tr>
<td></td>
<td>PEOSU4</td>
<td>I find open source software to be flexible to use.</td>
</tr>
<tr>
<td>Perceived compatibility with prior experience</td>
<td>CWSPE1</td>
<td>Using open source software is different from using other software I have used in the past.</td>
</tr>
<tr>
<td></td>
<td>CWSPE2</td>
<td>Using open source software is compatible with my past computer experience.</td>
</tr>
<tr>
<td></td>
<td>CWSPE3</td>
<td>Using open source software is a new experience for me.</td>
</tr>
<tr>
<td></td>
<td>CWSPE4*</td>
<td>Using open source software is not similar to anything that I have done before.</td>
</tr>
<tr>
<td>Perceived compatibility with software philosophy</td>
<td>CWSPP1</td>
<td>Use of open source software is NOT consistent with the way I think people and business should be using software.</td>
</tr>
<tr>
<td></td>
<td>CWSPP2</td>
<td>Using open source software runs counter to my own value.</td>
</tr>
<tr>
<td></td>
<td>CWSPP3</td>
<td>Using open source software goes against what I believe software should be used for.</td>
</tr>
<tr>
<td>Satisfaction</td>
<td>SAT1</td>
<td>Open source software has met my expectations.</td>
</tr>
<tr>
<td></td>
<td>SAT2</td>
<td>Overall, I am satisfied with most open source software applications.</td>
</tr>
<tr>
<td></td>
<td>SAT3</td>
<td>I strongly recommend open source software to others.</td>
</tr>
<tr>
<td>Perceived risks</td>
<td>PR1</td>
<td>I believe that migrating from proprietary software to open source software for most people is NOT too troublesome.</td>
</tr>
<tr>
<td></td>
<td>PR2</td>
<td>I believe that open source software is sufficiently supported by vendors/providers.</td>
</tr>
<tr>
<td></td>
<td>PR3*</td>
<td>I believe that migrating from proprietary software to open source software is risky.</td>
</tr>
</tbody>
</table>

* Item dropped to improve scale reliability.

Table 3: Individual level constructs and questions (Gwebu & Wang, 2010)
Table 4: Individual level constructs and questions (Gwebu & Wang, 2011)

<table>
<thead>
<tr>
<th>Construct</th>
<th>Item</th>
<th>Question</th>
</tr>
</thead>
<tbody>
<tr>
<td>Perceived usefulness</td>
<td>PU1</td>
<td>Using open source software would give me greater control over my tasks than using proprietary software.</td>
</tr>
<tr>
<td></td>
<td>PU2</td>
<td>I am more productive if I use Open Source Software compared to if I use proprietary software.</td>
</tr>
<tr>
<td></td>
<td>PU3*</td>
<td>Generally, Open Source Software is less expensive to acquire and maintain compared to proprietary software.</td>
</tr>
<tr>
<td></td>
<td>PU4</td>
<td>I perform tasks more effectively if I use Open Source Software compared to if I use proprietary software.</td>
</tr>
<tr>
<td></td>
<td>PU5</td>
<td>I perform tasks more efficiently if I use Open Source Software compared to if I use proprietary software.</td>
</tr>
<tr>
<td>Perceived ease of use</td>
<td>PEOU1</td>
<td>It is easier to perform most tasks when using Open Source software than when using proprietary software.</td>
</tr>
<tr>
<td></td>
<td>PEOU2</td>
<td>Generally, I find it easy to get Open Source Software to do what I want it to do.</td>
</tr>
<tr>
<td></td>
<td>PEOU3</td>
<td>It is easy for me to become skillful at using Open Source Software.</td>
</tr>
<tr>
<td></td>
<td>PEOU4</td>
<td>I find Open Source Software to be flexible to use.</td>
</tr>
<tr>
<td>Personal innovativeness in technology</td>
<td>PIT1</td>
<td>If I heard about a new information technology, I would look for ways to experiment with it.</td>
</tr>
<tr>
<td></td>
<td>PIT2</td>
<td>Among my peers, I am usually the first to try out new information technologies.</td>
</tr>
<tr>
<td></td>
<td>PIT3</td>
<td>In general, I am hesitant to try out new information technologies.</td>
</tr>
<tr>
<td>Social identification with OSS</td>
<td>SI1</td>
<td>I am proud to think of myself as a member of the Open Source Software community.</td>
</tr>
<tr>
<td></td>
<td>SI2*</td>
<td>In general, others think very favorably of the Open Source Software community.</td>
</tr>
<tr>
<td></td>
<td>SI3</td>
<td>Being an open source user is an important part of my self-image.</td>
</tr>
<tr>
<td>Behavioral intention to adopt</td>
<td>SI4</td>
<td>I think about being an open source user often.</td>
</tr>
<tr>
<td></td>
<td>BI1</td>
<td>I intend to adopt an open source software within the next 6 months.</td>
</tr>
<tr>
<td></td>
<td>BI2</td>
<td>During the next 6 months, I plan to use open source software.</td>
</tr>
</tbody>
</table>

*Items dropped due to low internal reliability.

2.5.5 SELECTED FRAMEWORK

The TOE framework was selected as the framework to investigate OSS ERP adoption barriers. The TOE framework was extended with the framework by Gwebu and Wang (2011) to also investigate the adoption barriers at an individual level.
2.6 ADOPTION BARRIERS FOR OSS

The various factors discussed in the literature will be discussed within the TOE framework, as this was the framework used for several OSS adoption studies that focussed on South Africa (Ellis & Van Belle, 2009; Johnston & Seymour, 2005; and Miscione & Johnston, 2010). In addition the individual factors will also be discussed within the individual level constructs identified by Gwebu and Wang (2011). The focus will, however, be on determining the factors contributing to rejection rather than adoption.

2.6.1 TECHNOLOGY

Total Cost of Ownership (TCO)

Dedrick and West (2003) broke cost down into hardware and software costs. Total Cost of Ownership (TCO) was, however directly related to the skills and resources available to an organisation. The reasons for this were the additional costs associated with training and technical support (Ellis & Van Belle, 2009; Johnston & Seymour, 2005; and Dedrick & West, 2003).

The leveraging of the South African government’s existing skill base and infrastructure was another reason for the government not seeing through the adopted OSS policy of 2003 (Miscione & Johnston, 2010). There was considerable uncertainty over the support costs for OSS, even though firms with programmers that participate in OSS development could have significantly lower support costs when compared to other firms. Interoperability was another cost to be considered, with OSS potentially requiring additional effort (labour hours) or software required to ensure interoperability of applications with the more commonly used proprietary applications (Zaffar et al., 2011). Nagy et al. (2010), however, stated that many organisations that have implemented OSS have as a result achieved significant cost savings in TCO.

According to Ellis and Van Belle (2009), research indicated that cost associated with ICT was an important factor for most organisations. The fact that there are little to no licence fees for the initial “purchase” of OSS, as well as upgrades of OSS results in an immediate saving to the TCO (Ellis & Van Belle, 2009). Dedrick and West (2003), however, saw switching cost as a major factor in the adoption decision with transitory transaction costs, and contractual costs (e.g. contract termination penalties) potentially countering the lack of licensing costs. The latter was deliberately introduced by vendors to build in barriers to subsequent
competitors. Whether the lack of licence fees has any advantage is further debatable as it has been shown that organisations prefer OSS with service support and as a result many free versions are not considered (Ellis & Van Belle, 2009).

Sen, Subramaniam, and Nelson (2011) found that the type of licence under which an OSS is released has an influence on the success or failure of the software.

The frequent releases of patches and software versions could also overwhelm some users and make the maintenance of some OSS applications extremely difficult (Gwebu, et al., 2011). Miscione and Johnston (2010) saw maintenance cost contributing to the adoption of OSS, as the software requires less maintenance than proprietary versions resulting in the TCO being less. Miscione and Johnston (2010) did, however, qualify this by indicating that the adoption depends on the perception about the cost to maintain OSS.

When making major technology upgrade decisions, the decisions can also affect the existing application portfolio (Zaffar et al., 2011). Moving to an OSS alternative could require that prior investments in proprietary software be written off as “sunk costs“. Since cost justification for most new technology investments are demanded by organisational executives the sunk cost of proprietary systems already in the organisation may reduce OSS adoption to being unjustifiable (Nagy et al., 2010).

Hardware capability requirements for OSS are indicated as being less than for proprietary software which results in the useful life of hardware being extended (Ellis & Van Belle, 2009).

Reliability

Many organisational managers perceived OSS an immature technology and not yet ready for commercial use as goods that are freely available, such as OSS are probably of inferior quality to proprietary software (Nagy et al., 2010). This perception was driven by the marketing divisions of proprietary software companies (Nagy et al., 2010). Miscione and Johnston (2010) found that South African SMEs often opted to purchase proprietary software instead of using OSS alternatives because the organisations seek immediate resolution of technological issues. The study by Miscione and Johnston (2010) also found that brand equity was important, as organisations fear the risk of unknown brands.
OSS was perceived to be more reliable and superior in quality due to the availability of the source code, and resultant transparency that allows for peer review which has resulted in enhanced security capabilities, e.g. software bugs and security holes are eliminated (Ellis & Van Belle, 2009; and Gwebu & Wang, 2011). It is, however, also argued by proprietary software advocates that OSS is not as stable and secure as perceived (Ellis & Van Belle, 2009). Reliability is seen as an enabler of OSS adoption, but it has greater influence over the OSS adoption decision for organisations with prior OSS experience (Miscione & Johnston, 2010). As such reliability is seen to not have such a big impact on the adoption decision.

**Compatibility**

The compatibility factor relates to the user perceptions of the integration levels offered by a particular technology (in this case an OSS ERP system) with the organisation’s existing technology infrastructure and skill set. In addition, the application must fit the specific tasks the organisation requires (Ellis & Van Belle, 2009). Compatibility with current applications was a major concern in the adoption decision (Dedrick & West, 2003; and Qu, Yang, & Wang, 2011).

**Bias**

A large portion of OSS was noted to be compatible with other operating system platforms such as MAC OSX and Microsoft Windows. Many IT departments are staffed by Microsoft certified technicians, resulting in a reluctance to adopt OSS systems, and as such a technical bias was noted as an adoption barrier (Ellis & Van Belle, 2009; and Johnston & Seymour, 2005).

This does, however, not only apply to the IT department, as migrating towards any OSS application supposes a steep learning curve and moving away from a familiar application into which most end users have invested a substantial amount of time learning, and have consequently become relatively comfortable with (Gwebu & Wang, 2011).

**Complexity and lack of knowledge**

There was a perception in South Africa that OSS is complex and problematic to deploy, and that there is a shortage of OSS technically skilled staff to deploy and maintain OSS (Ellis & Van Belle, 2009; and Johnston & Seymour, 2005). According to Gwebu and Wang (2011) there are scenarios where OSS users need to have the technical know-how to download, compile, configure, and/or install the software before it can be used. A study conducted on
the South African government indicates that the required skills for OSS implementation are generally available in South Africa (Mutula & Kalaote, 2010). Managers themselves might know about OSS alternatives, but lack the knowledge to implement and use OSS (Nagy et al., 2010).

**Performance Expectancy**

Ellis and Van Belle (2009) introduced this factor even though it is not part of TOE. It relates to expectations with regards to improved job performance through the use of the technology. The open source code allows for customisation to do this, but expertise is required to use this, and many companies see the opportunity offered to change source rather as a risk to system stability than an opportunity (Ellis & Van Belle, 2009). Miscione and Johnston (2010) found that this factor improves the adoption of OSS.

**Summary of OSS technology adoption factors**

Table 5 is a summary of the technology adoption factors identified in the literature with reference to the sources. Which of these adoption factors can be a barrier to adoption is indicated by a ‘-‘ in the Adoption column and the enablers by a ‘+‘. Taking the scope of the study into consideration, the questionnaire only applies to barriers to adoption. The statements were adopted from the research done by Ellis and Van Belle (2009) for the context of OSS ERP adoption barriers.

<table>
<thead>
<tr>
<th>Factor</th>
<th>Adoption</th>
<th>Statement</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cost of Ownership</td>
<td>-</td>
<td>S1: The support cost for OSS ERP systems are more expensive than that of proprietary systems</td>
<td>Miscione &amp; Johnston, 2010</td>
</tr>
<tr>
<td></td>
<td>-</td>
<td>S2: The costs involved in switching to a OSS ERP package is too high</td>
<td>Dodrick &amp; West, 2008, and Goode, 2008</td>
</tr>
<tr>
<td></td>
<td>-</td>
<td>S3: We have to pay a contract termination penalty too get out of our current ERP contract.</td>
<td>Miscione &amp; Johnston, 2010</td>
</tr>
<tr>
<td>Maintenance cost</td>
<td>+/-</td>
<td>S4: It is much more cost effective in the long run to maintain an OSS ERP package</td>
<td>Gwelu &amp; Wang, 2011</td>
</tr>
<tr>
<td>Sunk costs</td>
<td>-</td>
<td>S5: We will not implement an OSS ERP because of the cost already incurred for our current system.</td>
<td>Nagy et al., 2010</td>
</tr>
<tr>
<td>Reliability</td>
<td>+/-</td>
<td>S6: We will not be implementing OSS products because we question the reliability and security capabilities.</td>
<td>Nagy et al., 2010, Miscione and Johnston, 2010, Ellis &amp; Van Belle, 2009, Gwelu &amp; Wang, 2011</td>
</tr>
<tr>
<td></td>
<td>-</td>
<td>S7: We will not implement an OSS ERP because we perceive its performance weak relative to proprietary alternatives.</td>
<td>Gwelu &amp; Wang, 2011, Ellis &amp; Van Belle, 2009, Goode, 2008</td>
</tr>
<tr>
<td>Compatibility</td>
<td>-</td>
<td>S8: OSS ERP Systems are not compatible with the other software being used in our organisation.</td>
<td>Ellis &amp; Van Belle, 2009, Dodrick &amp; West, 2003, and Ou, Yang, &amp; Wang 2011</td>
</tr>
<tr>
<td></td>
<td>-</td>
<td>S9: Our employees do not have the necessary skill levels required by an OSS ERP.</td>
<td>Ellis &amp; Van Belle, 2009, Dodrick &amp; West, 2003, and Ou, Yang, &amp; Wang 2011</td>
</tr>
<tr>
<td>Bias</td>
<td>-</td>
<td>S10: OSS ERP Systems lack the ability to integrate with our legacy systems.</td>
<td>Ellis &amp; Van Belle, 2009, and Johnston &amp; Seymour, 2005</td>
</tr>
<tr>
<td>Complexity</td>
<td>-</td>
<td>S11: The cost savings provided by Microsoft, Oracle, SAP and Apple is much better than any of the OSS packages.</td>
<td>Goode, 2005, Ellis &amp; Van Belle, 2009, and Johnston &amp; Seymour, 2005</td>
</tr>
<tr>
<td>Lack of knowledge</td>
<td>-</td>
<td>S12: OSS ERP systems are much more complex to implement than proprietary systems.</td>
<td>Ellis &amp; Van Belle, 2009, Gwelu et al., 2011, and Johnston &amp; Seymour, 2005</td>
</tr>
<tr>
<td>Performance Expectancy</td>
<td>+</td>
<td>S13: We do not have the technical knowledge in our organisation to implement an OSS ERP System.</td>
<td>Ellis &amp; Van Belle, 2009, and Johnston &amp; Seymour, 2005</td>
</tr>
<tr>
<td>Adoption</td>
<td></td>
<td>+: Positive to adoption</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>-: Barrier to adoption</td>
<td></td>
</tr>
</tbody>
</table>

Table 5: Summary of the technology adoption factors and questions
The statements were set up in such a way for respondents to indicate their level of agreement or disagreement with each item shown in Table 5 on a four point Likert scale ranging from 1 (strongly disagree) to 4 (strongly agree) and are further discussed in section 3.2. The same methodology was applied to the adoption barriers and related questions identified for the Organisation, Environment, and Individual constructs in Table 6, Table 7, and Table 8 respectively.

2.6.2 ORGANISATION

Human and financial resources

Human and financial resources are collectively known as slack resources. Organisations with more time available to evaluate new technologies and a limited budget available for ICT expenses were more easily persuaded to adopt OSS (Ellis & Van Belle, 2009; and Dedrick & West, 2003).

According to Miscione and Johnston (2010) the available budget was not that relevant to the adoption decision. It was found that the available staff time was a factor impacting the adoption decision. Interestingly available time was more of a factor in the case of large organisations than smaller ones without dedicated ICT departments (Miscione & Johnston, 2010). Several surveys have shown that the size of a firm does have an impact on adoption, and the size and adoption is positively related (Spinellis & Giannikas, 2011).

Innovativeness of the organisation

The level of organisational innovativeness can be an influencing factor relating to the adoption consideration and timing of adoption of new technologies (Ellis & Van Belle, 2009; and Dedrick & West, 2003). Communication channels are key to innovation adoption and an increased awareness of OSS may increase the likelihood of adoption (Qu, Yang, & Wang, 2011). Spinellis and Giannikas (2011) found the provision of resources to promote ICT innovation, as well as the policy of the IT department or the company toward the use of OSS to be an influencing adoption factor and potential barrier.
Boundary Spanners

The presence of staff with previous OSS experience positively influences the adoption decision of a prospective technology (Ellis & Van Belle, 2009; and Spinellis & Giannikas, 2011). These staff members are known as boundary spanners.

The availability of in-house OSS skills and knowledge are important adoption factors. A lack of skills leads to an increased dependence on external support (Nagy et al., 2010; and Qu et al., 2011). Organisations with existing OSS skills are better equipped to mitigate the risks associated with OSS adoption and they also have lower training costs (Goode, 2005). A lack of skills and awareness has also been identified as a barrier to adoption in South African small and medium enterprises (Ellis & Van Belle, 2009).

The lack of awareness can be remedied by having OSS advocates and boundary spanners working in an organisation. Managers' stance toward IT innovation and the presence of boundary spanners are other key factors affecting OSS adoption (Qu et al., 2011). Having said this, there is little internal knowledge in most organisations on how to use OSS or customise the software for internal needs (Nagy et al., 2010).

Summary of OSS organisational adoption factors

Table 6 is a summary of the organisational adoption factors identified in the literature with reference to the sources. The concept of a brand name product was used to indirectly determine whether an organisation is more conservative in nature, or less innovative, as brand names have a reputation for good quality (Holt, 2004). A characteristic of a brand name is also that customers are willing to select the product over that of the competitor at a premium price (Farris, Bendle, Pfeifer, & Reibstein, 2010). If an organisation has a policy of only implementing brand names it would imply that financial resources are not a primary barrier or consideration.
<table>
<thead>
<tr>
<th>Factor</th>
<th>Adoption</th>
<th>Statement</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>Financial Resources</td>
<td>-</td>
<td>5.14. Our organisation is only implements well known brand names.</td>
<td>(Ellis &amp; Van Belle, 2009; and Dedrick &amp; West, 2003)</td>
</tr>
<tr>
<td>Human Resources (IT staff time)</td>
<td>+/-</td>
<td>5.15. The skill levels and required time available in our organisation is to little for an OSS ERP implementation.</td>
<td>(Ellis &amp; Van Belle, 2009; Dedrick &amp; West, 2003; and Mills &amp; Johnston, 2010)</td>
</tr>
<tr>
<td>Innovation of the organisation</td>
<td>+/-</td>
<td>5.16. We will not implement any OSS ERP because there are no well known brands in the market.</td>
<td>(Ellis &amp; Van Belle, 2009; Dedrick &amp; West, 2003; and Gwebu &amp; Wang, 2011)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>5.17. Our organisation prefer to stick to the tried and tested when implementing new IT solutions.</td>
<td>(Ellis &amp; Van Belle, 2009; Dedrick &amp; West, 2003; Gwebu &amp; Wang, 2011; and Spinellis &amp; Glastrinas, 2011)</td>
</tr>
<tr>
<td>Boundary Spanners</td>
<td>+/-</td>
<td>5.18. We do not have any staff that have experience in an OSS implementation.</td>
<td>(Ellis &amp; Van Belle, 2009; and Spinellis &amp; Glastrinas, 2011)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>5.19. If we have staff with experience in a particular ERP package we will strongly consider it irrespective of whether it is OSS or proprietary.</td>
<td>(Ellis &amp; Van Belle, 2009)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>5.20. The skill levels and required time available in our organisation is to little for an OSS ERP implementation.</td>
<td>(Gonde, 2005)</td>
</tr>
</tbody>
</table>

Table 6: Summary of the organisational adoption factors and questions

2.6.3 ENVIRONMENT

Availability of Product Skills & Support Services

Unlike proprietary software where a single company controls and supports a specific product, this is not the case with OSS products. This is seen as relating to greater level of risk to potential adopters compared to proprietary software products (Ellis & Van Belle, 2009). Nagy et al. (2010) also referred to the splintered nature of the industry as a result of forking as an adoption barrier to OSS. Forking is the taking of an OSS product, duplicating the sources, and continuing in different evolutionary directions. Formal training and support are often lacking (Gwebu & Wang, 2011; and Nagy et al., 2010). This lack of a formal support option offering services that are guaranteed to be available affects large corporations with the necessary resources to pay for formal support agreements and has less of an effect on SME’s that often rely on in house skills and community support (Ellis & Van Belle, 2009).

Users were often not comfortable dealing with the open source community for support offered online by the OSS community and preferred dealing with vendor support. Product service and support was offered by certain OSS vendors, but there was often a lack of knowledge or awareness about this option. Additionally, there were often no packaged technical support agreements, documentation was limited, and many end users often did not pose the technical skills necessary to operate OSS. The development model which enabled some of the benefits of OSS, also lead to concerns regarding technical support (Ellis & Van Belle, 2009; and...
Johnston & Seymour, 2005). Even when support services were available, managers were often unaware that there were support services or consultants available who could assist with open source software implementation or the range of services they offer (Ellis & Van Belle, 2009).

**Platform Long-term Viability**

Fear of adopting an application which may be abandoned and no longer supported negatively influences an organisation’s decision to adopt OSS (Ellis & Van Belle, 2009). According to Miscione & Johnston (2010) organisations seem to prefer platforms which are perceived to be the benchmark through brand equity. Selecting a technology standard with a wide footprint offers the technology user increased vendor support and investment as well as a broader range of complementary products. The inverse applies to adopting a technology standard which does not receive widespread interest (Ellis & Van Belle, 2009). Forking tends to fragment the adopter and applications market, damaging the ability of any version to gain a critical mass of adopters. It also causes the necessity for vendors to support multiple versions, or worse yet for vendors and adopters to first wait and see (Nagy et al., 2010).

**Product Awareness**

The lack of awareness by key ICT decision makers is a major obstacle to the widespread use of OSS in SA (Ellis & Van Belle, 2009; Johnston & Seymour, 2005; and Nagy et al., 2010). Extensive marketing campaigns enabled proprietary software products to generate a high level of public awareness (Ellis & Van Belle, 2009) compared to their OSS counterparts who was often found to have no marketing or advertising budget (Nagy et al., 2010). Nagy et al. (2010) names Compiere as a suitable OSS ERP alternative to expensive ERP Systems such as SAP and Oracle, and states that it is largely unknown to the adopter community. According to Ellis and Van Belle (2009) the South African OSS community operated under a non-commercial business model resulting in not actively marketing the OSS brand. This lack of marketing resulted in decision makers not being adequately informed about the alternative software packages available and the benefits offered (Ellis & Van Belle, 2009). According to the innovation diffusion theory the mass of existing adopters can affect the non-adopters and vice versa (Zaffar, et al., 2011). Zaffar, et al. (2011) deduces that this implies that the size of the existing base of adopters of an innovation can strategically impact the future diffusion process. It was found that the majority of SMEs and NGOs are not completely aware of all the options available regarding software and in particular OSS (Miscione & Johnston, 2010).
Integration

The possibility of inadequate legacy integration and subsequent lack of accountability for failed integration were also some of the reasons for organisations not adopting OSS (Nagy et al., 2010). This was of particular importance if seen in the light that many organisations sit with legacy systems because managers are often unwilling to accept the risk associated with modernising these legacy systems (Miscione & Johnston, 2010). Legacy system integration is challenging for both proprietary and OSS. The open source code makes integration with an OSS ERP system simpler than with proprietary ERP systems.

Summary of OSS environmental adoption factors

Table 7 is a summary of the organisational adoption factors identified in the literature and associated with reference to the sources.

<table>
<thead>
<tr>
<th>Factor</th>
<th>Adoption</th>
<th>Statement</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>Availability of Product Skills &amp; Support Services</td>
<td>-</td>
<td>S21: We do not perceive the offers as support sufficient to implement OSS ERP.</td>
<td>(Nagy et al., 2010; and Gui et al., 2011)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>S22: After sales support is very important when deciding to implement any new technology.</td>
<td>(Ellis &amp; Van Belle, 2009)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>S23: We are not aware of any OSS ERP providers in our area.</td>
<td>(Giveth &amp; Wong, 2011; Ellis &amp; Van Belle, 2009; Johnston &amp; Seymour, 2005; and Nagy et al., 2010)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>S24: The online OSS ERP community is a great alternative to the traditional support model of proprietary systems.</td>
<td>(Ellis &amp; Van Belle, 2009; and Johnston &amp; Seymour, 2005)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>S25: If there are large enough vendors for an OSS ERP that can support the systems we will consider the system over any other solution.</td>
<td>(Ellis &amp; Van Belle, 2009; Miscione &amp; Johnston, 2010; and Nagy et al., 2010)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>S26: We are not that concerned with the level of customisation, the package must just be good enough to start out with.</td>
<td>(Ellis &amp; Van Belle, 2009; Miscione &amp; Johnston, 2010)</td>
</tr>
<tr>
<td>Platform and long-term viability</td>
<td>+/-</td>
<td>S27: We do not perceive OSS ERP solution to be viable in the long-term.</td>
<td>(Ellis &amp; Van Belle, 2009; and Nagy et al., 2010)</td>
</tr>
<tr>
<td>Product Awareness</td>
<td>-</td>
<td>Open ended question: Which open-source ERP packages are you aware of?</td>
<td>(Ellis &amp; Van Belle, 2009; Johnston &amp; Seymour, 2005; and Nagy et al., 2010)</td>
</tr>
<tr>
<td>Integration</td>
<td>+</td>
<td></td>
<td>(Miscione &amp; Johnston, 2010; and Nagy et al., 2010)</td>
</tr>
</tbody>
</table>

Table 7: Summary of the environmental adoption factors and questions
2.6.4 INDIVIDUAL

It was found that there is a possible discrepancy between individual technology adoption and organisational technology adoption (Venkatesh, Moris, Davis, & Davis, 2003). There was significant evidence that suggest that the individuals’ perceptions of a software system influence their adoption and usage decisions (Gwebu & Wang, 2010). As decisions are ultimately made by individuals, the end user perceptions of technology are potentially significant (Johansson & Sudzina, 2008) and the behaviour intention to adopt a technology. Johansson and Sudzina (2008) suggested that it would be of interest to conduct more research about social influences on the adoption factors.

Perceived usefulness (PU)

PU was defined by Gwebu and Wang (2011) as the extent to which one believes that using an OSS application will enhance his or her job performance. This is similar to Performance Expectancy introduced under Technology by Ellis & Van Belle (2009).

Gwebu and Wang (2011) name a number of ways in which OSS can enhance job performance. Firstly, OSS makes a variety of quality software products affordable that users could otherwise not afford. The more technically skilled users can audit and/or customise OSS to suit specific functional and security requirements for the job.

By improving the perceived ease of use it will help bridge the gap between the reality of what a OSS application can offer and the perception of the mainstream market of the usefulness (Gwebu & Wang, 2010). PU was, in turn, shown to directly and positively impact the intention to adopt OSS applications (Gwebu & Wang, 2011).

Perceived ease of use (PEOU)

PEOU was defined by Gwebu and Wang (2011) as the extent to which a person believes that using an OSS application will be free of effort.

PEOU was found to be positively influenced by the user perceptions of the technological characteristics, namely flexibility, quality, and capability. It was also found that Personal Innovativeness in Information Technology (PIIT) has a significant effect on the PEOU (Gwebu & Wang, 2011).
Gwebu and Wang (2011), however, found no significant relationship between Social identification (SI) and the PEOU. This is slightly contrary to the findings that consistently found the developer community to perceive OSS applications more positively along multiple dimensions, one of which was PEOU than non-developer-non-community members (Gwebu & Wang, 2010).

Gwebu & Wang (2010) found that for OSS to reach the potential mainstream market it is very important to improve the perceived ease of use amongst the non-developer-non-community.

Often OSS applications are released at the pre-alpha, alpha or beta development stage (Dedrick & West, 2003; Goode, 2005; and Gwebu & Wang, 2010). Applications at this stage of development tend to be packaged inconveniently, unstable and lack an intuitive design. A user could be required to download, compile, configure, and/or install the software which requires technical know-how (Gwebu & Wang, 2011).

Further to this formal training and support were often lacking (Goode, 2005). This left the OSS user to effectively teach and troubleshoot themselves through support and documentation materials that are available. The frequent releases of patches and software versions could also result in maintenance that may seem cumbersome and even extremely difficult (Gwebu & Wang, 2011).

These are factors potentially impacting negatively on the perceived ease of use amongst the mainstream market of the non-developer-non-community and are potential barriers to adoption (Gwebu & Wang, 2011).

Gallego, Luna, and Buena (2008) determined, in a study of 347 Linux users, that there was a strong positive impact on the intention to use Linux, and by implication OSS, due to a perceived ease of use. PEOU was also shown to positively influence perceived usefulness (Gallego, Luna, & Buena, 2008). According to Davis (1989), PEOU directly, and indirectly via its influence on PU, impacted the adoption intention in a significant way.

**Personal Innovativeness in Information Technology (PIIT)**

PIIT was defined by Agarwal and Prasad (1998) as the willingness of an individual to try out any new Information Technology (Gwebu & Wang, 2011).

Other models also included innovativeness in some form or another. TOE lists organisational innovativeness (Dedrick & West, 2003). As highlighted in section 2.5.4, there is a potential
discrepancy between individual technology adoption and organisational technology adoption (Venkatesh, Moris, Davis, & Davis, 2003).

Frambach and Schillewaert (2002) recognised this and introduced personal innovativeness (PI) together with organisational facilitators and social usage as elements shifting the individual perception. Gwebu and Wang (2011) however argued that, since OSS is an instance of IT, a domain specific construct of PI in information technology will better predict individual behaviour towards an information technology than the global construct, PI, of individual innovativeness.

It was found that PIIT has a significant effect on the PEOU and the intention to adopt OSS (Gwebu & Wang, 2011; and Yi, Fiedler, & Park, 2006). A supporting view was that early adopters with high innovativeness see the potential benefits associated with an innovation more easily than subsequent adopters (Rogers, 2003). This would make potential users with a high PIIT more likely to view OSS applications as useful (Gwebu & Wang, 2011).

Risk factors such as training, documentation, and/or user support were also noted as more likely to be tolerated by potential users with a high PIIT (Gwebu & Wang, 2010).

By implication the inverse of the above is potentially also true, namely that potential users with a low PIIT will be more likely to be put off by the risk factors and this will also impact the intention to adopt a OSS package.

**Social identification (SI) with OSS**

Gwebu and Wang (2011) found the OSS community to represent different things to different members. One is a common software interest around an open-shared software solution, fulfilling specific software, needs that are not currently satisfied by available proprietary software solutions. To others, the OSS community embodies a social movement with definite social and political ideologies and agendas. Whilst for others, the OSS community is the open source brand, the “unbreakable Linux”.

The higher the perceived risk, the less likely users are to use the technology since there is a possibility of some form of loss, be it economic, psychological, physical or social (Gwebu & Wang, 2010). Gwebu and Wang (2010) divide individuals into two social groups, namely, OSS community group members and non-members.
Where there was a sense of solidarity with the OSS community it was found that it can positively impact member behaviour, including product evaluation, adoption, purchasing, word-of-mouth marketing, and member participation and engagement (Gwebu & Wang, 2010).

One of the elements within the movement that drive social identification is an individual’s frame of self-awareness of association with the OSS community which emphasise perceived similarities, e.g. shared software interests and ideologies, with other OSS members. As a result the association with the OSS community can also emphasise perceived dissimilarities with out-groups, e.g. proprietary software users. Stated differently this effective commitment can also manifest as strong sentiment against proprietary software firms and applications (Gwebu & Wang, 2010).

The strong sense of community and social association is probably typified by the rivalry between the OSS and free software movements that represent similar software types; the main dissimilarity between the two being that OSS is a software development methodology and the free software movement is a social movement. Stallman (2009) probably illustrated the social identification best when he described the differences between the two software categories as extending to the terminology, underlying philosophies and associated value systems.

The question is whether this strong association for OSS and against proprietary software does not actually serve as a barrier to the out-group to adopting OSS, and for the purpose of the research, OSS ERP systems.

**Behavioural intention to adopt**

TAM predicts that PU and PEOU determine the behavioural intention to adopt a technology (Gwebu & Wang, 2010). The behavioural intention to adopt in turn leads to the subsequent behaviour with regard to, or use of, a technology, in this instance OSS (Gwebu & Wang, 2010). Gwebu and Wang (2011) found a strong correlation between PEOU, PIIT, and SI and behavioural intention to adopt. Contrary to TAM, Gwebu and Wang (2011) found the correlation between PU and behavioural intention to adopt relatively weak to the other factors.

Behavioural intention to adopt is not an adoption factor, but the outcome of the other four factors in the individual construct.
Summary of OSS individual adoption factors

Using the questions in Table 4 that were compiled by Gwebu and Wang (2011) from adaptations of previous studies and reworded for the context of OSS adoption the following factors and questions (statements) were selected for this research,

<table>
<thead>
<tr>
<th>Factor</th>
<th>Adoption Statement</th>
<th>Source</th>
</tr>
</thead>
</table>
| Perceived Usefulness          | +/-: Using open source software would give me greater control over my tasks than using proprietary software.  
|                               | +/-: I am more productive if I use Open Source Software compared to if I use proprietary software.                                                                                                             | (Davis, 1989, and Gwebu & Wang, 2011)                                                        |
| Perceived Ease of Use         | +/-: Generally, I find it easy to get Open Source Software to do what I want it to do.  
|                               | +/-: It is easy for me to become skillful at using Open Source Software.                                                                                                                                     | (Davis, 1989, and Gwebu & Wang, 2011)                                                        |
| Personal Innovativeness in technology | +/-: Among my peers, I am usually the first to try out new information technologies.  
|                               | +/-: In general, I am hesitant to try out new information technologies.                                                                                                                                       | (Gwebu & Wang, 2010)                                                                          |
| Social Identification with OSS | +/-: I am proud to think of myself as a member of the Open Source Software community.                                                                                                                       | (Gwebu & Wang, 2010)                                                                          |
| Behavioural Intention to adopt | n/s: During the next 6 months, I plan to use open source software.                                                                                                                                           | n/s                                                                                          |

Table 8: Summary of the individual adoption factors and questions (Gwebu & Wang, 2011)

2.7 CONCLUSION

The literature review highlighted the lack of research available on the factors impacting the adoption of OSS ERP Systems. This was the case in general, rather than specific to South African organisations or specifically the barriers to adoption of OSS ERP Systems.

Through the literature review a body of knowledge relating to the adoption of OSS by organisations globally were found. Whilst the majority of this research focused on developed countries, the literature review did reveal research specifically done on OSS adoption enablers and barriers in South Africa.

In the studies sourced relating to the adoption of OSS in South Africa, the TOE framework was found to be the one most commonly used. One potential shortcoming identified by the literature with regard to the TOE framework used was the lack of investigating the impact of the individual as a factor on the adoption of OSS technology.

The review of the OSS adoption literature has provided a concrete base of theory through a combination of models such as TOE, TAM and SIT from which to identify appropriate constructs as potential barriers to OSS ERP adoption. The theory further provided a source from which qualitative research questions could be drawn and formulated. These constructs
were listed with the associated statements in Table 5, Table 6, Table 7, and Table 8 and effectively answered the second research question, what are the barriers to the adoption of Open Source Software? The third research question that was identified is: Are the barriers to the adoption of Open Source Software different for South African organisations? Comparing the findings of the work done on OSS adoption factors in South Africa the research question was answered to a satisfactory extent, and the findings are summarised in Table 11, Table 12, Table 13 and Table 14 in Section 4.5.

A study by Das Neves, Fenn, and Sulcas (2004) highlighted the factors companies consider when selecting an ERP system. By determining which of the OSS adoption barriers relate to OSS ERP systems it can further be investigated whether the barriers to adopting Open Source Software Enterprise Resource Planning Systems are in fact different from those that apply to ERP software in general. This was outside of the scope of this research and is noted as an opportunity for future research in Section 3.5.

All of the above research questions culminate into the main research question: What are the barriers to adopting Open Source Software Enterprise Resource Planning Systems for South African Organisations?

The literature revealed that within the OSS community there is not only a strong association for OSS but also against proprietary software. The Social Identification factor within the Individual construct could alienate the out-group, which currently forms the majority. If there is in fact little to no difference between the adoption barriers of OSS ERP and proprietary ERP systems a strong association with OSS ideology by the OSS community could potentially be seen as radical and serve as a barrier to the out-group adopting OSS ERP systems.
3. RESEARCH METHODOLOGY

3.1 RESEARCH APPROACH AND STRATEGY

The selection of a research methodology is seen by some researchers as merely an epistemological question, whilst other researchers view the selection of research method as a purely technical matter. Stating the latter differently, the selection of a research methodology is seen by some researchers as a question of which technique will fit the theoretical area being researched and the nature of the data collection environment best (Bryman, 1999).

What the most appropriate epistemology for the information systems discipline is has been a much debated topic (Debreceny, Putterill, Tung, & Gilbert, 2002). Debreceny et al. (2002) found that the principle research paradigm was positivist. It was, however, found that there was an increase in the use of interpretive research (Debreceny et al., 2002).

This research was undertaken to determine the adoption barriers of OSS ERP by South African Organisations. Even though there have been various studies on enablers and barriers to OSS adoption, this research studied OSS barriers in a new context and attempted to obtain new understandings of the barriers associated with OSS ERP adoption within the defined scope. This fits the definition of an exploratory purpose (Saunders, Lewis, & Thornhill, 2009). Using a similar argument as Debreceny et al. (2002) for their research done on e-commerce inhibitors, the use of qualitative research may be appropriate in OSS research as an alternative to a positivist approach.

The strength of the qualitative approach is “that there [is not] necessarily a single, ultimate truth to be discovered. Instead there are multiple perspectives held by different individuals, with each of these perspectives having equal validity, or truth” (Leedy & Ormrod, 2010, p.135). This is important to consider in light of the research undertaken by Gwebu and Wang (2011) showing the impact of the individual on the adoption decision. Qualitative research allows the researcher to make advances in the expansion of theory. On the other hand, quantitative research is designed to validate pre-existing theories (Bryman, 1999).

A potential problem with qualitative techniques is that it is seen by many scholars as unsystematic and not rigorous enough to provide reliable results (Richards, 2004; and Lilford & Braunholtz, 2003). Saunders et al. (2009) stated that research must be performed in a systematic, logical, and sound manner to increase knowledge, rather than simply derived from beliefs. According to Miles and Huberman (1994) research that merges qualitative and
quantitative methods offers a rigorous procedure for data gathering and analysis which contributes to the validity and reliability of research.

A mixed method research strategy which combines quantitative and qualitative strategies has increasingly been advocated within business management research (Saunders et al., 2009). Cresswell (2009) places quantitative and qualitative research strategies on opposite ends of a continuum and places mixed methods in the middle as it incorporates elements of both of quantitative and qualitative research strategies.

Considering the above factors which were similar in nature to those considered by Ellis and Van Belle (2009), a deductive and inductive approach to the theory was combined, similar to the approach used by Ellis and Van Belle (2009). Debreceny et al. (2002) conducted a valuable analysis of approaches to determine the barriers to technology adoption. Out of their research Debreceny et al. (2002) developed the Inhibitor Determination Methodology (IDM), which employes quantitative and qualitative strategies. Goode (2005) found the IDM appropriate for his research done on “What are the management barriers to open source adoption in commercial environments?”

It was felt that that the Inhibitor Determination Methodology (see Figure 3) is also appropriate for determining the adoption barriers for an OSS ERP by South African Organisations.

3.2 RESEARCH DESIGN, DATA COLLECTION METHODS AND RESEARCH INSTRUMENTS

The research design was a cross-sectional study of the adoption barriers of OSS ERP systems in South African organisations.

By definition cross-sectional research entails “the collection of data on more than one case and at a single point in time in order to collect a body of qualitative or quantifiable data in connection with two or more variables which are then examined to detect patterns of association” (Bryman & Bell, 2007, p. 55-56).

The data was collected through an electronic survey and a focus group during November 2011. This was an appropriate approach in light of the time constraints and the specific
research questions. With regard to the research question, the researcher was interested in the current adoption barriers of OSS ERP systems rather than how these have changed over time, or which adoption barriers have been consistent over time.

Debreceny et al. (2002) provides a outline for the mixed method (qualitative and quantitative) approach followed by the researcher, incorporating both inductive and deductive procedures in the IDM:

![Image of the research design—Inhibitor Determination Methodology (IDM) (Debreceny et al., 2002)](image)

The method is described by Debreceny et al. (2002) as multi-stage and multi-method.
The IDM comprises four (4) phases namely (Debreceny et al., 2002):

**Phase 1A:** Identify the population of inhibitor factors through a literature review and questionnaire survey.

**Phase 1B:** Focus groups of relevant practitioners and decision-makers rank and analyse the key inhibitors identified in Phase 1A.

**Phase 2A:** Group Decision Support Systems (GDSS) - facilitated groups of IS practitioners and decision-makers ranked the factors associated with each prime inhibitor identified in Phase 1.

**Phase 2B:** The same GDSS groups commented through synchronous topic discussion on the highly ranked factors identified in Phase 2A.

**Phase 1A**

Potential inhibitors were identified from the literature. The potential inhibitors were then further explored through an online survey (Appendix B).

The online survey comprised three (3) sections with the third section being made up of four (4) subsections.

The first section analysed the demographics of the respondent, both personal and organisational. The second section used open ended questions to allow respondents to provide answers independent of the theoretical framework and allowed for exploring adoption barriers not necessarily identified in the literature (Saunders, Lewis, & Thornhill, 2009). The third section used closed ended questions, based on the potential inhibitors identified in the literature.

The literature review revealed that despite the cost benefits associated with and OSS ERP implementation, the associated cost remains a factor to consider. Apart from an organisation needing to be in the financial position to afford the installation, the size of the business often dictates the need for an ERP system.

The South African Government introduced Act 53 (2003) Codes of Good Practice for Black Economic Empowerment. The requirements pertaining to the legislation have desensitised companies regarding disclosing their Broad-Based Black Economic Empowerment (B-BBEE) credentials, and consequently the B-BBEE category the organisation falls under.
The B-BBEE legislation offered a “user friendly” way of determining the financial size of a company. There are three B-BBEE categories (B-BBEE, 2004); respondents were asked to select the B-BBEE category of their organisation.

**Exempt Micro Enterprise (EME):** Organisations with an annual turnover of anything less than R5 million

**Qualifying Small Enterprise (QSE):** Organisations with an annual turnover of between R5 million and R35 million

**Generic Enterprise:** Organisations with a minimum annual turnover of R35 million.

This design strategy was found to be very successful with 83% of respondents indicating the B-BBEE category applicable to the organisation they represent.

The questions in the third section were grouped under the four identified constructs, Technology, Organisation, Environment, and Individual. To value each inhibitor the survey made use of a four (4) point Likert Scale. The Likert Scale was used to collect opinion data and the potential inhibitors were presented as statements. Respondents were requested to indicate their level of agreement by selecting one of the following four (4) categories: Strongly Disagree, Disagree, Agree, or Strongly Agree. An even number of points (4) was used to force the respondent to express their opinion towards an implicitly positive statement. Both positive and negative statements were used to ensure that the respondent read each statement carefully and consider their reply (Saunders et al., 2009).

The Likert Scale was selected as the data collection method as it was seen as an appropriate method to determine whether a specific adoption inhibitor applies to OSS ERP systems from a relatively large number of identified inhibitors in the literature in a quick and easy manner. This was seen as an important factor to increase the completion rate of respondents.
Phase 1B

A focus group comprising of knowledgeable stakeholders such as senior managers in IS firms, Chief Information Officers (CIO’s) of large commercial organisations and consultants of proprietary ERP systems were asked to rank the inhibitors identified in the previous phase.

The ranking was made, making use of the Delphi Method. The Delphi method was also used in a study by Kamhawi (2011) on IT and non-IT factors influencing the adoption of balanced scorecard systems. The Delphi method has proven a popular tool in information systems (IS) research (Okoli & Pawlowski, 2004).

The Delphi Method is particularly useful for refining research ideas (Saunders et al., 2009) and is a widely used and accepted method for gathering data from respondents within their domain of expertise (Hsu & Sandford, 2007).

The members of the group were individually briefed on the research focus area and the process to be followed. They were also encouraged to seek clarification and more information if required.

Typically the method would require each member to independently generate specific research ideas (Saunders et al., 2009), in this case inhibitors to OSS ERP adoption. All of the participants in the group were, however, respondents to the survey in Phase 1A, and already had the opportunity to provide specific inhibitors through the open ended questions in the second section of the survey.

The members of the focus group were first asked to rank the identified adoption barriers independently through the first iteration questionnaire in Appendix C. The barriers were provided in a table with no specific order with a brief description of each.

In the second iteration a questionnaire, provided in Appendix C, was sent independently to each of the panel members, and included a summarised ranking from the previous round and each panel member was asked to revise his/her ranking, or explain the reasoning for differing with the average ranking (Hsu & Sandford, 2007). According to Hsu and Sandford (2007) this round gives an opportunity to make further clarifications of both the information and their judgments of the relative importance of the items.

The final round was conducted through an electronic focus group. The focus group technique offers the ability for rapid and interactive focus on key issues being addressed in the research
area (Debreceny et al., 2002). Debrecency et al. (2002) found that the level of active interaction between participants with each other and the researcher allowed for ideas to be rapidly explored, addressed and fleshed out. This offers a high contextual validity, richness of data and flexibility (Debreceny et al., 2002). The list of items, their ratings, minority opinions, and items achieving consensus were distributed to the group members through eight topics in the electronic focus group and can be seen in Appendix D. This round provided a final opportunity for the participants to debate and possibly revise their judgments (Hsu & Sandford, 2007). At the end of this round the general consensus was summarised and participants were given the opportunity to give their final thoughts on the outcome.

Phases 2A and 2B

Due to time constraints the GDSS and Computer Assisted/Aided Qualitative Data Analysis (CAQDAS) could not be employed for the analysis, ranking and brainstorming of inhibitors. This was accounted for through the way in which the Delphi Method was incorporated into the previous phases.

3.3 SAMPLING

The IDM requires a literature review, survey, and focus group. How the sample of literature for the review, the respondents for the survey, and the member for the focus group was determined is discussed below.

3.3.1 LITERATURE REVIEW

How the literature sample was selected for the identification of the population of inhibitor factors as required by phase 1A was described in Section 2.1.

3.3.2 QUESTIONNAIRE SURVEY

Given that the aim of the research questions to investigate the adoption barriers to OSS ERP in South African organisations non-probability sampling was found to be appropriate (Saunders et al., 2009).

The surveys were focussed on individuals that are either professionals and/or decision makers within South African organisations. Two sources of individuals complying with these criteria were identified. The first source was all current MBA students and alumni at UCT’s
Graduate School of Business, and the second, all relevant individuals in the network of the researchers. It was felt that the adoption decision will ultimately be determined by decision makers who are either professionals, or to some extent influenced by professionals in the organisation.

A combination of self-selection sampling and snowball sampling was used. An email was sent to at least 420 individuals in the identified sources explaining the purpose of the research and requesting their participation by completing the online survey.

In order to increase the sample size, each correspondent was also asked in the initial communication to forward the request to other professionals and decision makers in their network.

Given the inductive nature of the research and the lack of a sampling frame, the sampling method was seen as sufficient (Saunders et al., 2009). By making use of snowball sampling it is not possible to determine the exact number of potential respondents targeted. A total of 158 respondents did, however, start the questionnaire survey of which 76 completed all the questions. The researcher believes that this provided a sufficient sample as the later surveys revealed few, if any, new insights which would imply data saturation was reached (Saunders et al., 2009).

3.3.3 FOCUS GROUP

Focus Group participants were selected because they had certain characteristics in common that relate to the topic, adoption barriers of OSS ERP systems, being discussed (Saunders, 2009). This included an understanding of ICT, and in particular the OSS and ERP landscape, and an understanding of the needs of the end consumer of ERP systems.

The focus group comprised two senior managers in IS firms, two CIO’s of large commercial organisations and two consultants of proprietary ERP systems.
3.4 DATA ANALYSIS METHODS

3.4.1 QUESTIONNAIRE SURVEY

Section 1 – Demographics

The analysis of the demographics of the individual respondents and companies represented by the respondents were exploratory in nature. The data was discrete and the aim was to compare proportions or totals of the occurrences of categories.

Pie charts have been shown to be the most frequently used diagram for showing proportions, whilst bar charts have been shown to provide equally good results (Anderson et al., 1999, as cited in Saunders et al., 2009). Pie charts and bar charts were used interchangeably depending on what the researcher felt best illustrated the data.

Section 2 – Open ended questions

Where the answers were discrete in nature, e.g. a product name, bar charts were used to analyse the response. Tables provide no visual significance to the highest or lowest values whilst a histogram provides an easy distinction and clear indication of the frequency of occurrences (Saunders et al., 2009). According to Saunders et al. (2009) a bar chart or pictogram is the most appropriate data representation for analysis of the frequency of occurrences of categories for one variable. The bar chart was found to be the most appropriate method for analysing the questionnaire survey.

Where the answers required the respondent to give their opinion, categorisation was used as an analysis process. For the categorisation process, segments of data were taken apart and named in concise terms. There are three main sources to derive the names for the identified categories (Saunders et al., 2009):

1.) terms that emerge from the data;

2.) the actual terms the participants used, or;

3.) the categories are derived from existing literature.

In the analysis categories arising from existing literature were used to analyse reasons given by respondents for not selecting an OSS ERP system. The reason for this was to more easily identify new constructs that might arise.
Terms that emerged from the data were used to categorise the understanding of respondents of the term OSS. In the case of the understanding of what OSS is, no formal frameworks specific to the understanding of OSS were researched and the question focussed on some factors within the construct rather than the broad topic.

The next step was to unitise the data (Saunders et al., 2009). A unit of data used in this analysis was the actual section of words the respondent wrote that fitted the category.

The final step was to develop categories. This was a process of combining or dividing categories to be able to refine and focus the analysis (Saunders et al., 2009).

**Section 3 – Likert Scale questions**

Questions were given as statements, the respondents were required to indicate their level of agreement, a four (4) point Likert Scale was used: Strongly Disagree = 1, Disagree = 2, Agree = 3, and Strongly Agree = 4.

Each factor was analysed separately and in some cases item responses were combined to create a score for the group of items.

The data were described through histograms with the mode indicated in a separate colour to the other bars.

The survey data was further simplified by combining the four response categories into two nominal categories, namely agree and disagree.

3.4.2 **FOCUS GROUP**

The Delphi method resulted in a final list of barriers in a ranked format to emerge. The arguments formulated by the participants around the position and validity of the respective adoption barriers were recorded, and form part of the findings.
4. RESEARCH FINDINGS, ANALYSIS AND DISCUSSION

4.1 SAMPLES

4.1.1 SIZE AND POPULATION - ORGANISATIONS

In total there were 158 respondents to the survey, of which 76 respondents completed all the questions. The range of responses for each question varied between 76 and 158. The organisations represented by the respondents covered a broad spectrum of industries as can be seen in Figure 4.

The coefficient of correlation between the number of respondents for the respective industries in the 76 and 158 samples of respondents was 0.9268, as shown in Figure 5. An unpaired t-test was further performed on all the industry variables of the survey to determine whether the respondents that completed the survey in full were a good approximation for the industries represented by the whole group of respondents. For all of the variables the P-values were greater than the chosen significance level of 0.05 as can be seen in Table 9. This meant that the difference between the two groups was not statistically significant.
It was difficult to test the correspondence of the sectorial spread of organisations represented by respondents to the sectorial spread of South African organisations according to Statistics South Africa (dti: Economic Statistics). This was due to groupings of organisations used for the survey questionnaire in some cases falling over more than one sectorial grouping used by Statistics South Africa and vice versa. The available data from Statistics South Africa also related to the Gross Domestic Product (GDP) contribution of the various industries rather than the number of organisations within the respective industry sectors. The GDP contribution of the respective sectors in South Africa for 1995 and 2009 are given in Figure 6. It was decided by the researcher that the sectorial spread of organisations represented by respondents were sufficient to represent South African organisations in general based on a comparison with the data from Statistics South Africa in Figure 6.

The sample of organisations represented by the respondents was generally more mature with a total of 91% of organisations older than 5 years as can be seen in Figure 7. For further analysis the lowest three segments were combined to create large enough sub samples.
Large organisations were much more prevalent in the sample, with organisations having more than 250 employees, and between 50 and 250 employees being a 54% and 14% share respectively. Organisations with between 10 and 50 employees, and less than 10 employees are the further 12% and 20% share respectively.

The B-BBEE categories of the respective organisations corresponded with the observation around the size of the organisation relative to the number of employees. Organisations that had an annual turnover of more than R35 million made up 53% of the sample, organisations with an annual turnover of between R5 million and R35 million was 17%, and organisations with an annual turnover of less than R5 million was 13%, whilst 17% of respondents choose not to give an indication of the B-BBEE category their organisation fell under.

Figure 7: Age of organisations represented

Figure 8: Number of employees in organisations

Figure 9: B-BBEE Category of Organisations
Enrolled MBA students and Alumni of UCT’s Graduate School of Business as well as other networks were targeted. The nature of the target group could have been a contributing factor to a potential bias towards medium to large enterprises and industries that are more reflective of the Western Cape economy. The reason for this was because the potential respondents were typically professionals in public or private organisations that can both afford, as well as need the services of these professionals. The second potential bias is based on the UCT Graduate School of Business being Cape Town based, and a larger percentage of students residing in the area.

Obsidian and Astidian are two of the bigger OSS vendors in South Africa, respectively focusing on operating systems (and other software in the technology stack) and OSS ERP and Client Relationship Management (CRM) applications. In discussions with the Chief Executive Officer (CEO) of Obsidian and general manager (GM) of Astidian, they indicated that none of their clients are small organisations. According to Obsidian, large organisations make up 80% of their client base and medium organisations the remaining 20%. Astidian indicated a split of 40% large and 60% medium. This corresponds with the findings of a 2009 Small Enterprise Development Agency (SEDA) report on ICT and Entrepreneurship in South Africa, that found that a large percentage of SMMEs do not use the Internet for business purposes and that Microsoft Word and Excel are the most popular software packages used by these businesses (Kew & Herrington, 2009).

The reasons given by the GM of Astidian for the lack of ERP adoption by smaller organisations are that an ERP either does not warrant the cost, or that there is no need for an ERP given the size of the organisation. This was view was supported by 13 of the respondents who indicated that their organisations have no need for an ERP; these respondents were all from organisations with less than 50 employees.

The bias towards medium-large organisations was not considered to be material as this appears to be the potential market for OSS ERP systems from a needs base. The literature also indicated that the decision to implement an ERP system was mostly based on strategic needs (Das Neves et al., 2004). Accordingly the sample was seen to be representative of South African organisations for the purpose of investigating the barriers to OSS ERP adoption in South African organisations.
4.1.2 POPULATION - RESPONDENTS

Male respondents were far more prevalent, with an overall 74% share. This corresponds with national figures for South Africa in the 2011 Global Gender Gap Report, which indicate a 70% male and 30% female share in positions classified as Legislators, senior officials, and managers (Hausmann, Tyson, & Zahidi, 2011).

The age of respondents in the sample is evenly distributed. For further analysis the lower two segments (Younger than 25 and between 25 and 35) were combined to create a large enough sub sample.

Most of the respondents rated their level of IT expertise as average or excellent. Only 5% rated their level of IT expertise as Poor, and 3% did not give an indication. This would suggest that the respondents are competent in IT.
Age played no role in the level of IT expertise. Contrary to the expectation of the researcher a larger percentage of the respondents over the age of 35 years considered their IT expertise to be excellent than for respondents younger than 35 years as can be seen in Figure 13.

4.2 UNDERSTANDING OF OPEN SOURCE SOFTWARE (OSS)

Of the 158 respondents, 105 provided a description of their understanding of what OSS is. A total of 11 respondents indicated that they had no concept. This is more than 10% of the group that had responded to the question; it was suspected that the actual percentage was much higher amongst the other 53 respondents that gave no answer. The main descriptive characteristics identified were:

- **Source code**

  This was the characteristic identified by the most respondents (63 out of 105 respondents). All but one of the 63 respondents described OSS as software for which the source code is available. The exception indicated that “open source does not mean access to the actual source code”. This reflects a general misunderstanding of the OSS concept as the availability of source code is one of the most fundamental characteristics.

- **Costs**

  The characteristic of the software being free of charge was the descriptive characteristic with the second highest number of respondents listing it. Of the 58 respondents who mentioned cost, a total of 51 indicated that it was free of charge.

  Seven (7) of the 105 respondents linked a cost for the actual software to the OSS concept. Two (2) saw it to be either discounted to proprietary software, or having a minimal cost. One (1) respondent associated OSS with a free core and additional modules at a cost. Two (2) respondents saw OSS as in some instances having no cost, with two (2) stating strongly that it is not free of charge.

  In one response a too low cost was seen as a barrier to adoption as it leads to questions regarding the quality for the product. This also agrees with Das Neves et al. (2004) who found that the need to implement an ERP system was based on strategic grounds which diminished the importance of TCO as a criterion.
Community of developers

Twenty-one (21) of the 63 respondents who made mention of the open source code also associated OSS with a community of developers. Concepts such as collaboration, OSS being maintained by the community of developers, and peer production were listed.

Some half-truths were also present, such as that all the developers working on OSS maintain it for free, OSS was not maintained by a software company, and that it was compulsory to share the source code if there were any improvements. At most two (2) respondents shared any one of these misconceptions.

License

None of the respondents associated the term free with freedom rather than cost. A total of 18 of the 105 respondents mentioned the licensing aspect of OSS. Of these respondents 11 indicated that there are no licenses involved.

The fact that there are some licensing restrictions involved was recognised by seven (7) respondents. Three of these were more specific and referred to some or other form of a general public license which has an “exact condition of use; under the same conditions as they [the user] received the base program. In other words you cannot profit from the work of others and for example sell the application as your own software”.

Pay for services

Only four (4) of the 105 respondents recognised that there are OSS vendors that offer services such as training, consultation, customisation and support at a cost.

Reliability and support

OSS was seen as more reliable than some proprietary software by one (1) respondent. Three (3) of the respondents indicated that they associated OSS with little or no dedicated support which makes it risky. This corresponds with the finding of Johnston and Seymour (2005) who identified training and skills availability, as well as after sales service and support as some of the OSS adoption barriers in South Africa.

OSS was defined as software that is freely available, and grants the rights to read, use, modify and distribute the source code for the software under the same conditions, without being discriminatory in any way (Rose, Johnston, & Van Belle, 2006). The free availability and access to the source code is the core of the OSS definition. These aspects were recognised by many of the respondents and were also the most prevalent characteristic associated with OSS.
The definition does state that there are specific conditions associated with the use of OSS. The licensing aspect appears to be sorely overlooked or misunderstood.

Apart from flexibility, low acquisition cost, and, indirectly, no vendor lock-ins only two of the respondents linked OSS applications with any of the multiple areas of potential technological superiority. These areas include high quality, security, reliability, stability, and regular upgrades (Gwebu, & Wang, 2011; Mutula & Kalaote, 2010; Nagy et al., 2010; and Zaffar, Kumar, & Zhao, 2011).

When asked which OSS were being used by the respective organisations only 28 respondents listed a software package, 63 indicated that they were not aware of any, and the remaining 67 did not provide any feedback. Four (4) of the packages listed are not OSS, but are rather freely available to use in some of the versions. The bar chart in Figure 14 indicates the number of respondents that listed a particular software package, and is not representative of the prevalence of one OSS application over another.

The data suggests that the organisational uptake of OSS is generally low. Alternatively a lack of awareness is suggested. Organisations may in fact be running OSS such as Linux, MySQL or Apache at a server level without end users being aware of this. The estimated market share of Apache of between 55% and 66% support the observation of a lack of awareness (Nagy, Yassin, & Bhattacherjee, 2010). This observation agrees with the finding of Johnston and Seymour (2005) who identified the lack of awareness as one of the barriers of OSS adoption in a South African context.
Figure 14: Awareness of OSS packages
4.3 ENTERPRISE RESOURCE PLANNING (ERP) SYSTEMS

No ERP system was present at 33 of the organisations represented by the 133 respondents to the question of which ERP system their organisation was running. 20 of the respondents did not know which ERP system, if any, was present at the organisation they represented. The ERP systems, and the number of times each was listed are shown in Figure 15.

All products that were only listed once were consolidated under Other. Of the 24 products listed a total of 11 were not ERP systems, but rather packages that fulfilled a function typically incorporated into an ERP system such as the accounting or asset management functionalities.

Compiere was the only OSS ERP package listed. SAP and Oracle systems were found to be the most prominent systems. This finding corresponds to the study of Das Neves et al. (2004) where SAP was the most prominent ERP system, and Oracle systems the second most prominent in their sample of 11 South African companies.

Only 23.23% of the 99 respondents could name an OSS ERP system, with some listing more than one or applications that are not an OSS ERP system. Apart from the 43 respondents that indicated that they did not know any OSS ERP systems, 34 named a proprietary system and 31 some other OSS application. Compiere was the best know OSS ERP system and was
listed 14 times, followed by open Bravo and OpenERP that were listed seven and six times respectively. Adempiere and OpenTaps were listed twice and the other OSS ERP packages only once.

There appears to be a lack of awareness of OSS ERP systems, this is similar to the observation made regarding OSS in general. It is interesting to note that open Bravo and Adempiere forked off Compiere. This data supported Nagy et al. (2010) that listed forking as an adoption barrier of OSS due to the splintering impact on the industry. These three versions of the product were listed a total of 23 times compared the next highest OSS ERP, namely OpenERP, which was listed 6 times.

The general perception amongst respondents was that OSS ERP packages are at the same quality levels as proprietary ERP systems. Only 16.39% of the respondents indicated that they perceived OSS ERP systems to be inferior to proprietary ERP systems. This supports the qualities of OSS listed by several authors such as high quality, security, reliability, and stability (Gwebu, & Wang, 2011; Mutula & Kalaote, 2010; Nagy et al., 2010; and Zaffar, Kumar, & Zhao, 2011). The perception of OSS ERP systems being of a similar or superior quality to proprietary alternative is in contrast to the literature that indicated the need of the end consumer for a user friendly and standardised product as a barrier (Johnston & Seymour, 2005).
4.4 ANALYSIS OF OSS ERP ADOPTION BARRIERS

In the literature review, 20 constructs were identified as potential adoption barriers. These were grouped under four dimensions namely Technology, Organisation, Environment and Individual and are listed in Table 10 with the associated statements in the Likert scale questions.

<table>
<thead>
<tr>
<th>Technology</th>
<th>Organisation</th>
<th>Environment</th>
<th>Individual</th>
</tr>
</thead>
<tbody>
<tr>
<td>TCO - Support cost ($S1)</td>
<td>Financial Resources ($S14)</td>
<td>Availability of Product Skills &amp; Support Services ($S21, $S22, $S23, $S24, $S25, $S26)</td>
<td>Perceived Usefulness ($S28, $S29)</td>
</tr>
<tr>
<td>TCO - Switching cost ($S2, $S3)</td>
<td>Human Resources (IT staff time) ($S15)</td>
<td>Platform and long-term viability ($S27)</td>
<td>Perceived Ease of Use ($S30, $S31)</td>
</tr>
<tr>
<td>TCO - Maintenance cost ($S4)</td>
<td>Innovativeness of the organisation ($S16, $S17)</td>
<td>Product Awareness</td>
<td>Personal innovativeness in technology ($S32, $S33)</td>
</tr>
<tr>
<td>TCO - Sunk costs ($S5)</td>
<td>Boundary Spanners ($S18, $S19, $S20)</td>
<td></td>
<td>Social identification with OSS ($S34, $S35)</td>
</tr>
<tr>
<td>Reliability ($S6, $S7)</td>
<td>Compatibility ($S8, $S9, $S10)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bias ($S11)</td>
<td>Complexity ($S12)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lack of knowledge ($S13)</td>
<td></td>
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</tbody>
</table>

Respondents were asked why the organisation they represented would not implement an OSS ERP system in an open ended question. A total of 13.4% of respondents indicated that the organisation does not need an ERP system, with size being given as the main reason. Another 7.3% could not provide any particular reason.
The adoption barriers indicated by respondents were associated with the constructs listed in Table 10. The various barriers that were highlighted in this open question will be discussed under the four technology adoption categories.

**Confidence intervals**

The Likert Scales used in the survey allowed for some statistical analysis through the use of confidence intervals.

Respondents had to indicate their agreement with statements by selecting one of the following: Strongly Disagree, Disagree, Agree, and Strongly Agree. These responses were converted to numerical values of respectively 1, 2, 3, and 4. A four indicated that the construct was seen as a barrier. For questions where strong agreement from the respondent indicated that it is not a barrier, the numbers were inverted for analysis purposes.

A comparative plot of the average and values was constructed for the statements that pertain to each dimension. The average is shown by a coloured marker. Each of the markers is accompanied by a 95% confidence interval, a thin black line. The intervals indicate, based on confidence, standard deviation and sample size, in which range the true population average lies.

Due to the ordinal nature of the data, the findings in this case will not have statistical significance. It was however deemed that the analysis will show certain tendencies that could be of value to the overall analysis.

4.4.1 TECHNOLOGY

Sunk costs (S5), Reliability (S6), Compatibility in terms of employee skills levels (S9) and Lack of knowledge (S13) stood out in Figure 19 as indicating potential barriers.

The data seems to suggest that quality (S7), software compatibility (S8), Bias (S11), and complexity (S12) can be dismissed as barriers.

The reason barriers such as sunk costs (S2, S3) cannot be dismissed immediately despite of both the averages for statements S2 and S3 being disagree is because the confidence interval cuts the 2.5 line.
Total Cost of Ownership (TCO). The respondents tended not to see costs such as support (S1), and switching cost (S2 and S3) as major barriers according to the data in Figure 19. Maintenance cost related to S4. The modes for S1, S2 and S4 are Disagree, and the mode for S3 is Agree as can be seen in Figure 20, Figure 21, and Figure 22. S4 was an inverse statement however and was inverted to reflect Agree on Figure 19.

S1 related to support cost. Nearly 61% of the 79 respondents disagreed that it is a barrier to adoption. This makes intuitive sense given the importance of support according to the literature (Ellis & Van Belle, 2009; and Johnston & Seymour, 2005). A lack support was also the biggest factor mentioned as a reason for their organisations not adopting an OSS ERP with nearly 27% of respondents indicating this.
Switching costs (S2 and S3) were found to be a potential barrier according to 53% of the 77 respondents. Contract termination penalties were indicated by nearly 54% of respondents. This corresponds with Dedrick and West (2003) who found switching cost as a major factor in the adoption decision, and noted transitory transaction costs and contractual costs such as contract termination penalties.

There was a disagreement by 54% of 79 respondents with the statement that it is much more cost effective in the long run to maintain an OSS ERP package. This could relate to the additional OSS costs associated with training and technical support (Ellis & Van Belle, 2009; Johnston & Seymour, 2005; and Dedrick & West, 2003), and interoperability (Zaffar et al., 2011). More (43 of the 79) respondents saw maintenance cost as a barrier.
The literature was divided on this as Ellis and Van Belle (2009) found maintenance cost to be an adoption barrier, whilst maintenance cost was found as a contributing factor to the adoption of OSS by Miscione and Johnston (2010). The relatively divided opinion of the respondents around maintenance cost seems to support the observation of Miscione and Johnston (2010) that adoption depends on the perception about the cost to maintain OSS.

Respondents appear to be relatively divided concerning TCO as an adoption barrier. Only 8.54% of 82 respondents mentioned costs as a reason why their organisations will not adopt an OSS ERP system. Costs do not seem to be a primary adoption factor. This agrees with the literature that found costs to have a secondary role in the adoption decision of OSS ERP systems (Johansson & Sudzina, 2008; and Johnston & Seymour, 2005).

60% of 78 respondents indicated that their organisations will not implement an OSS ERP system due to sunk costs. Statement S5 related to Sunk Costs and the mode for the respondents’ feedback was Agree (Figure 23).

Sunk costs were also stated by four of the respondents as a reason why their organisation will implement an OSS ERP system. This agrees with Nagy et al. (2010) who found sunk cost to be a major adoption barrier.

The ranking given to sunk costs by the respective members of the focus group originally ranged from the second most influential barrier to the least influential. At the end of the process the focus group agreed that sunk cost is not a barrier to OSS ERP adoption at all. The
argument was that “sunk cost as an adoption barrier is generic and not OSS specific”. The researcher agrees with this conclusion.

Reliability. There was a 56% agreement with the statement that they “will not be implementing OSS products because [they] question the reliability and security capabilities” amongst the 78 respondents to statement S6. The mode was Agree at 38.46%.

This is in contrast to the literature that found reliability as not having such a big impact on the adoption decision (Ellis & Van Belle, 2009; and Miscione & Johnston, 2010). Less than 5% of 82 respondents listed reliability, security, or stability as a barrier on the open ended question and 83.61% of 78 respondents to S7 perceived OSS ERP systems on standard or superior to proprietary systems.

The findings around performance support those for reliability. Nearly 63% disagreed to some extent with the statement that they will “not implement an OSS ERP because we perceive its performance to be weak relative to proprietary alternatives” (Figure 24). Reliability was also not raised as a concern by any of the respondents in the open ended question.

Whilst the findings (S6) and the literature (Ellis & Van Belle, 2009; and Miscione & Johnston, 2010) seem to disagree for OSS in general there appears to be agreement (S7 and open ended question on reasons for not adopting and OSS ERP system) that reliability is not an OSS ERP adoption barrier.
**Compatibility.** Respondents tended to agree that compatibility was a barrier, but only slightly at 52% (Figure 25). This was, however, not due to inter software compatibility, as the modes for S8 and S10 are both disagree, but rather compatibility with the skills set in the organisation, with a Agree being the mode for S9. Less than 6% of respondents indicated a lack of knowledge or compatibility in the open ended question.

![Figure 25: Compatibility](image)

This is in contrast with the literature that found compatibility with current applications a major concern in the adoption decision (Dedrick & West, 2003; and Qu, Yang, & Wang, 2011). This could be due to ERP systems being more inwardly focused, and documents that are produced, e.g. invoices and reports, not needing editing by external parties. Two respondents indicated that their respective organisations are part of larger groups that use a specific ERP, and that the requirement for intergroup company compatibility is an adoption barrier.

**Bias**

A total of 57% of respondents disagrees that applications provided by Microsoft, Oracle, SAP and Apple are much better than any of the OSS packages as can be seen in Figure 26. Nearly 26% of 77 respondents expressed some form of bias as an adoption barrier in their organisations in the open ended question. The bias related to the skill sets of the people in the organisation and/or more well-known products that were seen as the industry standard.
Bias was discussed in the focus group, and the agreement amongst the members was that even though it is an adoption barrier, it is not necessarily one specific to OSS ERP systems. An ERP professional would for example specialise in either SAP or Oracle. Bias due to brand equity will be at least as much of a challenge for a proprietary ERP system entering a market, as for an OSS ERP system. Similar to sunk costs, the researcher agrees with this conclusion.

Complexity. Complexity (S12) was not seen as an adoption barrier to OSS ERP systems by just over 58% of 76 respondents. No mention of complexity was made in the open ended question regarding OSS ERP adoption barriers. This is in contrast to the literature that found that there was a perception in South Africa that OSS is complex and problematic to deploy (Ellis & Van Belle, 2009; and Johnston & Seymour, 2005).
The literature found that ERP systems are complex and difficult and time consuming to implement (Madapusi & D’Souza, 2005; and Zaffar et al., 2011). The fact that this is the case in general would suggest that there is no particular difference between OSS and proprietary ERP systems. As a result complexity was not found to be an adoption barrier for OSS ERP systems.

**Lack of Knowledge**

The lack of knowledge (S13) stood out as a barrier. This is similar to the findings from literature that also found the lack of knowledge to be a barrier (Nagy et al., 2010).

![Figure 28: Lack of Knowledge](image)

4.4.2 ORGANISATION

The organisational dimension appeared to have much more of an underlying impact on the adoption barriers than the technology as can be seen in Figure 29.

Financial Resources (S14) was the only factor that appeared to potentially not be an adoption barrier.

Whilst 51% of the 76 respondents disagreed with statement S16, statement S17 also focus on Innovativeness of the organisation, and when combining the responses for the two statements, 63% of the 76 respondents indicated the Innovativeness of the organisation as a barrier. The other organisational factors, Human Resources (IT staff time) (S15) and Boundary Spanners (S18-S21) are both leaning towards indicating potential barriers.
Figure 29: Average ratings for organisational adoption barriers

*Human and Financial Resources (slack resources).* Similar to the literature the available budget was not that relevant to the adoption decision, but the available time was a factor impacting the adoption (Miscione & Johnston, 2010).

A total of 58% of 77 respondents found that the skill levels and required time available in their organisation are too little for an OSS ERP implementation. Time was a factor when acquiring a proprietary ERP system (das Neves, Fenn, & Sulcas, 2004). Time was also mentioned as an adoption barrier in the open ended question. However, this was only for 2.44% of respondents.
Innovativeness of the organisation. Nearly 77% of 76 respondents indicated that their organisations prefer to select tried and tested IT solutions when implementing new technology. The majority, 51%, of respondents disagreed that their organisations “will not implement any OSS ERP because there are no well-known brands in the market”. It was felt that the difference is marginal and given that the mode was Agree for both statements it appears that innovativeness of South African organisations is a barrier to adoption (see Figure 31).

A total of 18% of respondents indicated the conservative nature of their organisations as an adoption barrier in the open ended question as well. This concurs with the literature that found the attitude of organisations in developing countries as relatively conservative towards...
risk (Camara & Fonseca, 2007). These organisations considered it less risky to stay with proprietary products and there is resistance to change within IT (Camara & Fonseca, 2007; and Johnston & Seymour, 2005). Ellis and Van Belle (2009) did not find Innovativeness of the organisation to be an adoption barrier of OSS amongst South Africa SME’s, but found resistance to change to be a barrier. It was felt that resistance to change is a sub factor of Innovativeness of the organisation.

**Boundary Spanners.** The survey indicated that there was a lack of boundary spanners in South African organisations. All four of the statements (S18-S21) relating to boundary spanners had Agree as a mode (see Figure 32). Just over 11% of 82 respondents indicated factors relating to boundary spanners as an adoption barrier in the open ended question. It was found that the lack of boundary spanners definitely served as an adoption barrier for OSS ERP systems in South Africa. This concurs with the literature that found that organisations with existing OSS skills are better equipped to mitigate the risks associated with OSS adoption (Goode, 2005).

The biggest impact of boundary spanners was on the lack of knowledge (or lack of awareness) which the literature found to be a barrier to adoption in South African (Ellis & Van Belle, 2009; and Johnston & Seymour, 2005). A lack of awareness was also ranked by the focus group as the most influential adoption barrier to OSS ERP systems.

![Figure 32: Boundary spanners](image-url)
4.4.3 ENVIRONMENT

The environmental dimension had the factor with the strongest feedback in terms of a specific adoption barrier in the form of Availability of Product Skills & Support Services (S21, S22, S23, S25 and S26).

Platform and long-term viability of OSS ERP platforms (S27) was the only factor that that appeared to potentially not be an adoption barrier.

![Figure 33: Average ratings for environmental adoption barriers](image)

**Availability of Product Skills & Support Services (Support Infrastructure).** After sales support was seen as very important when deciding to implement any new technology by 51% of the 79 respondents who Strongly Agreed with the statement (S22) and a further 46% agreed. 58% of these respondents did not perceive the after sales support for OSS ERP systems sufficient.
The fact that 58.44% of 99 respondents were not aware of any OSS ERP providers in their area would suggest that the support infrastructure was an adoption barrier. Even though not by a great margin, the majority of respondents did find the OSS ERP online community as a “great” alternative to the traditional support models (Figure 34 and Figure 35). The finding that support infrastructure is an adoption barrier agreed with the literature in all aspects where it was found that it is an adoption barrier for OSS in general and SA, and for both OSS and proprietary ERP systems (Ellis & Van Belle, 2009; Goode, 2005; Johansson & Sudzina, 2008; Johnston & Seymour, 2005; Miscione & Johnston, 2010; Nagy et al., 2010; and das Neves et al., 2004).
A lack of knowledge partners (service provider or vendors) and the consequent lack of support was the reason given by the most respondents, 35% of 82, when asked why their organisation would not adopt an OSS ERP system.

The focus group agreed that the lack of knowledge partners is an adoption barrier and ranked it as the second most influential. It was felt that the number of vendors both in a particular area as well as across the country was more important than the size of the OSS ERP vendors. The vendors considered only needed to be large enough to be legitimate, e.g. offices and admin, sales and technical staff.

Nearly 79% of respondents agreed with the statement (S25) that if “there are large enough vendors for an OSS ERP that can support the system [they] will consider the system on par with any other solution”. For both of the statements (S25 and S26) the modes of the respondents’ feedback were Agree. There was, however, a 50/50 split between the respondents that agreed that they are not that concerned with the level of customisation and that the package must just be good enough to start out with, and those that disagreed.

In the literature Nagy et al. (2010) referred to the splintered nature of the industry as a result of forking as an adoption barrier to OSS. An analysis conducted on the South African landscape of OSS ERP vendors revealed that a total of five (5) different OSS ERP packages were being supported by a total of eight (8) vendors of which it is suspected that some are actually the same trading under different names (for further details see Table 15 in Appendix E). This analysis supports the literature with reference to the splintered nature of the OSS industry.
To summarise, the availability of external support services was found to be an adoption barrier. This agrees with the literature that found that a lack of support infrastructure was seen as an adoption barrier (Ellis & Van Belle, 2009; Miscione & Johnston, 2010; and Nagy et al., 2010). The availability of local vendor representation was also stated as a general requirement for ERP vendors to be considered by SA organisations (das Neves, Fenn, & Sulcas, 2004).

**Platform and long-term viability.** The literature found legitimacy to be an adoption barrier as for many organisations the decision to adopt OSS was influenced negatively by fear of adopting an application which will be abandoned and no longer supported (Ellis & Van Belle, 2009). The long-term viability of OSS ERP platforms was not seen as a major adoption barrier as 62.66% of 76 respondents Disagreed or Strongly disagreed with the statement (S27) that they “do not perceive an OSS ERP solution to be viable in the long-term”. The mode for the statement was Disagree (Figure 37). 7% of the 82 respondents to the open ended question regarding OSS ERP adoption barriers expressed some form of concern relating to legitimacy.

![Figure 37: Platform and long-term viability](image1)

**Product Awareness.** A complete lack of product awareness was found amongst South African Organisations. Only 23.23% of 99 respondents could name any OSS ERP system that is available (Figure 17). Slightly contradictory to this was that 42% who disagreed or strongly disagreed with the statement (S23) that they were not aware of any OSS ERP providers in their area. This could potentially be attributed to the fact that there were 34 proprietary systems listed amongst the responses when respondents were asked which OSS ERP packages they were aware of which in itself indicates a lack of product awareness.
This lack of awareness of OSS ERP packages that was found agreed with the literature where it was also found that the lack of awareness by key ICT decision makers was a major obstacle to the widespread use of OSS in SA (Ellis & Van Belle, 2009; Johnston & Seymour, 2005; and Nagy et al., 2010). The literature indicated that extensive marketing campaigns enabled proprietary software products to generate a high level of public awareness (Ellis & Van Belle, 2009) compared to their OSS counterparts who were often found to have no marketing or advertising budget (Nagy et al., 2010).

4.4.4 INDIVIDUAL

In general the individual adoption factors (S28 up to S35) of the respondents leaned towards being a barrier as can be seen in Figure 38. This manifests itself in a potentially low adoption propensity towards OSS (S36) as indicated by the red marker in Figure 38. The overall intention of respondents to use OSS software in the next six (6) months was only 37. This was as suggested by Gwebu and Wang (2011) who argued that behavioural intention to adopt is a key variable in determining future behaviour around OSS adoption.

![Figure 38: Average ratings for individual adoption barriers](image)

**Perceived usefulness (PU).** Both of the modes for the two statements associated with PU were both Disagree (Figure 39). On average 59% of respondents did not perceive that OSS will give them greater control of their work or make them more productive. This is in contrast with the literature that found performance efficiency to be an adoption enabler for
OSS (Johnston & Seymour, 2005). The coefficient of correlation between PU and the indication of the intended use of OSS in the next six (6) months was also very low at 0.08. It was again found that the correlation between PU and the intention to adopt OSS was not as strong as was suggested by the literature (Gwebu & Wang, 2011).

**Perceived ease of use (PEOU).** Respondents were relatively split over the PEOU with just under 51% of respondents perceiving OSS relatively easy to use. The modes for the two statements associated with PEOU were also split between Disagree and Agree (Figure 40). The coefficient of correlation between PEOU and the indication of the intended use of OSS in the next six (6) month was 0.3580. It was found that the correlation between PEOU and the intention to adopt OSS was not as strong as was suggested by the literature (Gwebu & Wang, 2011).
Personal Innovativeness in Information Technology (PIIT). Just over 60% of 77 respondents tended to show a lesser degree of PIIT. The modes for the two statements associated with PIIT were both Disagree (Figure 41). The coefficient of correlation between PIIT and the indication of the intended use of OSS in the next six (6) month was 0.3167. Given a sample N > 50 this was seen to be a significant. It was found that the relationship between PIIT and the intention to adopt OSS was not as strong as was suggested by the literature (Gwebu & Wang, 2011).

![Figure 41: Personal innovativeness in technology](image-url)

Social identification (SI). The majority, 67%, of the group of respondents did not identify strongly at a social level with the Open Source community. The modes for the two statements associated with SI were both Disagree (Figure 42). The coefficient of correlation between SI and the indication of the intended use of OSS in the next six (6) month was 0.6137. It was found that the connection between SI and the intention to adopt OSS was strong and agreed with the literature (Gwebu & Wang, 2011).

Behavioural intention to adopt

Nearly 63% of 76 respondents did not plan to use OSS during the next six months (Figure 43). As explained in section 2.6.4, behavioural intention to adopt is not an adoption factor as such, but rather an indication by the respondent of their anticipated adoption behaviour towards a technology, in this case OSS.

Of the individual factors considered, PU, PEOU, PIIT, and SI, there was only a meaningful correlation found between SI and the respondents behavioural intent to adopt.
An investigation of the adoption barriers of OSS ERP Systems for SA Organisations

OTHER

There was only one adoption barrier found whilst analysing the general responses to the reasons why South African organisations will not adopt an OSS ERP system that was not found in the literature.

One respondent indicated that the relatively low cost of OSS ERP systems could lead to organisations questioning the overall quality of the product. Although, it was only mentioned by one respondent, but it was felt that it was worth investigating further in the focus group.
4.5 SUMMARY OF FINDINGS

4.5.1 SURVEY FINDINGS

The barriers to the adoption, found through the literature review and survey, of OSS in general, OSS for South African organisations, and OSS ERP systems in South Africa are summarised in Table 11, Table 12, Table 13, and Table 14. The relevance of an adoption barrier was compared between OSS in general, OSS in South Africa, OSS ERP systems in South Africa in each table.

**Technology**

<table>
<thead>
<tr>
<th>Identified adoption Barrier</th>
<th>OSS Adoption Barrier</th>
<th>OSS Adoption Barrier in South Africa</th>
<th>OSS ERP Adoption Barrier in South Africa</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Cost of Ownership (TCO)</td>
<td>Divided.</td>
<td>No</td>
<td>No, secondary role in the adoption decision.</td>
</tr>
<tr>
<td>TCO - Sunk Costs</td>
<td>Yes</td>
<td>No reference in literature, some in surveys</td>
<td>No, not OSS specific but applies to all ERP’s.</td>
</tr>
<tr>
<td>Reliability</td>
<td>Yes</td>
<td>No</td>
<td>No, OSS ERP’s were perceived as similar in quality as proprietary ones.</td>
</tr>
<tr>
<td>Compatibility</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Bias</td>
<td>Yes</td>
<td>Yes</td>
<td>No, not OSS specific but applies to all ERP’s.</td>
</tr>
<tr>
<td>Complexity</td>
<td>Yes</td>
<td>Yes</td>
<td>No, ERP installations and systems are generally seen as complex.</td>
</tr>
<tr>
<td>Lack of Knowledge</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
</tbody>
</table>

Table 11: Technology adoption barriers summary
An investigation of the adoption barriers of OSS ERP Systems for SA Organisations

**Organisation**

<table>
<thead>
<tr>
<th>Identified adoption Barrier</th>
<th>OSS Adoption Barrier</th>
<th>OSS Adoption Barrier in South Africa</th>
<th>OSS ERP Adoption Barrier in South Africa</th>
</tr>
</thead>
<tbody>
<tr>
<td>Financial Resources</td>
<td>No</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Human Resources</td>
<td>Yes</td>
<td>Yes</td>
<td>No, not OSS specific but applies to all ERP’s.</td>
</tr>
<tr>
<td>Innovativeness of the organisation</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Boundary Spanners</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
</tbody>
</table>

Table 12: Organisational adoption barriers summary

**Environment**

<table>
<thead>
<tr>
<th>Identified adoption Barrier</th>
<th>OSS Adoption Barrier</th>
<th>OSS Adoption Barrier in South Africa</th>
<th>OSS ERP Adoption Barrier in South Africa</th>
</tr>
</thead>
<tbody>
<tr>
<td>Availability of Product Skills &amp; Support Services</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Platform and long-term viability</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Product Awareness</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
</tbody>
</table>

Table 13: Environmental adoption barriers summary
Individual

The research did not reveal a strong correlation between the individual adoption factors and the adoption of OSS. The only strong correlation was between the individual’s identification with the OSS ideology and community.

<table>
<thead>
<tr>
<th>Identified adoption barrier</th>
<th>OSS Adoption Barrier</th>
<th>OSS Adoption Barrier in South Africa</th>
<th>OSS ERP Adoption Barrier in South Africa</th>
</tr>
</thead>
<tbody>
<tr>
<td>Perceived Usefulness</td>
<td>No</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Perceived Ease of Use</td>
<td>Yes</td>
<td>No reference in literature</td>
<td>No</td>
</tr>
<tr>
<td>Personal innovativeness in technology</td>
<td>No</td>
<td>No reference in literature</td>
<td>No</td>
</tr>
<tr>
<td>Social identification with OSS</td>
<td>No</td>
<td>No reference in literature</td>
<td>No</td>
</tr>
<tr>
<td>Behavioural intention to adopt</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
</tr>
</tbody>
</table>

Table 14: Environmental adoption barriers summary

4.5.2 FOCUS GROUP

The various potential adoption barriers were initially grouped under eight topics and sent out to the focus group. The eight topics were Knowledge barriers, Sunk costs, The individuals’ perceptions of OSS ERP Systems, Lack of support, Low costs, Lack of sizable providers, Lack of brand equity, and The fact that it is OSS. The description of each and the ranking tool can be viewed in Appendix C.

The purpose of the focus group discussion was to further define the barriers for South African Organisations to adopting OSS ERP systems.
The only change between the first and the second iterations was that the average score for Knowledge barriers and Lack of brand equity ended up both being rated as the biggest adoption barrier as can be seen in Figure 44.

After an iterative debate, as per the method explained in Phase 1B, Section 3.2, the focus group reached a general consensus on the following ranking:

1) Knowledge barriers;

2) Lack of sizable providers, and;

3) Low costs.

Sunk Costs was eliminated as a barrier to OSS ERP adoption as it was agreed by the focus group that the sunk costs will be as applicable to proprietary ERP systems as it would be to an OSS ERP.

The fact that an ERP was OSS was dismissed by the focus group, and it was felt that OSS had evolved to a point where it was either neutral or potentially an adoption enabler.

The following sums of the discussion points for each of the three points.
Knowledge barriers

Knowledge barriers which were defined as: a Lack of awareness of software availability or relevance, technical knowledge needed to implement and use it, or business knowledge needed to customise it.

It was decided to collapse a Lack of Brand Equity into Knowledge Barriers as it is effectively equivalent to a Lack of awareness of software availability or relevance.

One member introduced Vested Interest or bias. The main reason given was the skill in a particular product that specific users, e.g. the account/financial manager, has which allows them to control the system environment in a company and "raise" their personal importance in the company. It was felt that this was covered in part of Knowledge Barriers, but that it is most probably the same as Sunk Cost, and this factor was consequently dismissed on the bases that it would apply to any ERP, and not exclusively to OSS ERP systems.

Lack of sizable providers

It was argued that the number of well-regarded providers will provide security against clients being locked in by a lack of skills, and also offer reliability of service. The concept of sizable providers did not necessarily require national organisations, but it was agreed that it does require providers to be well capitalised with a good track record.

The Lack of Support was seen as a direct consequence of the lack of providers. As such, this barrier was collapsed into a Lack of sizable providers. The same was decided for the individuals’ perceptions of OSS ERP Systems for similar reasons as the Lack of Support.

Low costs

The focus group found that it was a factor but much less so than the previous two. The impact was related to the perception of quality and legitimacy of the product and also the opportunities released by additional capital for developing infrastructure and creating brand awareness through marketing.

One group member summed up the forum discussion as follows:

“This really sums up the challenge of any OSS solution, End user's need to be aware of the solution, the availability, the track record etc. And the vendor needs strong local partners to implement. This has been covered well in the infrastructure space with the likes of
companies like Red Hat and Red Hat's many partners in the country, as one goes higher up the stack, this starts to change, and ERP is very high up the stack.”

4.6 RESEARCH LIMITATIONS

The use of surveys limited the ability to potentially clarify any uncertainty of a respondent around a particular question. It also limited the opportunity to further explore interesting and potentially insightful feedback in the open ended questions. The electronic focus group was used to explore these potential insights to some extent.

The Likert scale was originally designed with an even number (four) of options with the intent to force respondents to express their feelings. The analysis revealed that this may have been limiting as a neutral option would have been a more accurate reflection of the true feelings of some respondents. Some direct feedback from respondents to the researcher confirmed this. It was felt that this limited the potential insight that might have been gained from the research.

Due to time limitations of the research study additional research questions were noted but not further investigated in depth. Further research was, however, encouraged in these instances and listed in section 5.3.
5. RESEARCH CONCLUSIONS

The conclusion of this study concerns the inferences that were drawn from the collected data and the resultant analysis. In particular, this chapter focuses on answering the primary research question using the answers relating to the sub-questions that were identified in the literature review and listed in section 1.2. The summary of the main findings will be followed by a section discussing the significance of the findings. The final section of this chapter presents possible future research as a consequence to the conclusions drawn.

5.1 SUMMARY OF MAIN FINDINGS

The primary research question derived from the literature was:

1. What are the barriers to adopting Open Source Software Enterprise Resource Planning Systems for South African Organisations?

This primary research question was broken down into several secondary questions,

2. What are the barriers to the adoption of Open Source Software?

3. Are the barriers to the adoption of Open Source Software different for South African organisations?

4. Are the barriers identified for Open Source Software also applicable to Open Source Software ERP systems in South Africa and to what extent?

The findings for each of these secondary research questions, which was also provided in a tabular format in Section 4.5, will first be discussed as the secondary research questions, which culminate into the primary research question.

2. What are the barriers to the adoption of OSS?

The TOE framework was selected from the literature to evaluate potential adoption barriers against it. A determining factor for selecting the TOE framework was because this framework was also used in the literature that was found on OSS adoption barriers in South Africa. This allowed for easy comparisons. The literature also highlighted the lack of consideration of individual factors that relate to OSS adoption. This was also the case for the TOE framework. In response an individual dimension was added to the framework used for
this research. A total of 20 constructs (these were listed in Table 10) were identified in the literature as possible adoption barriers and grouped under the three TOE and Individual dimensions.

The conclusion drawn from evaluation of the literature was that all of these constructs were adoption barriers for OSS except for those that related to costs with the literature being divided regarding TCO.

3. Are the barriers to the adoption of OSS different for South African organisations?

Studies relating to OSS adoption factors specific to SA agreed that TCO was not an adoption barrier. The OSS adoption barriers identified for SA mostly agreed with those found for OSS in general globally. The only further differences were that reliability was not found to be an adoption barrier in South Africa. No reference to sunk costs was found relating to OSS adoption in SA. However, a few respondents did make mention of sunk costs as an adoption barrier in the survey.

4. Are the barriers identified for OSS also applicable to OSS ERP systems in South Africa and to what extent?

None of the technical adoption barriers typical of OSS were found to be applicable to OSS ERP systems. This was attributed to customisation and the associated challenges being standard practice with most ERP implementations. Compatibility was also discounted to the fact that ERP systems are mostly internally focused in an organisation. Complexity was also seen as a quality of any ERP implementation rather than specific to OSS ERP systems. An insightful conclusion drawn from the research emanated around the concept of Sunk Costs. It was found that whilst sunk cost was a definite adoption barrier, it related to all ERP systems and not just OSS ERP systems.

This principle was found to apply to a number of other constructs in relation to ERP systems, in particular those relating to factors in the Human Resource construct in the Organisational dimension which was accordingly found as not being an adoption barrier to OSS ERP systems in SA. Human Resources was also the only construct in the Organisational dimension which was found to differ for OSS ERP systems from the general adoption barriers for OSS in South Africa.
With regard to the environmental dimension the finding of this research was that platform and long-term viability was not an adoption barrier for OSS ERP systems in contrast with platform and long-term viability being an adoption barrier to OSS in SA in general. Product awareness and the availability of product skills and support services was found to be adoption barriers for OSS ERP systems similar to the general adoption barrier to OSS in SA.

The individual dimension revealed very little correlation between the respective constructs and a propensity to adopt OSS. The only construct that was found to have significant correlation was Social Identification.

With the primary objective of this study being to investigate what the barriers to adopting OSS ERP Systems for South African organisations are, the following constructs were identified as OSS ERP adoption barriers for SA organisations: The Innovativeness of the organisation, Boundary Spanners, Availability of Product Skills and Support Services, and Product Awareness.

These constructs and their underlying factors were reformulated in the focus group into two main barriers:

1) Knowledge barriers, and;

2) Lack of sizable providers.

Low costs emerged as a third unexplored potential adoption barrier.

5.2 SIGNIFICANCE OF FINDINGS

Globalisation is becoming an ever increasing factor to consider. ERP systems have been shown to improve productivity and offer a competitive advantage in this environment. Many South African companies are excluded from this benefit due to cost barriers. The affordability of OSS ERP systems has been driven as one of the major selling points by the industry.

Cost was, however, found to be of secondary concern compared to other adoption barriers. Factors such as the availability of support were found to be much more important. Even if a company could afford the OSS ERP alternative they would rather not implement the software if the required support is not available. Understanding the dynamics of the market requirements is crucial for OSS ERP vendors to be able to develop effective strategies.

This research highlighted that the generally accepted adoption factors associated with OSS might not apply to OSS ERP systems due to the unique nature of the application type.
5.3 FUTURE RESEARCH

This research investigated the adoption barriers for OSS ERP systems in SA. The findings suggested that the adoption barriers are very different from those found for OSS in general and that the requirements for success are not that far removed from those required of proprietary ERP systems. Most of the published research undertaken has been for OSS in general. In light of this research there is a possibility that the adoption barriers might be more inherent to the industry related to a specific application type rather than the development and licensing methodology. Determining if this is the case is a possible area for future research.

Another opportunity for future research that emerged from this study was the impact of social identification and the current characteristics of the OSS community. It would be interesting to explore whether there is any correlation between the potentially more liberal nature of the OSS community and the conservative nature found typical of business in developing economies.

Only one study was found that had an indication of the selection criteria used by South African organisations for ERP selection (das Neves, Fenn, & Sulcas, 2004). Based on the limited information in the study by das Neves et al. (2004), and the findings of this research regarding the adoption barriers of OSS ERP in SA, further research into whether the adoption barriers for ERP systems are materially different between proprietary and OSS systems is suggested.

Finally, a potential adoption barrier that emerged from this current study, but was not found in the literature or dismissed by the focus group was the relatively low cost of OSS ERP systems compared to proprietary ERP systems. Given the conservative nature of business in developing economies and cost being a potential measurement of quality; could this attribute of OSS, which has typically been seen as an enabler, not actually be an adoption barrier to OSS applications that have traditionally expensive proprietary alternatives? Indirect benefits of higher prices would include more funds to build infrastructure and for marketing to develop awareness. This is another opportunity for future research.
BIBLIOGRAPHY


An investigation of the adoption barriers of OSS ERP Systems for SA Organisations


ANNEXURE A. ERP SELECTION CRITERIA

A.1 BENCHMARK SELECTION CRITERIA CHECKLIST FOR AN ERP SYSTEM
(das Neves, Fenn, & Sulcas, 2004)

<table>
<thead>
<tr>
<th>1.0 Vendor (and stakeholders) evaluation</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.1 Number of installations performed by vendor locally</td>
</tr>
<tr>
<td>1.2 Market rating, market share, reputation, strength and sustainability of vendors</td>
</tr>
<tr>
<td>1.3 Generic demonstration by vendor of previous ERP implementations</td>
</tr>
<tr>
<td>1.4 Local representation and support (software and consultant)</td>
</tr>
<tr>
<td>1.5 Total cost of ownership of ERP system (software, hardware, training etc.)</td>
</tr>
<tr>
<td>1.6 Speed and ease of ERP implementation from conception to completion of project</td>
</tr>
<tr>
<td>1.7 Availability of live site visits that are equivalent in complexity and scope</td>
</tr>
<tr>
<td>1.8 Independent consultants (specialisation and bias)</td>
</tr>
<tr>
<td>1.9 Composition of selection committee including Champion and Motivator</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>2.0 Functionality of proposed ERP system</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.1 Proportion of functional requirements to run business</td>
</tr>
<tr>
<td>2.2 Fit to present and/or desired organisation culture (consultation all stakeholders)</td>
</tr>
<tr>
<td>2.3 Fit to business strategy and ability to gain competitive advantage</td>
</tr>
<tr>
<td>2.4 Range of modules that can be added as the business requirements change</td>
</tr>
<tr>
<td>2.5 Increased transparency and information flows with respect to targets and goals</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>3.0 Technical aspects of proposed ERP system</th>
</tr>
</thead>
<tbody>
<tr>
<td>3.1 Technical requirements and degree of redundancy of legacy system</td>
</tr>
<tr>
<td>3.2 Adaptability and flexibility with respect to any remaining legacy system</td>
</tr>
<tr>
<td>3.3 Robustness of software and ease/cost of maintenance</td>
</tr>
<tr>
<td>3.4 Customisation potential of system to meet requirements, present and future</td>
</tr>
<tr>
<td>3.5 User friendliness of system</td>
</tr>
<tr>
<td>3.6 Future Upgrade potential of system</td>
</tr>
</tbody>
</table>
A.2 SUMMARY SELECTION CRITERIA CONSIDERED (das Neves, Fenn, & Sulcas, 2004)

Table 3: Summary of vendor selection criteria considered

<table>
<thead>
<tr>
<th>Vendor evaluation</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
<th>F</th>
<th>G</th>
<th>H</th>
<th>I</th>
<th>J</th>
<th>K</th>
<th>Total</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of installations</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>10</td>
<td>100</td>
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<td>Market rating etc.</td>
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<td>1</td>
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<td>1</td>
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<td>1</td>
<td>10</td>
<td>100</td>
</tr>
<tr>
<td>Demonstration</td>
<td>1</td>
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<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>10</td>
<td>100</td>
</tr>
<tr>
<td>Local representation</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>10</td>
<td>100</td>
</tr>
<tr>
<td>Total cost of ownership</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>9</td>
<td>90</td>
</tr>
<tr>
<td>Speed &amp; ease</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>9</td>
<td>90</td>
</tr>
<tr>
<td>Availability of live site visits</td>
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<td>1</td>
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<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
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<td>1</td>
<td>1</td>
<td>1</td>
<td>9</td>
<td>90</td>
</tr>
</tbody>
</table>

Table 4: Summary of functionality selection criteria considered

<table>
<thead>
<tr>
<th>Functionality of proposed ERP system</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
<th>F</th>
<th>G</th>
<th>H</th>
<th>I</th>
<th>J</th>
<th>K</th>
<th>Total</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Functional requirements</td>
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<td>1</td>
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<td>1</td>
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<td>1</td>
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<tr>
<td>Fit to organisation culture</td>
<td>1</td>
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<td>Range of modules that can be added</td>
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<td>1</td>
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<td>1</td>
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<td>1</td>
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<tr>
<td>Incr. transparency &amp; info. flows</td>
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<td>1</td>
<td>1</td>
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<td>11</td>
<td>100</td>
</tr>
</tbody>
</table>

Table 5: Summary of technical aspects selection criteria considered

<table>
<thead>
<tr>
<th>Technical aspects of proposed ERP system</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
<th>F</th>
<th>G</th>
<th>H</th>
<th>I</th>
<th>J</th>
<th>K</th>
<th>Total</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Technical requirements</td>
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<td>1</td>
<td>1</td>
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<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>9</td>
<td>90</td>
</tr>
<tr>
<td>Adaptability &amp; flexibility</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>10</td>
<td>100</td>
</tr>
<tr>
<td>Robustness and ease/cost</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>10</td>
<td>100</td>
</tr>
<tr>
<td>Customisation potential</td>
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<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>8</td>
<td>80</td>
</tr>
<tr>
<td>User friendliness of system</td>
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<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>9</td>
<td>90</td>
</tr>
<tr>
<td>Future upgrade potential of system</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>8</td>
<td>80</td>
</tr>
</tbody>
</table>
APPENDIX B. THE ONLINE SURVEY

OSS ERP - Survey

In which Sector Industry is your Organisation/Business?
- None -

How long is your organisation in existence?
- Less than 1 year.
- Between 1 and 3 years.
- Between 3 and 5 years.
- Between 5 and 20 years.
- More than 20 years.

How many employees are there at your organisation?
- Less than 10.
- Between 10 and 50.
- Between 50 and 250.
- More than 250.

Under which BEE category does your organisation fall?
- None -

How would you rate your level of IT expertise?
- None -

What is your gender?
- Male
- Female

What is your age group?
- None -
What do you understand by the term ‘open source software’ (OSS)?

Which ERP package does your organisation currently run?
- e.g. SAP, JDE, Sage X3, Compiere

Which open source ERP packages are you aware of?

What is your perception of the quality of open source ERP package?
- Inferior to proprietary products
- On standard
- In many cases superior

Why would your organisation not implement an open source software ERP package?

Which, if any, OSS packages are your organisation currently making use of?
### OSS ERP - Survey

Please indicate your level of agreement with each of the statements below.

<table>
<thead>
<tr>
<th>Statement</th>
<th>Strongly Disagree</th>
<th>Disagree</th>
<th>Agree</th>
<th>Strongly Agree</th>
</tr>
</thead>
<tbody>
<tr>
<td>The support cost for OSS ERP systems are more expensive than that of proprietary systems.</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>The costs involved in switching to an OSS ERP package is too high.</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>We have to pay a contract termination penalty to get out of our current ERP contract.</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>It is much more cost effective in the long run to maintain an OSS ERP package.</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>We will not implement an OSS ERP because of the cost already incurred for our current system.</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>We will not be implementing OSS products because we question the reliability and security capabilities.</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>We will not implement an OSS ERP because we perceive its performance to be weak relative to proprietary alternatives.</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>OSS ERP Systems are not compatible with the other software being used in our organisation.</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
</tbody>
</table>
Our employees do not have the necessary skill levels required by an OSS ERP.

OSS ERP Systems lack the ability to integrate with our legacy systems.

The applications provided by Microsoft, Oracle, SAP and Apple are much better than any of the OSS packages.

OSS ERP systems are much more complex to implement than proprietary systems.

We do not have the technical knowledge in our organisation to implement an OSS ERP System.
<table>
<thead>
<tr>
<th>Statement</th>
<th>Strongly Disagree</th>
<th>Disagree</th>
<th>Agree</th>
<th>Strongly Agree</th>
</tr>
</thead>
<tbody>
<tr>
<td>Our organisation only implements well known brand names.</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>The skill levels and required time available in our organisation are too little for an OSS ERP implementation.</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>We will not implement any OSS ERP because there are no well known brands in the market.</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>Our organisation prefer to stick to the tried and tested when implementing new IT solutions.</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>We do not have any staff that have experience in an OSS implementation.</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>If we have staff with experience in a particular ERP package we will strongly consider it irrespective of whether it is OSS or proprietary.</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>The skill levels and required time available in our organisation is too little for an OSS ERP implementation.</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>We do not perceive the after sales support sufficient to implement a OSS ERP.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>After sales support is very important when deciding to implement any new technology.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>We are not aware of any OSS ERP providers in our area.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>The online OSS ERP community is a great alternative to the traditional support model of proprietary systems.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>If there are large enough vendors for an OSS ERP that can support the system we will consider the system on par with any other solution.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>We are not that concerned with the level of customisation, the package must just be good enough to start out with.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>We do not perceive an OSS ERP solution to be viable in the long-term.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Please indicate your level of agreement with each of the statements below.

<table>
<thead>
<tr>
<th>Statement</th>
<th>Strongly Disagree</th>
<th>Disagree</th>
<th>Agree</th>
<th>Strongly Agree</th>
</tr>
</thead>
<tbody>
<tr>
<td>Using open source software would give me greater control over my tasks than using proprietary software.</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>I am more productive if I use Open Source Software compared to if I use proprietary software.</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>Generally, I find it easy to get Open Source Software to do what I want it to do.</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>It is easy for me to become skilled at using Open Source Software.</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>Among my peers, I am usually the first to try out new Information technologies.</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>In general, I am hesitant to try out new Information technologies.</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>I am proud to think of myself as a member of the Open Source Software community.</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>I think about being an open source user often.</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>During the next 6 months, I plan to use open source software.</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
</tbody>
</table>
APPENDIX C. RANKING TOOLS

FIRST ITERATION

Morning Gentleman,

Thank you once again for your willingness to assist in the project. As discussed the process will run over two phases. The first phase is to rank the barriers listed below from 1-8, with 1 being the biggest barrier and 8 the least of an adoption barrier.

Please return this ranking directly to me without cc’ing any of the other participants. Once I have everyone’s feedback I will average the ranking for each of the listed barriers and then post the results on the forum to which I will send a link.

The forum will be used as a platform to interact and debate why you feel one barrier is more of a factor than another which is ranked above it, and I will facilitate the process towards a final list.

Please indicate your ranking in the “Rank” column of the table below.

<table>
<thead>
<tr>
<th>Barrier</th>
<th>Description</th>
<th>Rank</th>
</tr>
</thead>
<tbody>
<tr>
<td>Knowledge barriers</td>
<td>Lack of awareness of software availability or relevance, technical knowledge needed to implement and use it, or business knowledge needed to customize it.</td>
<td></td>
</tr>
<tr>
<td>Sunk costs</td>
<td>Prior investments in proprietary software.</td>
<td></td>
</tr>
<tr>
<td>The individuals’ perceptions of OSS ERP Systems</td>
<td>The knowledge gap between what OSS ERP can really offer and what mainstream software users know about ERP OSS.</td>
<td></td>
</tr>
<tr>
<td>Lack of support</td>
<td>After sales support is very important when deciding to implement any new technology.</td>
<td></td>
</tr>
<tr>
<td>Low costs</td>
<td>There is a perception that OSS is either free or much cheaper than similar proprietary packages and that something that much cheaper cannot really be as good.</td>
<td></td>
</tr>
<tr>
<td>Lack of sizable providers</td>
<td>The lack of large enough vendors for OSS ERP Systems that can support the system are considered a barrier to adoption. Various options are required.</td>
<td></td>
</tr>
<tr>
<td>Lack of brand equity</td>
<td>The lack of market share in terms of brand awareness and local case studies (references).</td>
<td></td>
</tr>
<tr>
<td>The fact that it is OSS</td>
<td>The perception is that it is less reliable and that there might be security issues.</td>
<td></td>
</tr>
</tbody>
</table>

Thank you once again for your willingness to assist. It is sincerely appreciated.
SECOND ITERATION

Hi Respondent,

Thank you for your quick reply earlier today. Below are the average ranking of the barriers, plus your ranking. Before starting the discussion on the forum we would like to go through one more iteration. Given the ranking below and having had some time to maybe reconsider, please indicate any modifications you would like to make to your rankings (and why), or justify why your ranking is better than the average.

<table>
<thead>
<tr>
<th>Barrier</th>
<th>Description</th>
<th>Your Ranking</th>
<th>Average</th>
<th>Final Rank</th>
<th>Modified ranking</th>
<th>Reason</th>
</tr>
</thead>
<tbody>
<tr>
<td>Knowledge barriers</td>
<td>Lack of awareness of software availability or relevance, technical knowledge needed to implement and use it, or business knowledge needed to customize it.</td>
<td>6</td>
<td>2.8</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lack of brand equity</td>
<td>The lack of market share in terms of brand awareness and local case studies (references).</td>
<td>1</td>
<td>3</td>
<td>2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lack of sizable providers</td>
<td>The lack of large enough vendors for OSS ERP Systems that can support the system are considered a barrier to adoption. Various options are required.</td>
<td>2</td>
<td>3.2</td>
<td>3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lack of support</td>
<td>After sales support is very important when deciding to implement any new technology.</td>
<td>3</td>
<td>4</td>
<td>4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sunk costs</td>
<td>Prior investments in proprietary software.</td>
<td>8</td>
<td>4.6</td>
<td>5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>The individuals' perceptions of OSS ERP Systems</td>
<td>The knowledge gap between what OSS ERP can really offer and what mainstream software users know about ERP OSS.</td>
<td>4</td>
<td>5.6</td>
<td>6</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Low costs</td>
<td>There is a perception that OSS is either free or much cheaper than similar proprietary packages and that something that much cheaper cannot really be as good.</td>
<td>5</td>
<td>6</td>
<td>7</td>
<td></td>
<td></td>
</tr>
<tr>
<td>The fact that it is OSS</td>
<td>The perception is that it is less reliable and that there might be security issues.</td>
<td>7</td>
<td>7</td>
<td>8</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
APPENDIX D. FOCUS GROUP FORUM

<table>
<thead>
<tr>
<th>Topic</th>
<th>Author</th>
<th>Replies</th>
<th>Views</th>
<th>Last post</th>
</tr>
</thead>
<tbody>
<tr>
<td>Barriers not listed</td>
<td>Lou_Tome</td>
<td>0</td>
<td>1</td>
<td>Tue Nov 22, 2011 2:01 pm</td>
</tr>
<tr>
<td>The fact that it is OSS (Avg 8)</td>
<td>Lou_Tome</td>
<td>0</td>
<td>1</td>
<td>Tue Nov 22, 2011 2:01 pm</td>
</tr>
<tr>
<td>Low Costs (Avg 7)</td>
<td>Lou_Tome</td>
<td>0</td>
<td>1</td>
<td>Tue Nov 22, 2011 2:01 pm</td>
</tr>
<tr>
<td>The individuals' perceptions of OSS ERP Systems (Avg 6)</td>
<td>Lou_Tome</td>
<td>0</td>
<td>1</td>
<td>Tue Nov 22, 2011 2:01 pm</td>
</tr>
<tr>
<td>R&amp;D Costs (Avg 6)</td>
<td>Lou_Tome</td>
<td>0</td>
<td>1</td>
<td>Tue Nov 22, 2011 2:01 pm</td>
</tr>
<tr>
<td>Lack of support (Avg 8)</td>
<td>Lou_Tome</td>
<td>0</td>
<td>2</td>
<td>Tue Nov 22, 2011 2:01 pm</td>
</tr>
<tr>
<td>Lack of viable providers (Avg 5)</td>
<td>Lou_Tome</td>
<td>0</td>
<td>4</td>
<td>Tue Nov 22, 2011 2:01 pm</td>
</tr>
<tr>
<td>Knowledge barriers and Lack of brand equity (Joint Avg of 6)</td>
<td>Lou_Tome</td>
<td>0</td>
<td>7</td>
<td>Tue Nov 22, 2011 2:01 pm</td>
</tr>
</tbody>
</table>
An investigation of the adoption barriers of OSS ERP Systems for SA Organisations

Knowledge barriers and Lack of brand equity (Joint Avg of 1)

<table>
<thead>
<tr>
<th>Author</th>
<th>Message</th>
</tr>
</thead>
<tbody>
<tr>
<td>Def. Knowledge barriers: Lack of awareness of software availability or relevance, technical knowledge needed to implement and use OSS, or business knowledge needed to customize it.</td>
<td></td>
</tr>
<tr>
<td>Def. Lack of brand equity: The lack of market share in terms of brand awareness and local case studies (client references).</td>
<td></td>
</tr>
</tbody>
</table>

After the second transition the only change in the ranking was that Knowledge barriers and Lack of brand equity were both seen as the biggest barriers with an average score of 2.80.

Knowledge Barriers: Paul and Muggle strongly disagreed with respectively ranking it as fifth and sixth with the other panel members marking it as first [11]. The reasons given were:

Paul [1]:

> Quote:
> Once an OSS product has reached a certain level of maturity this is no longer a factor - and in fact the community nature of OSS means there are generally good resources out there. Most well written software is relatively easy to customize, and OSS benefits from many eyes looking at the problem.

Muggle [1]:

> Quote:
> I believe the knowledge is out there, it is once again the brand awareness and the lack of partners in a country that create barriers. More brand will lead to more implementers.

Kevin [1/2] ranking Knowledge barriers and Lack of brand equity as first [11] and second respectively commented as follows:

> Quote:
> I think many people are unaware of OSS products, and few are trained or have experience with OSS.

Muggle who ranked it as one [1] said:

> Quote:
> OSS is poorly marketed - see point 1 [Knowledge barriers]

Lack of brand equity was rated 1, 2, or 3 except for Deneil who rated it as etc [6]. Deneil’s reasoning was,

> Quote:
> Companies [in my opininon] are willing to do new things and take on new products as long as there is a strong rationale for this.

Muggle who ranked it as one [1] said:

> Quote:
> Many companies are not aware of alternatives, the brand awareness of OSS vendors are normally shocking. Everyone knows, SAP, ORACLE, Partal etc., ask the average man on the street about: Complete or Open Brano and see what the reaction is.

Do you think it should both be seen as the most important or do these comments change your opinion?
Lack of sizable providers (Avg 3)

Opinion varied greatly with individual rankings of 1, 2, 4, and 5. The comments were as follows:

Paul (1):
Quote:
Small operators are more vulnerable, businesses are under-resourced, increasing risk of having no long-term backup. Presence of big firms speaks to maturity of product.

Mugge (7):
Quote:
This once again leads off the chart, I think if more partners are needed in SA, take Compaal. I am aware of 2 in the whole country.

Kevin (4):
Quote:
Not as sure size of vendor is so important.

Andrew (5):
Quote:
Debatable issue - sunk cost is bigger issue I believe.

Given the big variation in feedback, how would you convince the opposing members to lower or increase their ranking or have you already changed your mind and why?

Lack of support (Avg 4)

Again varied rankings of 2, 3, 4, 5, and 6. Interestingly the "providers" found it less of a barrier that the clients. Reasoning was as follows:

Paul (2):
Quote:
Similar to above (lack of sizable providers), but too risky if support is hard to come by or excessively expensive - can lead to project failure.

Kevin (3):
Quote:
I believe lack of after sales support is a greater barrier than size of vendors.

Mugge (6):
Quote:
Same as above, too few partners in the country.

Andrew (8):
Quote:
Don't agree - I think other issues are larger and "support" only comes in after all factors considered.

How would you convince the members leaning towards the other side of the scale otherwise? Do you think the number and/or size of providers have an impact on the perception of support and as such it is in fact only secondary to other factors?
An investigation of the adoption barriers of OSS ERP Systems for SA Organisations

Sunk Costs (Avg 5)

Lea_Tome

Post subject: Sunk Costs (Avg 5)

Most of the group tended to lean toward the middle (4,4,5) with two extreme rankings of 2 and 8. The comments were as follows:

Derek (2):

"It's not just the investment in the software, but complex licensing around ERP and IS with different renewal periods, money spent training staff, and investment in operational processes that are entrenched."

Nuggie (4):

"Sunk costs is a barrier to ANY IT migration not just OSS, so in my mind this is not the main reason why are not considering migrating to OSS ERP. It is a main reason why they won't migrate at all, even if they are on an OSS ERP and wanted to go to Propri, it is always a barrier, but not an OSS one."

Should sunk costs be in the middle, or at the top or bottom? What is your argument?

The individuals’ perceptions of OSS ERP Systems (Avg 6)

Lea_Tome

Post subject: The individuals’ perceptions of OSS ERP Systems (Avg 6)

This seems to be more towards the bottom with the in rankings being 4, 4, 6, 3, 5. Paul you were quite far down at 8, what was your reasoning? The only comment received was from Nuggie (4):

"This is me, going back to brand once again, more brand will make more people aware of what OSS ERP can offer."

In general everybody, except Andries, rated ‘low costs’ and “The fact that it is OSS” is in the bottom two or lower than "The individuals’ perceptions...". Andries, however, rated this barrier as 6. Is this not maybe 4 or after 4?"

Low Costs (Avg 7)

Lea_Tome

Post subject: Low Costs (Avg 7)

The results are slightly spread (3, 5, 7, 7, 8), but in general towards the bottom rankings. Andreis you are the outlier in this case with three, you felt quite strongly about this stating:

"No - they believe it is so low cost it is inferior."

Nuggie rated it as the second highest of the barriers at (5) and stated:

"I think more and more people are understanding the value of OSS, and also think there is always a cost."

Andries, can you maybe elaborate on the reasons for feeling so strongly? Is there anybody that can convince Andries and Nuggie towards the bottom?"
The fact that it is OSS (Avg 8)

Len_Tome 8:09 pm Tue Nov 22, 2011

Post subject: The fact that it is OSS (Avg 8)

Def: The perception is that it is less reliable and that there might be security issues.

All the rankings were in the bottom three (6, 7, 7, 8). Maggio (7) stated:

Quote:

I believe that most informed people are beyond the "OSS cannot be secure" question?

Is it such a small factor that we can maybe agree on ranking it as the least important barrier listed?

Barriers not listed

Lea_Tome 8:09 pm Tue Nov 22, 2011

Post subject: Barriers not listed

Are there any barriers you believe are not included in the list? What are the barriers? Where would you rank it and why?
## APPENDIX E. OSS ERP PACKAGES WITH VENDORS IN SOUTH AFRICA

<table>
<thead>
<tr>
<th>Open Source ERP</th>
<th>Vendors</th>
<th>Location(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Compiere</td>
<td>Astidian</td>
<td>Sandton – Gauteng</td>
</tr>
<tr>
<td></td>
<td>nTier</td>
<td>Randburg - Gauteng</td>
</tr>
<tr>
<td></td>
<td>Blockburg</td>
<td>Randburg - Gauteng</td>
</tr>
<tr>
<td>Open Bravo</td>
<td>Open One</td>
<td>Cape Town – Western Cape</td>
</tr>
<tr>
<td>WebERP</td>
<td>Exalon</td>
<td>Durban – KZN</td>
</tr>
<tr>
<td>OpenERP (previously known as TinyERP)</td>
<td>Spiraleye</td>
<td>Pretoria - Gauteng</td>
</tr>
<tr>
<td></td>
<td>Systemlink</td>
<td>Pretoria - Gauteng</td>
</tr>
<tr>
<td></td>
<td>Dekatech</td>
<td>Alberton - Gauteng</td>
</tr>
<tr>
<td>ADempiere</td>
<td>nTier</td>
<td>Randburg - Gauteng</td>
</tr>
<tr>
<td></td>
<td>Blockburg</td>
<td>Randburg - Gauteng</td>
</tr>
</tbody>
</table>

Table 15: OSS ERP vendors in South Africa