Enterprise resource planning in manufacturing SMEs in the Vaal Triangle

by

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ABSTRACT

The adoption of Enterprise Resource Planning tools has improved business processes in organisations. This increase has, however come with challenges for the small and medium business sector. First the adoption and deployment of proprietary ERP comes at great cost for organisations whilst it is also difficult for the organisations to ensure that scalability is introduced due to the dynamic change in the SME sector.

The adoption and use of open source ERP tools then presents an opportunity for the SME sector. The usage of open source software has increased over the years. This increase has also extended to open source ERP tools. These tools offer the same functions as the proprietary at a fraction of the cost. Despite the benefits that open source ERP offers diffusion of this technology into the SME sector in South Africa has been minimal. This means the SME sector in South Africa is not benefiting from the widely available cost effective open source ERP available in the market. An opportunity therefore exists for them to utilise the technology to gain competitive advantage.

The research was done primarily to determine the open source ERP adoption patterns of SMEs in the Vaal region. The research sought to determine the drivers for ERP adoption and barriers to adoption. Focus was specifically extended to investigating knowledge on open source alternatives.

The results from the research indicate that the SMEs understand the benefits of adopting ERP for their businesses. The research further revealed that the adoption factors identified in the literature are still relevant in South Africa. The factors identified included costs, lack of training, lack of support, lack of knowledge and the lack of open source vendors.

The empirical research also identified that the SME still harbour fear about open source ERP tools due to lack of training ,support and knowledge .From the study it is clear that a new approach needs to be taken to encourage adoption of open source ERP. These approaches include giving incentives to SMEs to adopt open source ERP. These incentives may be in the form of training packages and skills workshops to help

overcome the barriers and improve implementation of open source ERP. The research identified the critical need for increased formal education and training in open source software development and emphasis on ERP tools.

Government research bodies need to play a role in this area. For an example, there is need for SME and university collaborations in open source ERP deployment, whereby the latter needs to include software development tools in their curricula for SMEs so as to increase awareness. Clear-cut comparisons of existing proprietary systems against open source systems by focusing on functional and technological requirements need to be undertaken. This will help to reflect a cost benefit analysis as well as interoperability between the open source ERP and existing systems.

During the adoption process, SME are encouraged to go through the full life cycle of open source ERP adoption. In this cycle the SME needs to do a thorough analysis regarding selection, implementation, integration, migration, training and evaluation of installed tools. That way they will gain the competitive advantage afforded by the tools.

Key terms: Enterprise Resource Planning, ERP tools, SMEs, Open source software, Vaal Triangle.

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CHAPTER 1

NATURE AND SCOPE OF THE STUDY

1.1   INTRODUCTION

The cost and risk involved in Enterprise Resource Planning (ERP) implementation has resulted in the need for careful planning among businesses. The high costs of implementation have meant that, traditionally only large firms took the plunge. Even small and medium sized businesses (SMEs) ought to emulate these new ERP strategies regardless of their diminutive financial budgets. The risks involved, however, have meant that only a few SMEs are involved in ERP utilisation and those who have already implemented the strategies are not effectively applying the models. There is therefore a need to develop a cost effective framework for ERP implementation which not only meets SME needs but also takes into consideration the dynamic environment that today's SMEs operate in.

In South Africa and elsewhere the Enterprise Resource Planning (ERP) systems are widely used to extract and process data from different functional areas across the enterprise (Gore, 2008:5). The ERP tools help to show the visibility of information across the enterprise and enable seamless access to information. The use of information technology and systems has improved business operations. The uptake of information technology tools such as the Internet, low cost telecommunications (such as Voice over IP), and social networking media has increased over the years for both small and big business operators (Abdelghaffar & Azim, 2010:12). When effectively installed and utilised, ERP systems serve to simplify business processes and give organisations a cost competitive edge by ensuring that the whole business value chain from raw materials inputs to final product is integrated.

The decision to embark on an enterprise resource planning project requires careful planning. It has been found through various qualitative studies that in instances where the Enterprise Resource Planning (ERP) system is installed, the system is either

underutilised or is used in parallel with other secondary systems .It is therefore important that the ERP is not only effectively utilised but that a measurable return on investment study and viability is carried out to avert capital loss (Worthen, 2002:4).

1.2   THE ERP FOR SME MARKET

The ERP market is now also flooded with open source ERP tools and proprietary tools for SMEs. The open source tools give the same functionalities as the customised proprietary versions at a cheaper cost yet the South African SMEs are not taking advantage of these tools (Moolman, 2011:9). The open source ERP tools are web-enabled which allow users to trade and operate online. This study seeks to find barriers to adoption of open source ERP tools by SMEs and come up with a best-for-fit framework for Open source ERP implementation.

1.3   BACKGROUND TO THE STUDY

Over the years, Enterprise Resource Planning (ERP) systems have been directed at large firms that are willing and able to make immeasurable investments on integrated software systems (Malie, Duffy & Van Rensburg 2008:18). The manufacturing industry has implemented ERP systems to simplify business operations and ultimately this move has impacted on the firms' strategy, culture and general organisation (Yen & Sheu 2004:207). The process of ERP installation requires a lot of resources and the costs are high. However despite the heavy investments on ERP implementations, a significant proportion of these implementations do not fully meet the information requirements of organisations especially in the small and medium sector.

The affordability of some proprietary ERP for SME tools is a problem for SMEs hence the need for alternative approaches to ERP which are less expensive . Most manufacturing companies have had to implement Enterprise Resource Planning (ERP) systems to remain competitive (Yen & Sheu 2004:208). An ERP is an integrated information system that enables the full and efficient utilisation of resources for its information needs. When fully utilised the ERP systems can yield a number of benefits and improvements such as enabling faster and more accurate information transactions, increasing productivity and reduced logistics costs.

Singla (2008:123) identified the following tangible benefits of ERP implementation:

- Reduced inventory
- Reduced labour costs
- Productivity improvement
- Procurement
- Technology cost reduction.

The study further alludes to profit improvement on-time delivery and maintenance reduction.

1.4   PROBLEM STATEMENT

While the adoption of ERP is undoubtedly critical for manufacturing firms of any size, the uptake of ERP systems by SMEs in South Africa has not been fully realised despite the existence of both proprietary and open source ERP tools developed for SME. The availability of Open source ERP tools for an example has not changed the uptake of ERP by SMEs. The abundance of Open source ERP tools developed with SMEs in mind has increased over the years but the uptake of these is very low especially in the South African environment (Moolman, 2011:12).

With limited technical expertise and resources, SME firms potentially face more challenges. With uptake of open source ERP, which are lower in prices compared to commercial systems, being so low, the challenge extends beyond financial outlays. There is hence a need for a study to find user perceptions and challenges with respect to the use of ERP. The focus being on open source based ERP. Thus the usage of ERP and implementation is investigated with a view to come up with a framework and guidelines that addresses today's dynamic environment particularly within a South African Manufacturing context. It is critical that the information needs of SMEs are understood as well as the challenges that they face so that a framework for open source ERP adoption and implementation is developed to meet their needs.

The low uptake of ERP tools is despite the fact that ERP can have an even greater impact on the competitiveness of SMEs (Yen & Sheu, 2004:208). It is therefore important to understand why Open source ERP tools are not adopted by SMEs. Based on this assertion, this study seeks to investigate the ERP utilisation patterns by SMEs, and determine what they consider to be success factors. The study further seeks to determine barriers and challenges to ERP adoption.

1.5   WHY SMEs NEED ERP

In South Africa SME growth has been supported by big organisations since these enterprises are considered the backbone of the economy. However the failure by emerging SMEs to adopt and fully utilise IT technologies such as ERP has been an inhibitor for growth. A study on ERP modification (Celar, Mudnic & Gotovac, 2010: 27) after installations showed that a lot of resources are required for this action hence the need for correct pre-installation planning.

Furthermore, very little research has been conducted on ERP utilisation in the past in Africa with most studies having been carried out in Europe (Equey & Fragniere 2007:8; Olhager & Selldin 2003:5), Asia (Upadhyay & Dan 2009:3), Australia (Zhou, Xing & Nagalingam 2010:306) These studies have not focused on the uptake or lack of uptake of Open source ERP by small and medium businesses. This study therefore seeks to provide a contribution to both academia and industry, on open source ERP user perceptions from within a South African SME context.

1.6   OBJECTIVES OF THE STUDY
The following section discusses the primary and secondary objectives that were set for this study.

1.6.1 Primary objective

The primary objective for this study is to develop guidelines for the adoption of Open Source ERP tools by the SME sector in the South African environment.

1.6.2   Secondary objectives

The structured sets of secondary objectives that support the attainment of the primary objective include:

- To investigate alternative approaches to ERP implementation among SMEs in the South African environment.
- To identify barriers to Open source SME ERP uptake by small and medium businesses
- To develop a best fit implementation framework for open source ERP implementation in the small and medium business sector.

1.7   SCOPE OF THE STUDY

The scope of this study is limited to enterprise resource planning as a software engineering discipline and the geographical demarcation as outlined. This study will delve into the ERP systems implemented among manufacturing firms in South Africa. The study is limited to small and medium enterprises. The National Small Business Act of South Africa of 1996, as amended in 2003, describes an SME as "a separate and distinct entity including cooperative enterprises and non-governmental organizations managed by one owner or more, including its branches or subsidiaries if any is predominantly carried out in any sector or sub-sector of the economy mentioned in the schedule of size standards and can be classified as a SME by satisfying the criteria mentioned in the schedule of size standards" (SA, 2003). In terms of size and employer size the SME will be defined according to the table below:

Table 1.1: The definitions of small business according to industry sector

Sector or subsectors in accordance with the Standard Industrial Classification	Size or class	Total full-time equivalent of paid employees Less than	Total annual turnover Less than	Total gross asset value (fixed property excluded) Less than
Agriculture	Medium	120	R 4.00 m	R 4.00 m
	Small	50	R 2.00 m	R 2.00 m
Mining and Quarrying	Medium	200	R30.00 m	R18.00 m

	Small	50	R 7.50 m	R 4.50 m
Manufacturing	Medium	200	R40.00 m	R15.00 m
	Small	50	R10.00 m	R 3.75 m
Electricity, Gas and Water	**Medium**	**200**	**R40.00 m**	**R15.00 m**
	Small	**50**	**R10.00 m**	**R 3.75 m**
Construction	**Medium**	**200**	**R20.00 m**	**R 4.00 m**
	Small	**50**	**R 5.00 m**	**R 1.00 m**
Retail and Motor Trade and Repair Services	**Medium**	**120**	**R30.00 m**	**R 5.00 m**
	Small	**50**	**R15.00 m**	**R 2.50 m**
Wholesale Trade	**Medium**	**120**	**R50.00 m**	**R 8.00 m**
	Small	**50**	**R25.00 m**	**R 4.00 m**
Commercial Agents and Allied Services	**Medium**	**120**	**R50.00 m**	**R 8.00 m**
	Small	**50**	**R25.00 m**	**R 4.00 m**
Catering	**Medium**	**120**	**R10.00 m**	**R 2.00 m**
	Small	**50**	**R 5.00 m**	**R 1.00 m**
Transport	**Medium**	**120**	**R20.00 m**	**R 5.00 m**
	Small	**50**	**R10.00 m**	**R 2.50 m**
Storage	**Medium**	**120**	**R20.00 m**	**R 5.00 m**
	Small	**50**	**R10.00 m**	**R 2.50 m**
Communications	**Medium**	**120**	**R20.00 m**	**R 5.00 m**
	Small	**50**	**R10.00 m**	**R 2.50 m**
Finance	**Medium**	**120**	**R20.00 m**	**R 4.00 m**
	Small	**50**	**R10.00 m**	**R 2.00 m**
Business Services	**Medium**	**120**	**R20.00 m**	**R 4.00 m**
	Small	**50**	**R10.00 m**	**R 2.00 m**
Social and	**Medium**	**120**	**R10.00 m**	**R 5.00 m**

Personal Services	Small	50	R 5.00 m	R 2.50 m

Adapted from: SA (1996)

1.7.1 Field of study

The research focuses on utilisation of Enterprise Resource Planning tools by Small and medium businesses. It focuses on the ERP made especially for the SME. It focus on both proprietary and open source SME ERP tools and aims to understand the challenges the SME sector faces in adopting both proprietary and open source tools.

1.7.2 Limitations of study

The study will be limited to the Vaal Triangle regions where there are manufacturing SMEs. The unavailability of a single database from which to draw sample elements was the only drawback for the study. Nonetheless, valuable insight will be gained from the study of available SME ERP systems among manufacturing SMEs.

1.8   LAYOUT OF THE STUDY

The diagram below gives a general flow of the research work to be undertaken.

Figure 1.1: Layout of the study

CHAPTER :ONE

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┌─────────────────────────────────────┐
│         PROBLEM STATEMENT            │
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│         DEFINE OBJECTIVES            │
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┌─────────────────────────────────────┐
│        LITERATURE OVERVIEW           │
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│       DEVELOP QUESTIONNAIRE          │
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│          DATA COLLECTION             │
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┌─────────────────────────────────────┐
│    ANALYSIS AND ENTREPRETATION       │
│             OF DATA                  │
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│        CONCLUSIONS AND               │
│         RECOMENDATIONS               │
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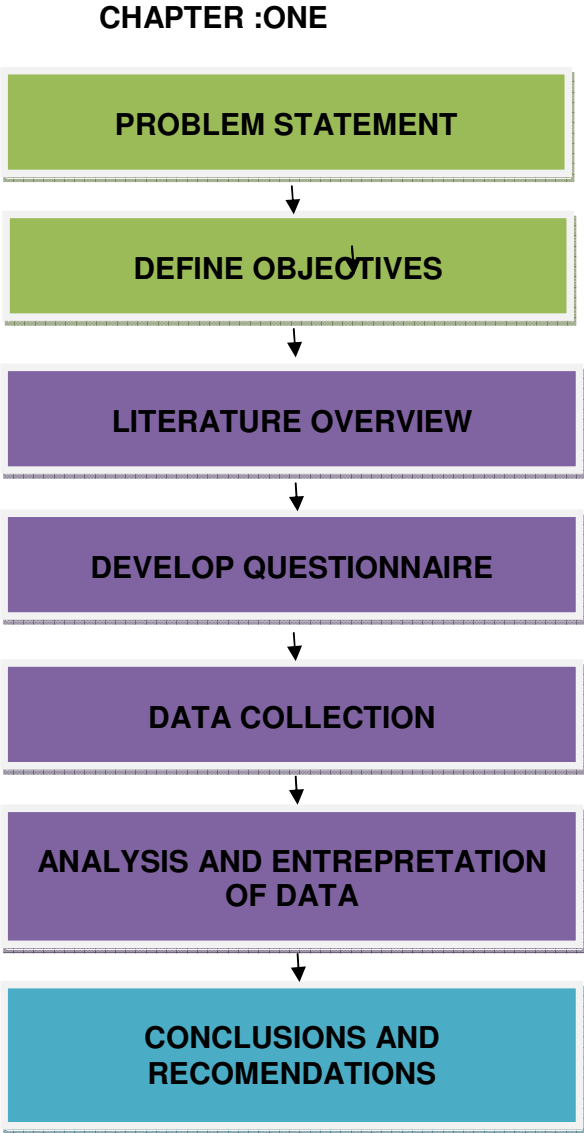
CONCLUSION

The ERP software itself is not a driver for business success but the expected results of an efficient and properly deployment will match with increase business success. Given the historical glitches that are associated with deployment it is important that a study on alternative framework is done.

CHAPTER TWO: LITERATURE REVIEW

This chapter focused on the literature study. ERP definitions were provided and analysed. The SME ERP Usage patterns and implementation factors in other parts of

the world were discussed. A performance evaluation between open-source and proprietary SME ERP tools was undertaken including discussion on alternatives to implementing ERP tools. The study reviews efforts by the South African government to improve connectivity. An example of this being the department of communication's rural internet accessibility projects. The Literature review examines the characteristics, attributes and attitudes that are common among SME towards ERP. The literature review aims to gain an in-depth knowledge about SME ERP utilisation.

CHAPTER THREE: RESEARCH METHODOLOGY AND ANALYSIS

This chapter will focus on the research methodology and data collection and analysis. Sampling techniques and the data collection process will be elaborated on. An interpretation of research findings will also be provided in alignment with the research objectives. The chapter focuses on the empirical study, which is about data collection from the demographic area. The chapter outlines the sampling procedure, the research instrument and the design. The chapter focuses on statistical analysis of the data, presentation of the results and interpretation of the results.

CHAPTER FOUR: CONCLUSIONS AND RECOMMENDATIONS

This chapter constitutes the conclusions and recommendations emanating from the study. Limitations encountered during the study will be highlighted together with any propositions for future research. It will also include a summary for the study.

This focuses on making conclusions about the state of ERP utilisation by SME and examines the gaps between current utilisation and desired levels and suggests a framework for closing the gaps. The chapter therefore recommends initiatives to enable SMEs to have a benchmark to use when deciding on ERP implementation. As a support for continuous improvement future research direction path are suggested.

1.9   SUMMARY

The adoption and efficient utilisation of ERP improves business processes. The high cost of adoption is considered an inhibitor for adoption of ERP. This is because the proprietary tools are expensive. The open source ERP tools offer a better cost effective alternative. This is because open source tools are used extensively throughout the world. In the South African context the adoption of open source software in general and

open source ERP is very low. This is due to the lack of skills and support. There is also general lack of awareness of such tools due to the fact that proprietary vendors do not make these alternatives available.

It is therefore important to understand from literature the adoption patterns of open source ERP. This is extended to looking at alternative ERP adoption models and identifying the barriers to adoption by the SME community. The findings from literature are then tested on the SME community in the Vaal area.

CHAPTER 2

LITERATURE REVIEW

2.1 INTRODUCTION

In the previous chapter the status of the Enterprise Resource Planning usage and the advantage thereof was discussed. The main points raised were that ERP provides improved business operations. Despite the advantages offered by Enterprise Resource Planning the main problem is that the uptake is low in South Africa.

In this chapter the study will examine how ERP tools both proprietary and open have been implemented. The chapter will focus on the ingredients for success in ERP adoption. The study evaluates the characteristics of Open Source ERP designed for small business as well as medium businesses.

The study will look at the efforts that have been carried out to integrate ERP into small enterprises, the focus being on the critical role ERP play in small and medium businesses. The advantage of utilising information technology as a leveraging tool in business is discussed. The study also focuses on the effect of social networking tools and their effects in ERP security and utilisation considering the fact that this area is growing and SMEs have an opportunity of accessing the untapped virtual community who interact and use it (Michael, Miller & Roberts 2009:34).

2.2 ERP DEFINITION

Enterprise Resource Planning (ERP) is the technology that provides the unified business function to the organisation by integrating the core processes. ERP now is experiencing the transformation that will make it highly integrated, more intelligent, more collaborative, web-enabled, and even wireless (Mtsweni & Bierman, 2008:30). The ERP system has vulnerability and high confidentiality in which the security is critical for it to operate. Many

ERP vendors have already integrated their security solution, which may work well internally; while in an open environment, we need new technical approaches to secure an ERP system. This is necessitated by the need for SMEs to access the social network sites community although this in itself presents challenges around security related issues. The study also focuses on the integration of ERP onto the mobile platform and integration of ERP in web services. This approach has rigorous implications since the majority of business is conducted through mobile devices. Integrating ERP into this platform has huge potential for SMEs but again in the South African environment there still remains infrastructural challenges; primarily the cost of broadband and then the issue of security(Moolman,2011:23).

2.3   OVERVIEW OF ERP

ERP provides two major benefits that do not exist in non-integrated departmental systems: (1) unified enterprise view of the business that encompasses all functions and departments; and (2) where all business transactions are entered, recorded, processed, monitored, and reported. This unified view increases the requirement for and the extent of interdepartmental cooperation and coordination(Mtsweni & Bierman, 2008:28)

The main advantage of ERP is that since it integrates several modules less time is spent on updating information. Information is entered once and the system is automatically updated. This ensures faster decision making. Studies of Justras (2010:7) and Marnewick and Labuschagne (2005:12) identify the following as some of the benefits of utilising ERP:

- ➢ Greater accuracy of information with detailed content and accurate presentation
- ➢ ERP allows a company to better benchmark its business processes against best practices in other companies
- ➢ Provides access for entering and retrieving information and hence reducing the use of paper
- ➢ Ensures quick responses to changes in business operations and market conditions
- ➢ Improves information access and management throughout the business
- ➢ Improves timeliness of information by permitting hourly or daily posting
- ➢ Improves cost control and better monitoring and resolution of queries

A case study conducted by the Aberdeen Group (Jutras, 2010:6) showed that an effective ERP for SME implementation resulted in a 22% reduction in operating costs, a 20% reduction in administrative costs, a 17% reduction in inventory costs, a 19% improvement in on-time delivery and a 17% in schedule compliance in the manufacturing sector. It is clear therefore that ERP are cost effective in the long run.

The ERP however have a number of weaknesses. The huge budgets employed in ERP projects imply that very few SMEs can afford to install the same. Other problems with ERP implementations occur after the entire implementation process. When users have found their way and understand the system, the tendency is to test the limitations of the system. This could have the effect of disrupting internal controls. It is therefore important that a plan is put in place to deal with post implementation errors (Upadhyay & Dan, 2009: 8).

2.4   ERP DEPLOYMENT CASE STUDIES

ERP tools have been deployed in a number of settings and an evaluation of their impact has been done. A number of variables are measured in the impact analysis and these are considered. Another area to focus on is the ingredients that enable a successful implementation of ERP to be made. These ingredients are known as critical success factors (Upadhyay & Dan, 2009:8). Critical success factors (CSF) are widely used in the information systems arena to guide the best way to implement systems. CSFs (Critical Success Factors) can be understood as the few key areas where things must go right for the implementation to be successful. Past studies have identified a variety of CSFs for ERP implementation, among which context related factors consistently appear. A study conducted by Malie & Van Rensburg (2008:21) identified the following CSFs for success of ERP implementation project.

> ➢ **Project Management**
> Project Management involves the use of skills and knowledge in coordinating the scheduling and monitoring of defined activities to ensure that the stated objectives of implementation projects are achieved. The formal project implementation plan defines project activities, commits personnel to those activities, and promotes organisational support by organising the implementation

process. Whilst the approach is possible with bigger organisations with a high budget this area of project management is not effective for SMEs as they lack financial and human resources (Justras, 2009:17).

➢ **Business Process Reengineering**

Another important factor that is critical for the success of ERP implementation is the Business Process Reengineering (Bhatti, 2005:3) which comes as a result of ERP. This is defined as the fundamental rethinking and radical redesign of business processes to achieve dramatic improvements in critical, performance measures, such as cost, quality, service and speed. Organisations should be willing to change their businesses to fit with the changing economic environment. Technology changes which occur almost frequently mean that businesses have to be ready to adapt to these changes to improve their operations. The deployment of ERP can result in improved business process which gives good results,

➢ **User training and education**

In ERP implementation process many projects fail in the end due to lack of proper training. Many researchers consider user training and education to be an important factor of the successful ERP implementation (Nelson & Somers, 2003:595; Al-Mashari, 2002:186). The main reason for education and training program for ERP implementation is to make the user comfortable with the system and increase the expertise and knowledge level of the publics. ERP related concepts, features of ERP systems, and hands on training are all important dimensions of a training program for ERP implementation. Training is not only on using the new system, but also in new processes and in understanding the integration within the system – how the work of one employee influences the work of others.

➢ **Technological infrastructure**

IT infrastructure, hardware and networking are crucial for an ERP system's success. It is clear that ERP implementation involves a complex transition from legacy information systems and business processes to an integrated IT infrastructure and common business process throughout the organisation.

Hardware selection is driven by the firm's choice of an ERP software package. The need for powerful hardware remains critical for proprietary ERP. For Open Source systems the operating systems do not demand that much hardware hence adopting Open Source ERP presents SME with an opportunity for a product at lower cost (Avgerou, 2008:137).

> **Change management**

Change management is a primary concern of many organisations involved in ERP project implementation (Nelson & Somers, 2003:596). Many ERP implementations fail to achieve expected benefits; possibly because companies underestimate the efforts involved in change management and identify organisational change as the body of knowledge that is used to ensure that a complex change, like that associated with a new big information system, gets the right results, in the right timeframe, at the right costs. Generally, one of the main obstacles facing ERP implementation is resistance to change. The reluctance to accept change (Hiatt & Creasey 2006:7) can inhibit ERP effectiveness. Resistance can be destructive since it can create conflicts between actors. To implement an ERP systems successfully, the way organisations do business will need to change and ways people do their jobs will need to change as well. The recurring improvisational change methodology tools is proposed as a useful technique for identifying, managing, and tracking changes in implementing an ERP system. Change Management is important and one of the critical success factors identified in the literature. It is imperative for success of implementation project starting at the initial phase and continuing throughout the entire life cycle.

> **Management of Risk**

Every Information technology implementation project carries important elements of risk; hence it is probable that progress will deviate from the plan at some point in the project life cycle. ERP implementation project risks are described (Placide & Louis, 2005:2) as uncertainties, liabilities or vulnerabilities that may cause the project to deviate from the defined plan. Risk management is the competence to handle unexpected crises and deviation from the plan (Tommaso 2009: 1711). The implementation of an ERP system project is characterized as a complex activity and involves a possibility of occurrence of unexpected events. Therefore,

risk management has to be employed to minimize the impact of unplanned incidents in the project by identifying and addressing potential risks before significant consequences occur. It is understood that the risk of project failure is substantially reduced if the appropriate risk management strategy is followed.

➢ **Top Management Support**

Top management support has been consistently identified as the most important crucial success factor in ERP system implementation projects (Nelson & Somers, 2003; Khaled, Al-Salti & Eldabi, 2008). Top management has to provide the necessary resources and authority or power for project success. Top management support in ERP implementation has two main facets: (1) providing leadership; and (2) providing the necessary resources. To implement an ERP system successfully, management should monitor the implementation progress and provide clear direction of the project. They must be willing to allow for a mindset change by accepting that a lot of learning has to be done at all levels, including themselves.

➢ **Effective Communication**

Communication is one of most challenging and difficult tasks in any ERP implementation project. It is considered a critical success factor for the implementation of ERP systems by many authors. It is essential for creating an understanding, an approval of the implementation and sharing information with other stakeholders (Bernroider & Tang, 2010:23). In addition to gaining approval and user acceptance, the communication will allow the implementation to initiate the necessary final acceptance. The communication process should start early in the ERP implementation project and can include overview of the system and the reasons for implementing it should be consistent and continuous.

➢ **Team work and composition**

ERP team work and composition is important throughout the ERP implementation project. An ERP project involves all of the functional departments and demands the effort and cooperation of technical and business experts as well as end-users. The implementation team comprises functional personnel and management, IT personnel and management, top management, IT consultants, ERP vendor ,

parent company employees, management consultants, hardware vendor. The ERP team should be balanced, or cross functional and comprise a mix of external consultants and internal staff so the internal staff can develop the necessary technical skills for design and ERP implementation. Having competent members in the project team is the fourth most important success factor for Information Systems' implementation. Furthermore the members of the project team(s) must be empowered to make quick implementation decisions.

➤ **User Involvement**

User involvement refers to a psychological state of the individual and is defined as the importance and personal relevance of a system to a user. It is also defined as the user's participation in the implementation process. There are two areas for user involvement when the company decides to implement an ERP system: (1) user involvement in the stage of definition of the company's ERP system needs, and (2) user participation the implementation of ERP systems. The functions of the ERP system rely on the user to use the system after going live, but the user is also a significant factor in the implementation (Nelson & Somers, 2003:15).

➤ **Use of consultants**

Due to the complexity of implementing an ERP system, it requires the use of either internal or external experts who are knowledgeable about the installation and software (Herzog, 2006). Many companies prefer or must have external consultants to perform ERP implementation and research on ERP implementation shows that consultants are involved in different stages of the ERP project implementation. Clearly, the use of consultants is a critical success factor and has to be managed and monitored very carefully. The drawback is that SME needs may be unique and business processes can be forced to be modified to fit in with the modules being offered by the consultants.

➢ **Conclusion**

It can be observed from the above that ERP implementation is quite a complex process and requires careful planning. It is important that users and the team involved in planning and implementation work together. It is important also that the installation is aligned with company strategy and ensures top management support. It is however clear that this project is inherent with risk hence the need for careful planning. Given the benefits of installation of ERP it is important that open source alternatives are explored,

2.5   SOUTH AFRICAN ERP ENVIRONMENT

Government has rolled out an extensive support structure for Internet access through the universal access agency (UASSA) (Kholadi, Roodt, Paterson & Weir-Smith, 2006:23). Although universal access projects originally target rural areas and townships, the availability and accessibility provides opportunities for the small business sector in the urban environment as well. It is therefore important that Small and Medium Enterprises are able to adopt such technologies. Adopting and effectively utilising ERP technology will give local companies a competitive advantage (Finger, 2007:8). These efforts have not achieve the desired effect due to integration problems and poor interfaces as well as higher costs of customisation (Shtub 2001:567). The reason for this is because the SME sector needs unique tools for their operations and customised solutions are difficult to port.

Research literature on ERP vendors' shows that they are concentrating on the customization process needed to match the ERP system modules with the features of existing processes. This has not been extended extensively to open source tools. In South Africa, studies have shown that resource scarcity, the lack of strategic planning of Information Systems (IS), the limited expertise in IT and also the opportunity to adopt a process-oriented view of the business are among the factors that strongly influence, either positively or negatively, ERP adoption by SMEs. What still needs to be investigated is why in an environment where there are alternative ERP, tools are scarcely being used. The development of Small Medium Enterprises (SMEs) is seen as an important means of alleviating unemployment. ICT has been identified (Nkumbula, 2008:2) as a key sector for economic growth. It therefore follows that SMEs in the ICT field should be attracting significant attention. The government and other concerned business entities have already pledged their support in a number of ways to develop this sector. This is encouraging for vendors of Enterprise Resource Planning (ERP) systems as SMEs' are a key potential area of growth for these vendors. While large enterprise markets have a limited client base that remains to be served, the SME industry has a huge market base, with over 600 000 companies playing (Nkumbula, 2008:5) in this segment. For this reason, there is a need for ERP providers to focus their attention on SME markets in South Africa.

SMEs acknowledge the benefits of using technology and communications systems in order to compete effectively. The benefits involved in ERP software include cost savings through cutting down on labour, improved efficiency by eliminating error rates, reduced fraud, information integration and improved business competition (and governance) (Koh & Simpson, 2005:629). A post implementation study (Tommaso, 2009:1715) identified simplification of internal business processes as one of the benefits of ERP implementation. Due to these factors, many SMEs consider it critical to get access to information which gives them the capacity to sustain their business operations. One of the vertical markets expected to raise demand for ERP systems is the manufacturing industry (Justras, 2010:23). The importance of ERP in manufacturing lies in its ability to provide correct and timely information. This is critical to increasing flexibility, reducing lead times, improving effectiveness in order processing, enhancing quality and reducing inventory.

2.6   AVAILABLE ERP TOOLS FOR BUSINESSES

In general ERP tools available for the SME sector are divided into proprietary and open source tools. The following discussion will look at both alternatives and their functionalities. The following table list both types and indicates their functionalities.

Table 2.1: List of proprietary and Open Source ERP

		Proprietary		
ACCPAC	mid	ERP	Stand Alone and Web based	
Baan	mid, small	ERP	Stand alone and web based	
Microsoft Dynamics NAV	Mid-Market	ERP, CRM, Intercompany, Multicurrency, Cost Accounting, Reporting & Analysis services	Stand alone	
Open Systems Accounting Software	Low to Mid Market	ERP, SCM, e-commerce, Reporting & Business Intelligence	Stand Alone	
QuickBooks Pro/Premier	Low to Mid Market	Financial management, Inventory Management, Payroll	Stand alone	
Pastel	Low/mid	Payroll./Accounting	Stand alone and web based	
		Open source		
OpenPro	Low to mid-market	ERP, CRM, POS, Business Intelligence, General Ledger, Accounts Receivable, Accounts Payable, Inventory control, Manufacturing, Payroll & HR, ecommerce,	Web based	PHP
Open bravo	Low to mid-market	ERP, CRM, POS, Business Intelligence, General Ledger, Accounts Receivable, Accounts Payable, Inventory control, Manufacturing, Payroll & HR, ecommerce connectivity	Web based	Java

Adapted from: Herzog 2006:34

From the functionalities described in Table 2.1, it is clear that there are potentially more functionalities from open source ERP tools than proprietary tools. For example one popular tool used by SME is Pastel which offers limited functionalities compared to Open bravo. The question to be investigated is why despite the abundance of free ERP tools such as Open Bravo the small businesses and medium businesses in South Africa have not adopted the Open source ERP which are cheaper.

2.7 ERP DEPLOYMENT ALTERNATIVES

In making the decision to procure ERP tools SME are faced with a number of alternatives. The following alternatives are available: *outsourcing, ERP developed in-house, and online leasing.*

2.7.1 Outsourcing

The goal of outsourcing ERP would be to allow the organisation to focus more on its core activities hence gaining competitive advantage. In addition by sharing its resource requirements with experienced vendors it gains important business insight knowledge (Emilio Alvarez-Suescun 2007:8).

The other major drawback is loss of privacy and skills (Dibbern, Brehm, & Heinzl, 2002:3) The vendors may not have a thorough understanding of the business, especially the functional areas, organisational culture and business processes. Knowledge transfer is a problem as consultants are generally not willing to pass on their knowledge to company staff. In cases where there is knowledge transfer the IT staffs who receives such knowledge may leave the company so that issues around system upgrades, maintenance stays with the vendor.

2.7.2 On-line leasing

From studies in literature another alternative approach that SME can use is one known as software as a service model (SaaS) which was propounded by Carraro and Chong, (2006). In this approach software modules needed for a typical application are delivered through the Internet. This ensures that the SME does not incur costs for hardware upgrades and new software installation. It also does not incur maintenance costs. The uptake of the SaaS model is still small. This is because most SMEs in South Africa are not familiar with the model.

The SaaS approach has limitations. First in the South African environment, with low broadband the approach may have limited success. On the other hand the daily operations of the company will be taken over by third parties and the vendor may not consider certain issues a priority yet these issues may have serious security implications (Deb, Mohammed & Kierstead, 2008:11). To be able to do this there is need to consider having clear guidelines on protecting SME intellectual property.

2.7.3 Implementing ERP in-house

In the in-house approach the SME develops their ERP tools. The development process is a made-to-measure task and ensures that the resulting tools meet the day to day needs of the organisation. This approach has been enhanced by the availability of cheap software development tools which integrate easily with the off-the-shelf modules and adoption of open standards by the developer communities (Wirfs Brock, 2008:25).

This approach ensures saving in costs. Many software development tools are available making software development easier (Olsen & Saetre, 2007:43). It is possible to integrate off-the-shelf tools with the development ensuring that the time-frame is reduced. It ensures that the SME is in full control of the development. It also ensures that the development easily matches the organisational culture and meets the organisation's requirements.

The implementation of in-house systems ensures that the SME is not forced to adapt to the requirements of the structure demanded by ERP as prescribed by vendors. The new ERP systems should capture in one sense the business philosophy of the company. This is because most day-to-day operations of the company are managed through the IT system. The SME will thus not be able to respond to changes in the environment, something which makes in-house development possible.

Disadvantages

Skills and rollout will take longer. It requires large IT staff. In the case of South Africa the paucity of software development expertise makes this approach difficult. The cost of developing in-house expertise within the SME community would be prohibitive.

2.8   THE ERP AND WEB SERVICES

Mobile handheld devices are popular devices that provide secure, private, authentic, and accurate communication and exchange of confidential information. The prices of the devices have been decreasing whilst the technology on the devices has been exponentially increasing (Nleya & Adigun, 2008:15). Small business operators have

access to these devices and are able to access their company with ease. Secure web-based ERP systems; ensure faster access to information but security is an issue.

2.8.1 Web services: Characteristics

Emerging web services supported largely by wireless networks are characterised by their heterogeneous nature, providing support for multi-access technology and higher speeds requirements. This is an opportunity for SMEs and using web-enabled ERP will allow them to make a larger reach. However migrating to this exposes SMEs to security and the system may become inflexible. This is because most of the web services and connectivity tools tend to ignore unique user requirements. Thus the available web-based ERP tools need to be evaluated to see if they can migrate to the SME segment without the need for huge financial outlays. This integration of ERP into web services has been ongoing, and the web is going to be the platform for transactions and since the ERP modules will in some instances be sent over the web security will be paramount and this allows clients to access information without going through the ERP software itself.

The proliferation of web-enabled mobile devices also presents a challenge to the SME sector. There is a need to enable these devices to access company based systems. The openness of the operating systems presents challenges to small business operators who may not have software which constantly scans for potential intrusions (Brehm, Gómez & Rautenstrauch, 2005:23).

SMEs by their very nature need ERP solutions that do not demand significant initial investment. This is because in general they have limited IT resources hence taking the Open source route is the ideal (Naik, 2005:28). Generally the solutions proposed for ERP should have the following features:
- easiness of setup to minimise investment requirement and maintenance costs
- leanness of use to minimise operating costs
- scalability to maximise the applicability of the investment.

2.9   ERP AND SOCIAL NETWORKING

The social network tools are designed with a goal of getting information out of people and into people. Integrating social network tools into ERP can allow SME to reach a number of potential customers for their products. This means that the integrated ERP system should provide support for user mobility. The access to ERP by social network population can also result in security challenges. A study by Singla (2008:121) identifies unique risks associated with ERP implementation. The study showed that the tight interdependencies of business processes, relational databases and business process make them amenable to security breaches. The danger of information theft if access is granted to network sites is huge. ERP for SME deployment should include controls for potential breaches.

2.9.1 Security considerations

Security is critical for ERP systems and auditing the infrastructure is a challenge (Hughes & Beer, 2007). This is because ERP is used in several industries. There is a need when installing ERP to develop a security policy and a model for ERP systems. In this section, the study discusses the developments as well as current trends in security for ERP systems. Security problems exist in every level of an ERP system. These facets can be classified into three categories: network layer, presentation layer, and application layer, which include business processes, internal interfaces, and database. A better way to provide security may be to place a firewall server between the user and the ERP system. Most open source and proprietary systems offer this function. For SME businesses, priority is security of database systems. According to Kimwele, Waweru and Kimani (2010:38), a typical security model will have the following features:

- **Security policy and administrator:** ERP experts have to provide controls in such a way that explicit and well defined security policies can be easily defined and maintained. The security policies will offer the rules for the access of subject to object, and these are the constraints put on the administrators when they are granting/denying permissions to the users.
- **User authentication**: to verify whether the user is the same person as he claims.
- **Separation of duties**: tasks must be classified such that certain tasks can only be performed by certain users or roles.

- **Authorization**: to verify whether the user has access to the relevant resources. Depending on the authorization rules, the user is granted access.
- **Time restriction**: the access is permissible only during certain times. This ensures that data is being accessed for example, for business use during the day.
- **Log and trace:** the logging and tracing of relevant events has to be done with preventing the log files from breach. Essentially we need end-to-end security for ERP systems.

Although security is a major issue in ERP implementation this does not seem to be considered a priority in the developing world (Kimwele, Waweru & Kimani, 2010:34). There is minimal adherence to security policies and it is clear from this study that even though ERP offers benefit the SME may not enjoy these without compromising security. To meet the above challenges the SME and ERP vendors need to work together to protect data.

2.10   OBSTACLES TO SME ERP UTILISATION

Whilst usage of ERP among large businesses has grown over the years, in the Small and Medium Enterprise (SME) sector, utilisation of ERP has increasingly been faced with a number of challenges. First there is a general lack of skills in the adoption of ERP systems and the ERP tools are generally expensive (Justras, 2009:25). ERP vendors have tried to develop customised products for the SME sector without success. This has been due to the lack of technical expertise, lack of adequate support and difficulty of providing in-house software. The other obstacle is the mismatch between the customised ERP tools and the requirements of the businesses. These changes occur at higher frequency due to the dynamic economic environment. As such it is difficult for developers to match. A recent survey carried out by IDC shows that around 90% of mobile users use messaging as their main communication tool disregarding the safety level of such a communication system; if phones are lost or shared, anyone can access the data on the phone by another party.

2.11 CONCLUSION

In the literature study a critical success factors and challenges in implementation and adoption of ERP are explained. The benefits of ERP as identified in literature include:
- improved business processes
- Increased availability to data
- timely and accurate information
- increased customer response times
- quick response to changing market conditions

The study also identified critical success factors in the adoption of ERP including top management support, user training and vendor software support. It also identified some challenges in the adoption of ERP. The challenges identified in literature include the lack of training, high costs of ERP tools and the absence of support especially for Open source ERP tools. It also identified the issue of integration and the lack of in-house skills as an inhibiting factor in ERP adoption. The other challenge identified was the issue of security.

The literature study also looked at examples of SME ERP in the market. It was discovered that there was indeed an array of Open Source ERP tools which give the same functions as the proprietary tools. The challenge is then to find out why the small businesses are not taking advantage of these tools. These tools would enable the SME to better optimise their business processes. From the study it is apparent that the implementation of an ERP system requires careful planning.

2.12 CHAPTER SUMMARY

The advantages of ERP deployment have been explored and ingredients for success in deployment explored. The different software ERP tools available on the market have been explored, in particular the capability of open source ERP which present an opportunity for the small business sector in South Africa. The next challenge therefore is to find out if the parameters discussed in the literature still hold true for the South African SME environment. In particular the task now is to find out what factors hinder the

diffusion of Open Source ERP within the SME sector. The challenge is to find out the barriers to adoption of these tools by the small businesses.

Given the fact that the majority of open source tools have all the important functionalities, provided by proprietary ERP the other challenge is to find out why SMEs are not adopting Open source tools. Once the barriers to adoption are identified the next step will be to develop a best-for-fit framework for Open Source ERP adoption.

The Open source tools if properly utilised can be a driver for business competitive advantage. This is because users, when properly trained can customise the tools to their needs. This is because the source code is usually available for download.

CHAPTER 3

RESEARCH METHODOLOGY AND DATA ANALYSIS

3.1   INTRODUCTION

The key objective of this study was to examine the ERP adoption patterns by SMEs and critically determine the barriers that exist in the implementation of Open Source ERP. The following factors on ERP adoption were investigated:

- critical success factors in ERP adoption
- alternatives to ERP adoption
- barriers to ERP adoption
- types of ERP
- benefits of utilising Open source ERP

Following the preliminary theoretical framework that was developed in the previous chapter the next work was to carry out an across the field survey of manufacturing SMEs in the Vaal. The goal of this survey was to determine and test whether or not the issues that were raised in literature apply to the South African environment. This chapter therefore describes the research methods used and gives a justification of the adapted methods. The selected research design and approach are explained.

The purpose of this chapter is to present the results of the empirical study; in context with the research objectives and design and in relation to the broader problem statement. The discussion will therefore contain the findings correlated to the research questions. The discussion also contains processes that were followed to gather data.

3.2   RESEARCH DESIGN

Several techniques can be used to develop a framework for dealing with research problems. Khan (2007:35) has suggested the following summarised research design as in Table 3.1.

Table 3.1: Types of research design

Design	Objective	Research study	Output
Exploratory	This research is conducted to clarify and define the real nature of the problem more precisely	Qualitative studies using literature searches, case studies, focus group interviews	Gives valuable insights and leads to clearer understanding of purpose
Explanatory	Establishes nature of relationships between two or more variables where one variable determines value of another	Quantitative studies using experiments, field experiments, observations and interviews	Analysis of relationships, time series, variations, interaction of factors and underlying behaviour.
Descriptive	To describe an existing scenario, segment characteristics, with respect to variables and conditions that exist during period under investigation	Quantitative studies using various sample survey method.	The research problem is systematically described with a view to making specific predictions and recommending a final course of action

Adapted from: Khan (2007:35)

In this study exploratory and descriptive designs were followed. This is because this study focuses on identifying and clarifying the research objectives in order to develop reliable conclusions based on research findings (Hague, 2002:26).

3.3   RESEARCH APPROACH

In this study the questionnaire was used as a research instrument in the data gathering process. This approach was taken because it was found to be cheaper and more flexible. It was found to be a more objective research approach given the budgetary and

time constraints. Questionnaires are used in quantitative approaches and this approach uses logical and critical thinking with a focus on facts (Ghauri & Gronhaung, 2002:86).

A quantitative study also seeks to apply statistical analysis on data to enhance accuracy and reduce errors when analysing findings (Creswell, 2003:95). According to Dhurup (2008:19), quantitative studies provide findings that are less open to dispute since they apply a scientific approach in a research enquiry.

3.4   GATHERING OF DATA

The study used a survey method for data collection. Malhotra (2004:115) defines a survey as "an interview with a large number of respondents using a pre-designed questionnaire". The survey aims to collect primary data that is valid, representative and also reliable. In this research the aim was to determine utilisation of ERP by small business operators involved in manufacturing. On closer investigation it was found that less than 100 operators of the 400 targeted were actually involved in manufacturing.
Of these involved in manufacturing only 70 had IT systems that can be classified as close to an enterprise resource planning tools. The rest identified such tools as simple spreadsheets as ERP.Thus the questionnaires were distributed to these 70 .

3.4.1 Questionnaire Design and Development

A questionnaire is defined as a structured technique for data collection that consists of a series of questions that a respondent has to answer (Malhotra, 2004:280). To design the questionnaire used in this study the guidelines provided by Upfold and Sewry (2006:5) were used. The following factors were taken into account:
- Questionnaire had to generate interest in the respondents
- Questionnaire had to be precise
- Questionnaire presented on good quality paper
- Respondents able to complete questionnaire in absence of researcher.

Information regarding the questionnaire was entered by the respondents, onto the self-administered questionnaire. The questionnaire was developed from the literature review on ERP and open source software. The questionnaire contained questions and items

relevant to the initial research problem. Questions or items addressing the same themes were classified together.

The questionnaire was structured in the following format:

- **Section A: Demographic information**
  - Age
  - Educational level
  - Gender
- **Section B: Business Profile**
  - Age of business
  - Industry sector
  - Legal status of business
  - Number of employees
  - Annual turnover
  - Main objective in next three years
- **Section C: Knowledge of Open Source Tools**
- **Section D: Benefits of using ERP tools**
- **Section E: Open source ERP adoption Decisions**
- **Section F: Barriers to Open ERP adoption**
- **Section G: Impact of Open ERP adoption**

In sections A and B the respondents had to indicate the applicable answer by marking the designated block with a cross. Multiple choice questions were used under these sections as the data was mostly either nominal or ordinal.

In sections C, D,E,F and G a 5 point Likert scale was used to measure responses that range from "strongly disagree" with a value of one, to "strongly agree" with a value of five. The Likert scale gives a reliable measure of attitudinal data from respondents. A Likert scale adds up responses to statements representative of a particular attitude. A Likert scale is often used in survey design to get around the problem of obtaining meaningful quantitative answers to restricted closed questions. A Likert scale is recognisable when you are asked to indicate your strength of feeling about a particular issue on a **1-5 rating scale**. Using a Likert Scale with closed questions generates statistical measurements of people's attitudes and opinions. Hague (2002:88) argues

that attitudes influence behaviour and thus the Likert scale enables researchers to determine if specific attitudes and behaviour exists or do not exist among the population.

3.4.2 Data collection

Printed copies of the questionnaire were distributed to small and medium businesses in the Vaal triangle area. These businesses targeted were selected from the databases of Sedibeng district municipality as well as information gathered from Gauteng Enterprise Propeller. The questionnaires were physical taken (hand-delivered) to the premises of the businesses with the respondents asked to complete it and an agreed time frame of 4 weeks given for collection. The aim was to distribute questionnaires to as many SMEs as possible. The demographic area included the area within the Vaal Triangle including Vereeniging, Vanderbijlpark, Meyerton and Sasolburg.

A total of 28 usable questionnaires out of 32 were returned from the sample, which constitutes a fair response rate of 56% from a business sample. The main reasons for non-returns during the process were the limited time available to respondents to complete the questionnaires. It was also attributed to the absence of the respondents or their busy schedule after three revisits to collect the questionnaires.

3.5   RESULTS AND DATA INTERPRETETION

3.5.1 Theoretical Framework for Data Analysis

After collection of the data, the results were put through a number of processes. The goal was to test the results for accuracy and reliability after observing trends. Descriptive statistics was performed followed by a Reliability Analysis.

3.5.2 Descriptive statistics

The descriptive statistics was performed on the responses. The descriptive statistics approach was taken as it summarises the data responses in a way that captures the most important aspect in the data (Stangor 2007:114). The main parameters measured through descriptive statistics included the **mean** and **standard** deviation.

The mean measures the average value within a given sample.
The mean was calculated using the formula:

$$\bar{X} = \frac{\sum_{i=1}^{i=n} X_i}{n}$$

Where: n is the number of responses.

The standard deviation gives an idea of how close the entire set of data is to the average value. Data sets with a small standard deviation have tightly grouped, precise data. Data sets with large standard deviations have data spread out over a wide range of values.

The **standard deviation** was calculated using the formula:

$$\sigma = \sqrt{\frac{1}{n-1}\sum_{i=1}^{i=n}(X_i - \bar{X})^2}$$

3.5.3 Reliability analysis

Reliability refers to the degree in which data collection methods reflect transparency and congruency with other research in a similar area (Martins *et al.*, 1996:47). Reliability analysis was used to determine if measures obtained through questionaires were free from errors and therefore would yield accurate results (Zikmund, 1999:221). In this study Cronbach's α (alpha) was used. It is commonly used as a measure of the internal consistency or reliability of a psychometric test score for a sample of examinees.

The formula for calculation of Cronbach's α is below:

$$\alpha = \frac{K}{K-1}\left(1 - \frac{\sum_{i=1}^{K}\sigma_{Y_i}^2}{\sigma_X^2}\right)$$

Where: K is the number of components (*K-items* or *testlets*), σ_X^2 the <u>variance</u> of the observed total test scores, and $\sigma_{Y_i}^2$ the variance of component i for the current sample of persons (DeVelles, 1991).

Alternatively, the Cronbach's α can also be defined as

$$\alpha = \frac{K\bar{c}}{(\bar{v} + (K-1)\bar{c})}$$

Where: K is as above, $\bar{v}$ the average variance, and the average of all covariances between the components across the current sample of persons.

The standardized Cronbach's alpha can be defined as:

$$\alpha_{\text{standardized}} = \frac{K\bar{r}}{(1 + (K-1)\bar{r})}$$

Where: K is as above and $\bar{r}$ the mean of the $K(K-1)/2$ non-redundant correlation coefficients (i.e., the mean of an upper triangular, or lower triangular, correlation matrix).

According to Malhotra (2004:268), Cronbach's alpha's coefficient values should range from 0 to 1. Values below 0.6 indicate unsatisfactory reliability whilst those above 0.6 indicate satisfactory reliability.

The findings of the study were interpreted collectively based on the specific Sections under which the instrument was developed as shown in Annexure A.

3.5.4 Demographic profile (Section A)

Section A of the questionnaire delved into the respondents' biographical disposition. Questions were asked about gender, age and level of education of the sample

members, respectively. This information would serve as the basis for understanding the sample composition; effects of demographic characteristics on the development and shaping of attitudes and acceptance of open source tools.

3.5.4.1 Results obtained under Section A

Of the 28 respondents that responded to the survey, 16 respondents (57% of the sample) were male and 12 were female (43% of the sample). The proportion of females in managerial positions within SMEs is lower than that of males, indicating a heavier weighting of males in management and/or ownership positions as well as in the ownership of SMEs. This is shown in Figure 3.1 below.

Figure 3.1: Respondents' Gender
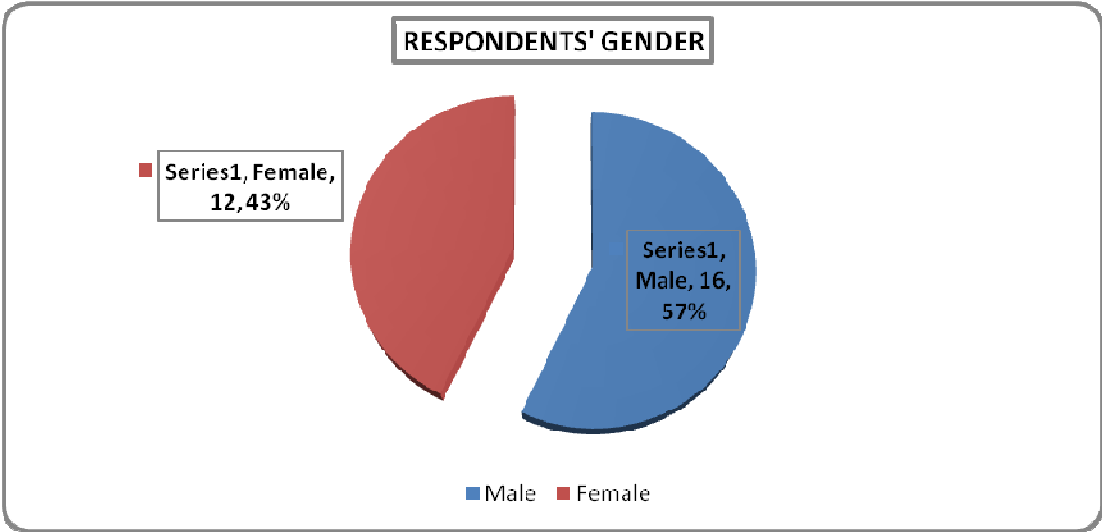
The largest sample proportion was represented by the below 30 years age range at 43% of the sample (12 respondents) as shown in Figure 3.2 below. The 30 years to 39 years age range followed closely at 36% of the sample (10 respondents). Moreover, the 40 to 49 year age group represents 14% of the sample (4 respondents) whilst those over 50 years are only 7% of the sample (2 respondents). The significance of these results is that a futurist approach will need to be developed for IT tools since the current majority of users are in the younger age ranges.

Figure 3.2: Respondents' age groups

RESPONDENTS' AGE GROUPS

Above 50years — 7%
40yrs - 49yrs — 14%
30yrs - 39yrs — 36%
Under 30 years — 43%
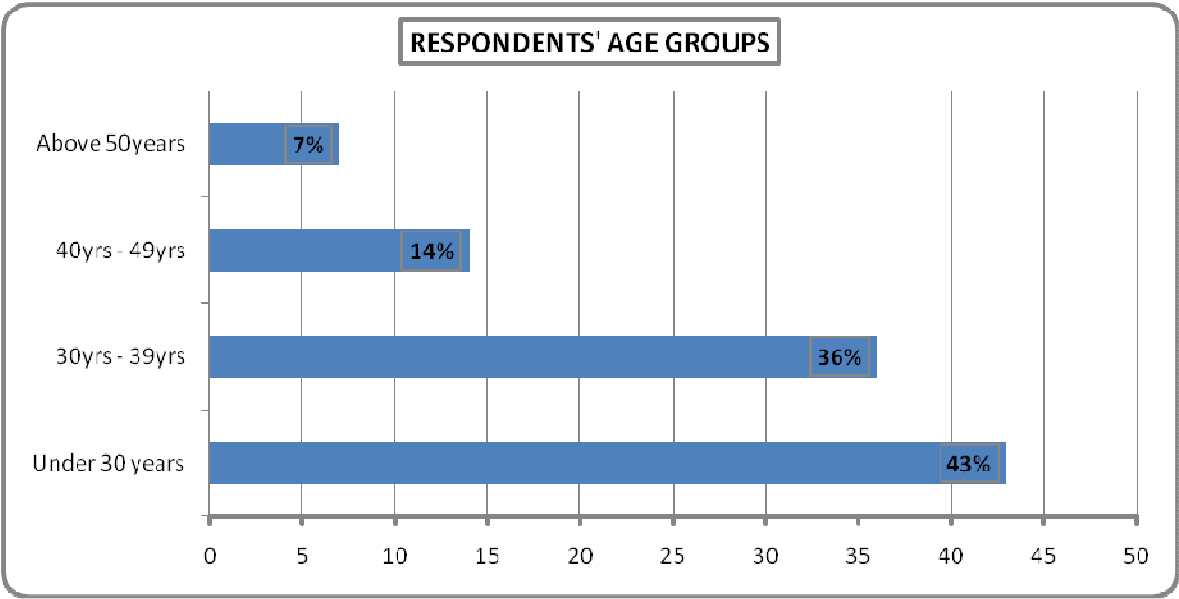
The purpose of question A3, in Section A of the questionnaire (refer to Appendix A) was to determine the highest academic qualification of the participants. The results can be utilised in determining the knowledge and influence of previous education on attitudes and understanding of open source ERP tools.

The highest academic qualification of all the participating respondents is presented in Figure 3.3 below. A majority of respondents (43% of the sample; 12 respondents) are in possession of an undergraduate or equivalent degree, followed by 29% of the sample (8 respondents) of the respondents who have qualified with only high school education. A total of 7 respondents (25% of the sample) have postgraduate qualifications. Only one respondent (4% of the sample) are in possession of other formal qualification other than primary education. This data provides sufficient evidence for the majority of business owners having matric and higher qualifications.

Figure 3.3: Respondents' highest education levels
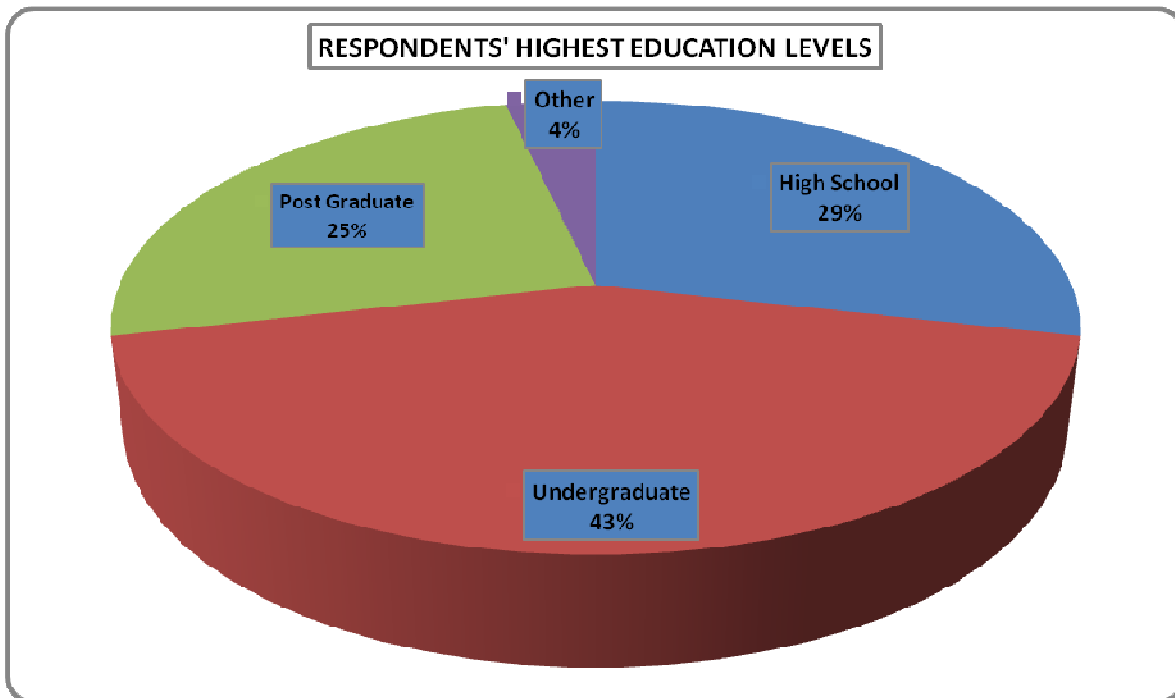
3.5.5 Business profile (Section B)

Section B of the questionnaire pertained to the business status of the small and medium enterprises that were included in the survey. Questions that were asked focused on the age of the business as well as the registration status. The SME owners/managers were also asked questions regarding their legal form of business as well as the business industry sector. This section focused on examining the business profile of adopters of ERP tools. The business profile may have an influence on the information technology specific needs of the SMEs as well as policy in highly regulated industries.

- **Results obtained under section B**

Twenty three respondents (81% of the sample) were registered as at the time of the survey whereas only five respondents (19% of the sample) were not registered entities as shown in Table 3 below.

Table 3.2: Business Profile of the respondents

		Valid N	Percentage
Registration Status	Registered businesses	23	81
	Unregistered business	5	19
	Total	**28**	**100**
Form of Business	Sole Trader	10	36
	Partnership	5	18
	Close co-operation	9	32
	Co-operative	3	11
	Other	1	4
	Total	**28**	**100**
Business Sector	Chemical	4	14
	Food	10	36
	Equipment	6	21
	Oil/Gas	1	4
	Other	7	25
	Total	**28**	**100**
Business growth objectives	To reduce in size	1	4
	To stay the same	3	7
	To grow	24	89
	Total	**28**	**100**

Ten of the respondents (36% of the sample) were operating as sole traders as at the time of the survey whereas only 5 respondents (18% of the sample) were practising as a partnership. However, 32% of the sample (9 respondents) was made up of close co-operations. Co-operatives constitute 11% of the sample (3 respondents) whereas only one respondent (4% of the sample) reported that they were operating as some other unspecified form of business.

A majority of SMEs (36% of the sample; 10 respondents) were in the food business sectors constituted under the retail, hotel and restaurant business classification. Only six respondents (21% of the sample) were in the equipment business sector. However, 14%

of the sample (4 respondents) was in the chemical business. Only one respondent (4% of the sample) was in the oil industry whereas other industry sectors that were represented comprised seven respondents (25% of the sample).

Moreover, 89% of the businesses (24 respondents) that were surveyed were pursuing a business growth objective as at the time of the survey. Three of the respondents (7% of the sample) consented to staying the same in terms of business size whereas only one business (4% of the sample) was making plans to cut down on business operations within the next 3 years.

Figure 3.4 below depicts the employee base of all the sample members that were surveyed.

Figure 3.4: SME employee base
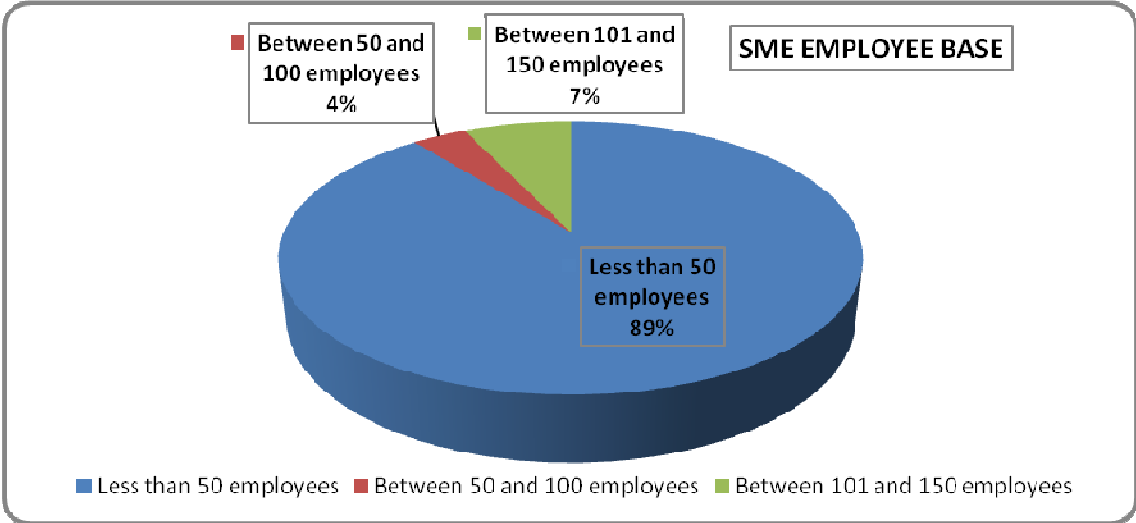
Some 89% of the businesses that were surveyed (24 respondents) constituted small business entities with less than 50 full time employees. However, three of the respondents (7% of the sample) had an employee base of between 101 and 150 full time employees at the time of the survey whereas only one respondent (4% of the sample) comprised between 50 and 100 full time employees.

The length of time in business is depicted in Figure 5 below. A majority of the businesses constituting half the sample size (14 respondents) comprise businesses that

have been in business between 1 year and 3 years. Only 36% of the sample (10 respondents) has been in business for more than 3 years whereas only 14% of the sample (4 respondents) has been operating for less than a year.

Figure 3.5: Length of time in business
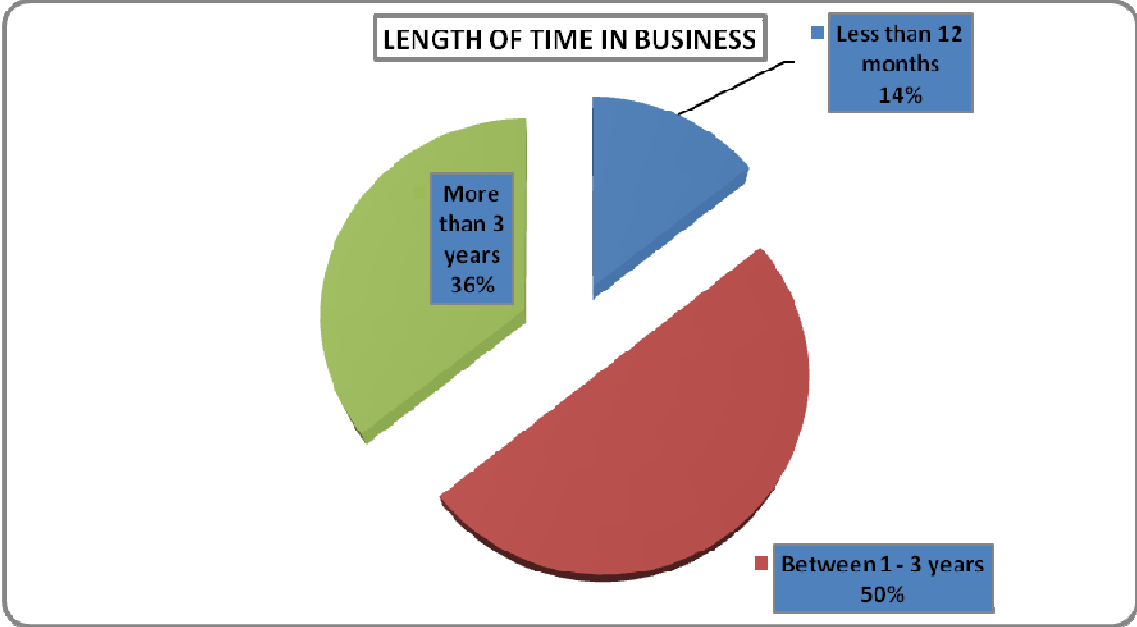
Question B6 (Refer to Annexure A) required the respondents to comment on the financial success of their businesses as shown in Figure 3.6 below. Twenty-one business entities (78% of the sample) indicated that their annual turnover fell in the R2 million to R4 million range. Only 4 respondents (approximately 15%) acceded that they make over R32million per year whereas only two respondents highlighted their business' turnover as being between R2 million and R4 million annually.

Figure 3.6: SME annual business turnover
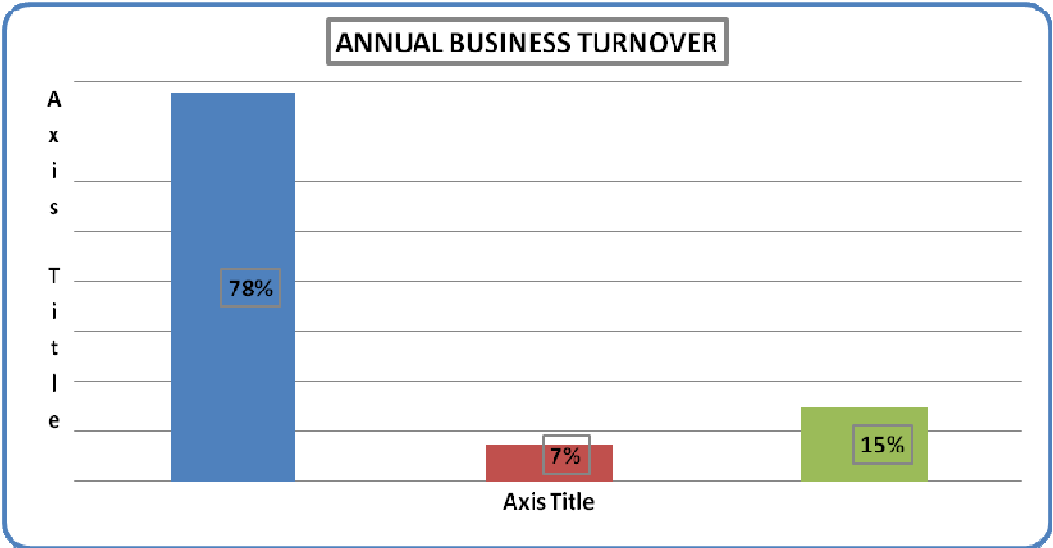
3.5.6 Knowledge of open source tools (Section C)

Section C of the questionnaire measured the respondents' knowledge of open source tools. The questions were formatted on a Likert scale with 1 representing strongly disagree; 2 being disagree; 3 neither agree nor disagree; 4 agree; 5 strongly agree. The descriptive statistics have been outlined in Table 3.3 below.

3.5.7 Results obtained under section C

Table 3.3: Descriptive statistics

Knowledge of Open source tools	N	Minimum	Maximum	Mean	Std. Deviation
QC1	26	2	5	4.15	.834
QC2	27	1	5	2.85	1.262
QC3	27	1	5	2.74	1.163
QC4	27	1	5	3.07	1.174
QC5	27	1	5	3.00	1.301
QC6	26	1	5	2.42	1.391
QC7	27	1	5	2.81	1.272
QC8	27	1	5	2.96	1.255
QC9	26	1	4	2.69	1.158
QC10	26	1	5	2.88	1.243
QC11	26	1	5	2.19	1.132

When asked whether or not they were comfortable using office tools such as word-processing and spread-sheets, a majority of respondents either agreed or strongly agreed to this statement giving a mean of 4.15 with a standard deviation of 0.834. With regards to training received; a majority of respondents highlighted that they had not received any training on open source tools thus giving a mean of 2.85 with a standard deviation of 1.262. A mean of 2.74 was obtained for the question on whether SMEs were using open source tools. However, on the question of the businesses having an already established IT training program, most businesses neither agreed nor disagreed to this statement, giving a mean of 3.07 and a standard deviation of 1.174. A mean value of 3.00 was obtained for the question on whether the SMEs always get updates on new software tools with a corresponding standard deviation of 1.301. Question C6 made an enquiry into knowledge of open source foundation. A mean of 2.42 and a standard deviation of 1.391 were obtained from the respondents in this regard.

Questions C7 to C11 measured the owners/managers' familiarity with web servers, office suites, development tools and support tools or lack of familiarity thereof as depicted in Figure 3.7 below.

Figure 3.7: Familiarity with open source ERP tools
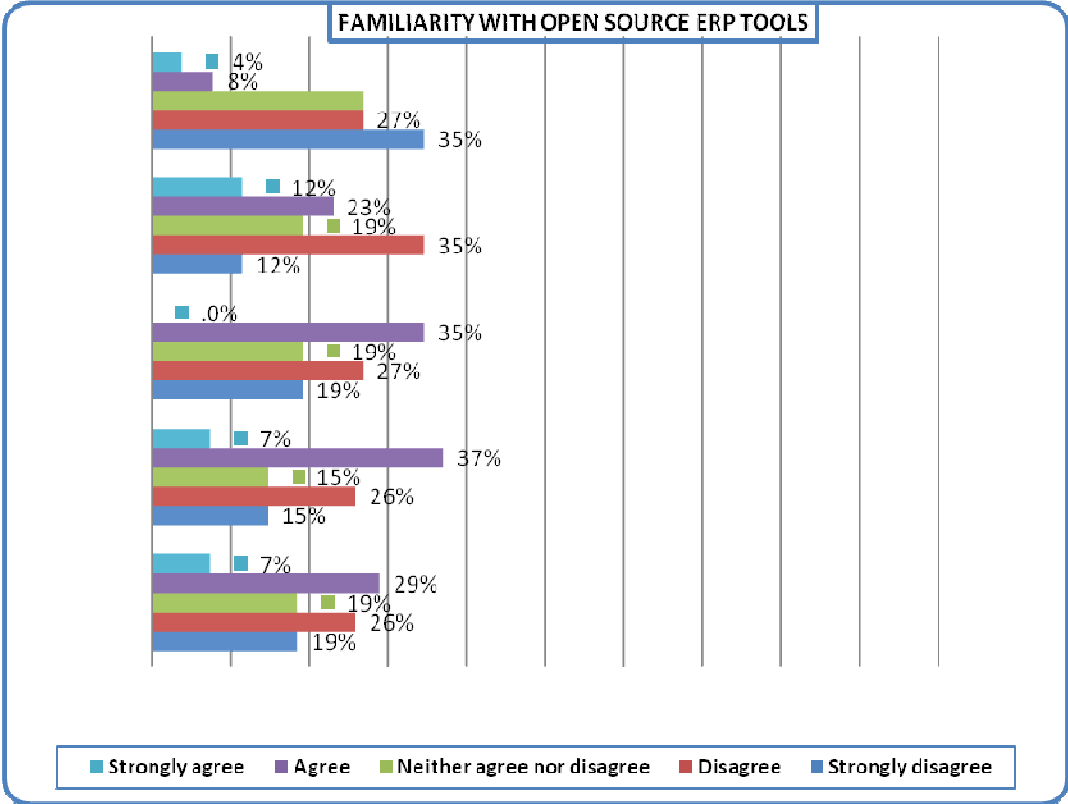
Approximately five respondents (19% of the sample) either strongly disagreed or neither agreed nor disagreed when asked whether they were familiar with open source webservers whereas only 26% of the sample (7 respondents) disagreed. A majority of the respondents (8 respondents; 29% of the sample) agreed that they were familiar whereas only two respondents (7% of the sample) strongly agreed to this notion.

With regard to familiarity with open source office suites; 15% of the sample (four respondents) either strongly disagreed or were neutral to this statement. Only two respondents (7% of the sample) strongly agreed to this notion whereas seven respondents (26% of the sample) disagreed that they were familiar with open source tools. A majority of respondents (11 respondents; 37% of the sample) acceded to the statement that they were familiar with open source office suites.

On the level of familiarity with open source development tools; 19% of the sample (5 respondents) either strongly disagreed or they remained neutral that they had any familiarity. However, 27% of the sample (approximately 7 respondents) disagreed that they had any familiarity with open source development tools whereas 35% of the sample (11 respondents) agreed to this statement. None of the respondents strongly agreed in this case.

Nearly 10 respondents (35% of the sample) disagreed when asked whether they were familiar with open source support tools. Similarly, 12% of the sample was either strongly disagreeing or strongly agreeing to the statement. However, only 19% of the sample (5 respondents) remained neutral on this question whereas 23% of the sample members were in conceded to this opinion.

Several SME owners/managers acknowledged that they were not familiar with open source tools. This comprised 8% of the sample (2 respondents) and 4% of the sample (one respondent) who either agreed or strongly agreed to this statement, respectively. Approximately 8 respondents (27% of the sample) either disagreed or remained neutral when asked this question. The largest number of respondents (9 respondents; 35% of the sample) strongly disagreed that they did not possess any familiarity with open source tools.

3.6 ERP BENEFITS (SECTION D)

The survey aimed to acquire knowledge on the benefits that have accrued to SMEs that are presently utilising open source ERP tools. This would serve as a motivational tool for firms who have not yet started using ERP and also as a drive for most SMEs to make a strategic decision to systematically adopt ERP tools.

3.7 RESULTS OBTAINED UNDER SECTION D

Figure 3.8: Reduction in operational costs
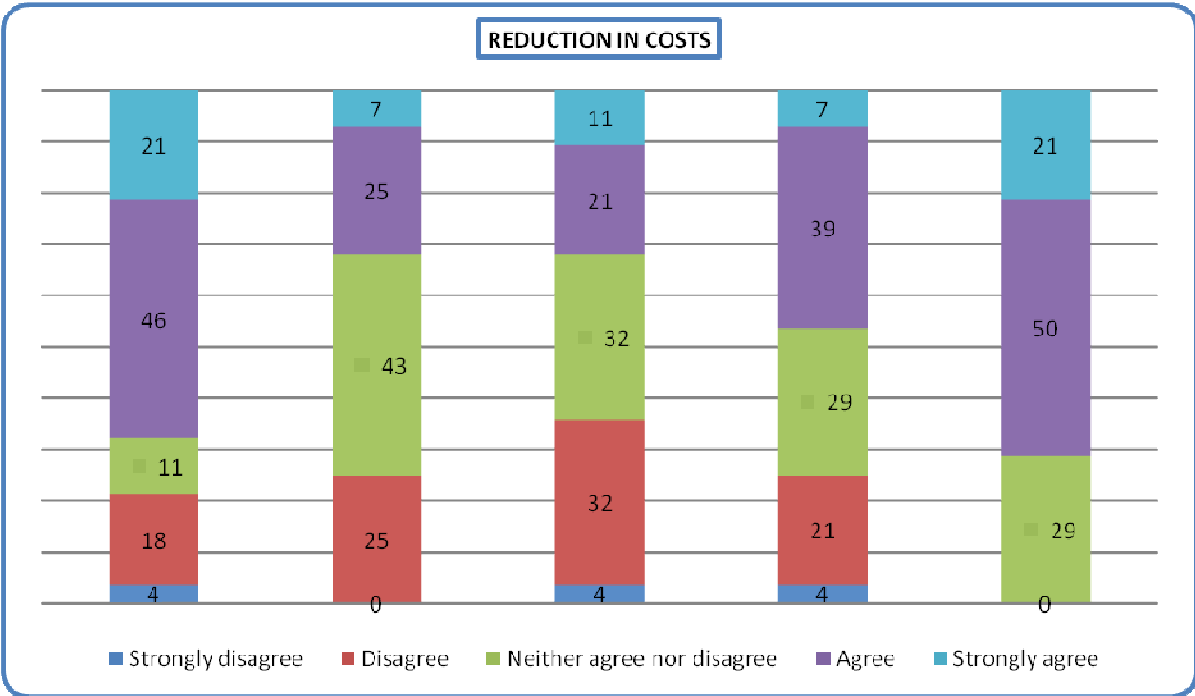
Figure 3.9: Risk and security issues
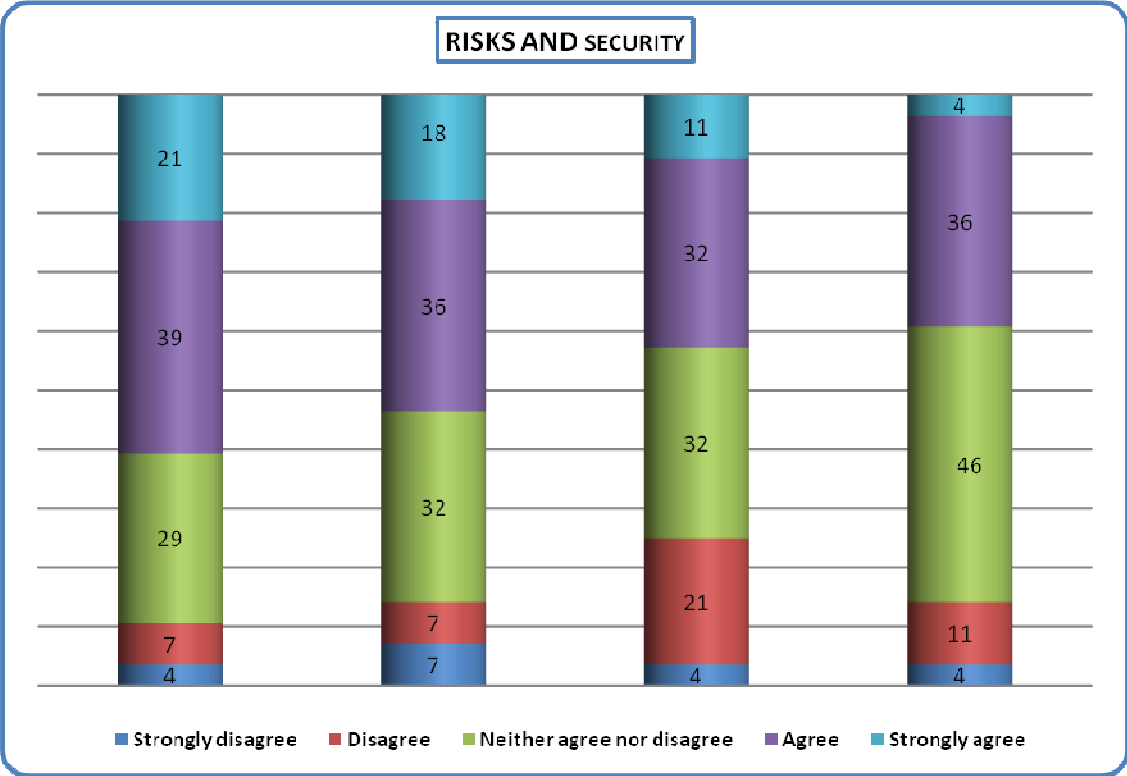
Figure 3.10: Information gathering

INFORMATION GATHERED USING ERP TOOLS

Category	Strongly agree	Agree	Neither agree nor disagree	Disagree	Strongly disagree
Competitors	21	50	29		
Markets	25	39	32	4	
Suppliers	36	29	36		
Products		25	54	11	11
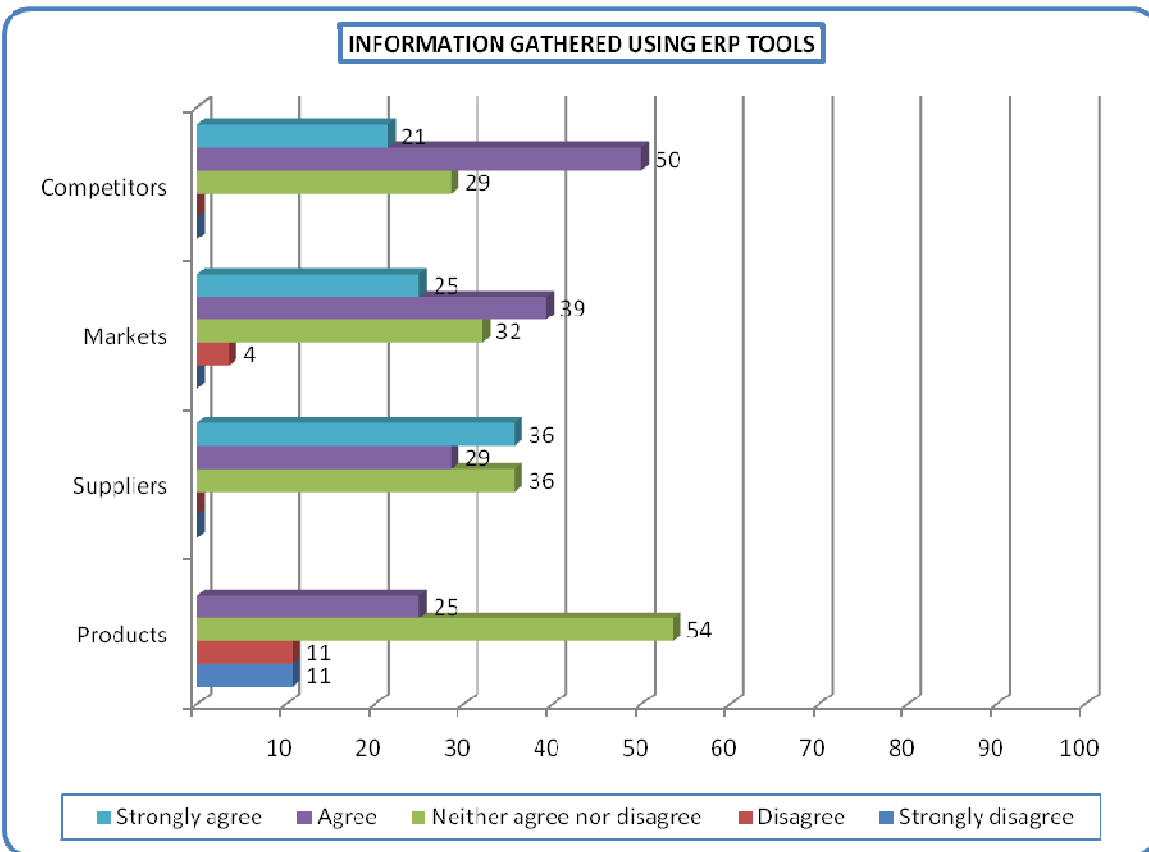
Figure 3.11: Communication benefits of ERP
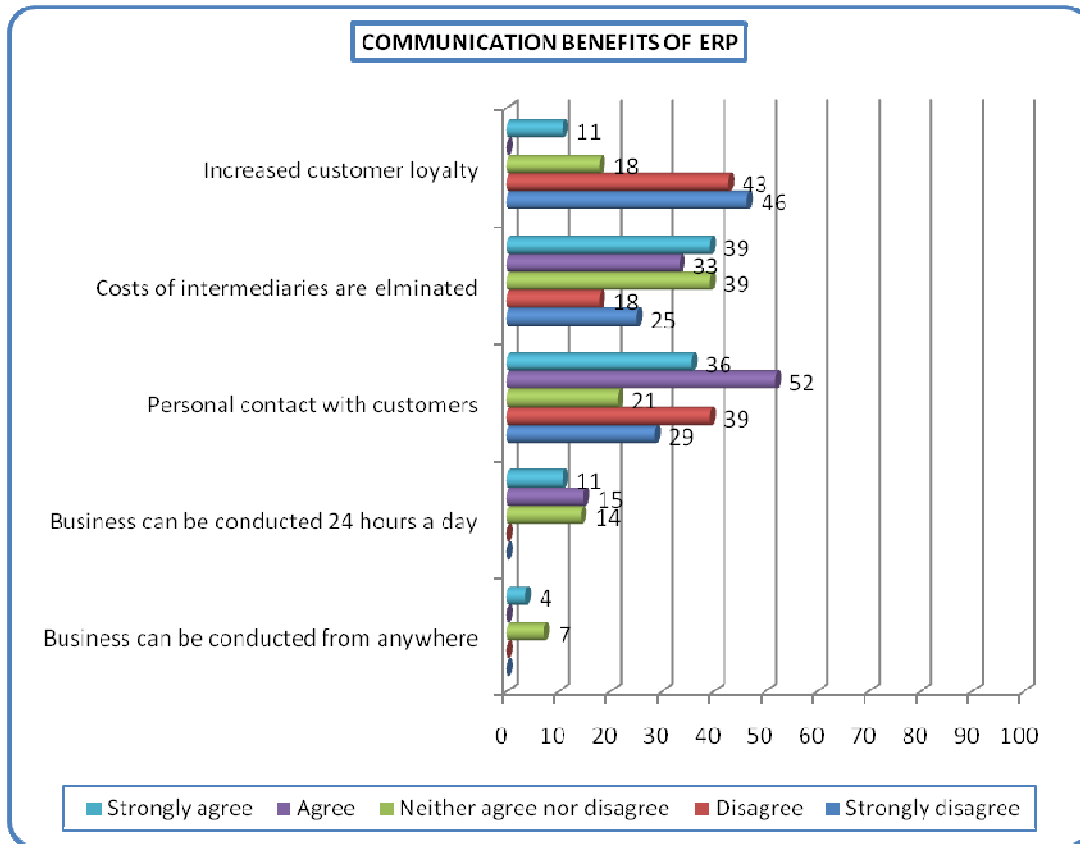
Approximately 44% of the sample (12 respondents) affirmed that ERP open source tools have led to increased chances of survival for their businesses. Furthermore, 31% of the sample strongly agreed whereas 32% agreed that increased market share is attained from the usage of ERP open source tools. Additionally, 11% of the sample strongly agreed that ERP tools lead to enhanced business performance and 63% only conceded to this statement. Furthermore; 22% of the sample said they have accrued ERP benefits on increased productivity of managers and 48% of the sample agreed to the same notion. Nearly, 37% of the sample and 26% of the same either strongly agreed or agreed when asked whether they had derived benefits of high performance and enhanced business image respectively; from the usage of ERP tools. These results are highlighted in Figure 3.12 below.

Figure 3.12: Business performance
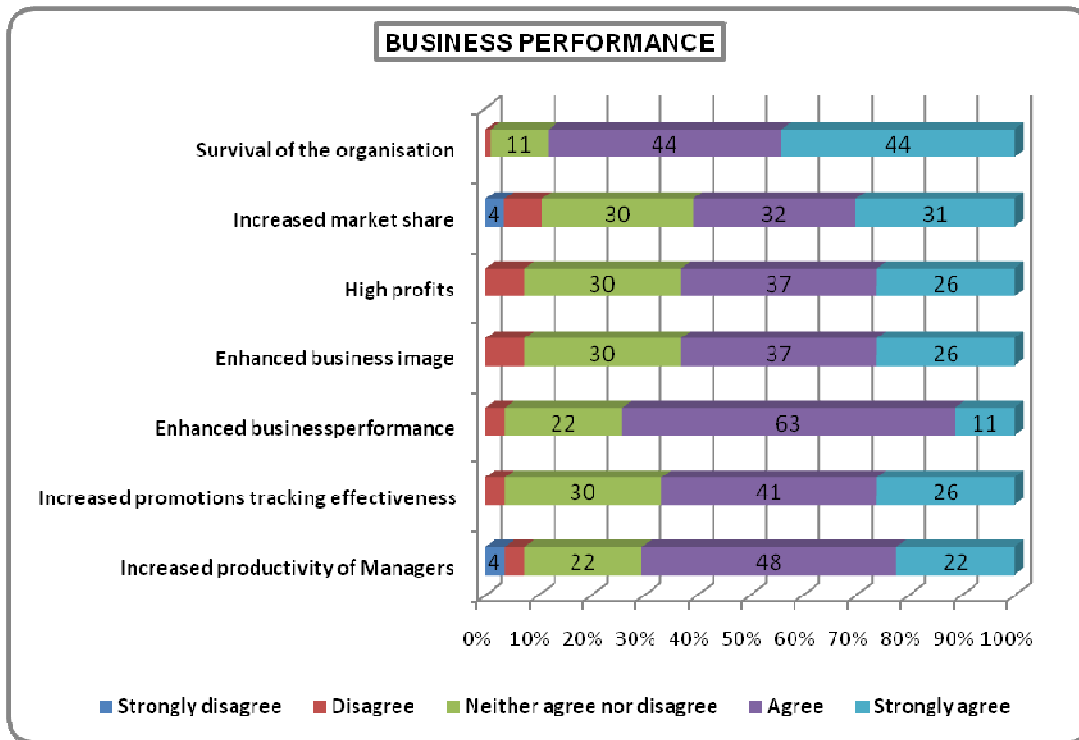
3.8 ERP DRIVERS (SECTION E)

The survey aimed to acquire knowledge on the motivational factors underlying adoption of ERP open source tools by SMEs (Refer to Section of the questionnaire in Appendix A). These would help explain the acceptance process as well as the drivers for adoption.

Analysis of the results

On the statements pertaining to resource availability as major drivers, the availability of skilled staff, finance as well as the technological infrastructure were cited as the major drivers of ERP acceptance and adoption as reflected by the average mean of $\bar{x}$ 2.74, 2.86 and 3.00 respectively. All four statements as reflected in Table 3.6 indicated relative high levels of disagreements on the use of ERP.

  ➢ **External pressure in ERP adoption decision**

The purpose of questions E8-E11, in Section E of the questionnaire (refer to Appendix A) was to accumulate a body of knowledge of external factors that influence the ERP adoption decision.

Table 3.4:   Disagreement on the use of ERP

	N		Minimum	Maximum	Mean
		Capability to implement ERP			
QE1	28	Financial resources to adopt ERP	1	5	3.00
QE2	28	Technological resources to adopt ERP	1	5	2.86
QE3	27	Adequate staff skills to adopt ERP	1	5	2.74
		Open Source usage			
QE4	28	Easy to use	1	5	2.50
QE5	28	Flexible to use	1	5	2.57
QE6	28	Understandable	1	5	2.71
QE7	28	Possible to implement because there is an abundance of trainers	1	5	2.25
		Any pressure to adopt Open Source ERP			
QE8	28	Our competitors are pressuring us	1	5	3.04
QE9	28	Our industry is pressuring us	1	5	2.96
QE10	28	Our suppliers are pressuring us	1	5	2.71
QE11	28	Our government is pressuring us	1	5	2.68
		Overall			2.85

- **Analysis of the results**

From the results above it is apparent that there is disagreement that external pressure in the form of suppliers, competitors or regulatory authorities have a major effect on adoption decisions. The respondents do not feel pressured by competitors in their decisions to adopt ERP. This assertion seems to contradict research findings of Koh and Simpson (2005:631) that indicate that pressure from stakeholders such as competitors and suppliers is a positive driver of ERP acceptance and ultimate adoption.

➢ **Management , employee and company culture**

- **Purpose of question**

The purpose of questions E12-20, in Section E of the questionnaire (refer to Appendix A) was to determine if adoption decisions were determined to a large extent by the type of management running the SME or the existing employee and company culture.

Table 3.5: Top management and employee support

	N		Minimum	Maximum	Mean
		Top management and employee support			
QE12	28	Top management is very enthusiastic	1	5	3.32
QE13	28	Our employees are very enthusiastic	1	5	3.43
QE14	28	Our organisation will meet customer demands	2	5	3.64
QE15	28	Our organisation will gain competitive advantage	2	5	3.79
		Overall			3.54

Table 3.6: Open source and company values

	N		Minimum	Maximum	Mean
		Open source and company values			
QE17	28	Goals	1	5	3.68
QE18	28	Values	2	5	3.75
QE19	28	Culture	2	5	3.64
QE20	28	Technology infrastructure	3	5	4.00

- Analysis of the results

All eight statements as reflected in Tables 3.5 and 3.6 indicated relative high levels of agreement with the factors identified as leading reasons for adoption of ERP. The mean score values ($\bar{x}$) ranged between 3.32 and 4.00 indicating high levels of agreeability with the notion that the adoption of ERP tools is highly consistent with the goals, values, culture and technology infrastructure of the SMEs. Furthermore, most of the respondents highlighted that their top management is very enthusiastic about adoption of the ERP systems.

> How will use of Open Source ERP benefit employees?

- Purpose of question

The purpose of questions E21-25, in Section E of the questionnaire (refer to Appendix A) was to determine if respondents understood employee benefits of using open source ERP tools.

Table 3.7: Benefits of Open Source ERP

	N		Minimum	Maximum	Mean
		Benefits of Open Source ERP			
QE21	28	Improve job performance	3	5	4.18
QE22	28	Increase productivity	2	5	4.04
QE23	28	Increase effectiveness on the job	2	5	4.00
QE24	28	Do their job with greater ease	2	5	4.04
QE25	28	Increase motivation in the work place	2	5	3.96
		Overall			4.01

- **Analysis of the results**

All four statements as reflected in the table above indicated relative high levels of understanding of benefits of using the tools. The respondents rated **improved job performance** as the most significant benefit of adopting ERP systems. The factor obtained an average mean of $\bar{x}$ = 4.18. Other statements indicating relative high levels of knowledge of benefits included **Increased productivity** indicating an average mean of $\bar{x}$ = 4.04, **ease of use** ($\bar{x}$ = 4.04), **improved job effectiveness** ($\bar{x}$ = 4.00).

➤ **ERP barriers to adoption (Section F)**

- **Purpose of question**

The purpose of questions F1-F20, in Section F of the questionnaire (refer to Appendix A) was to determine what factors militated against the implementation of open source ERP despite the benefits identified in previous sections of the research questionnaire.

- **Results obtained**

Obstacles that the respondents are experiencing in their current business operations are reflected in Table 3.10 below. The results are ranked from the highest to the lowest mean score.

Table 3.8:   Current business operations

Variable	N		Minimum	Maximum	Mean
QF1	28	Too expensive to implement	2	5	4.25
QF2	28	Lacks vendor support	2	5	4.18
QF3	28	Disorganised	1	5	2.93
QF4	28	Not relevant to our line of business	1	5	2.75
QF5	28	Not consistent with the size of our business	1	5	2.68
QF6	28	Too difficult to manage and maintain	1	5	2.93
QF7	28	Time-consuming to implement	1	4	3.18
QF8	28	A security threat for our business	1	5	3.00
QF9	28	Lack of application offerings in the market	2	5	3.25
QF10	28	Lack of support & maintenance	1	5	3.64
QF11	27	No training and advice on open source tools	1	5	4.04
QF12	28	There is fear of risks associated with ERP	1	5	3.50
QF13	27	Few of our organisation's suppliers and customers use Open Source ERP	2	5	3.93
QF14	28	Few of our organisation's competitors use Open Source ERP	2	5	3.43
QF15	28	Our organisation does not know much about open source ERP	2	5	3.61
QF16	28	Our organisation Is not aware of government open source	1	5	3.79
QF17	28	Our organisation lacks training and support from the ERP vendors	1	5	3.89
QF18	28	Does not possess adequate staff skills in IT	1	5	3.46
QF19	28	Our market possesses an element of fear surrounding use of ERP in our organisation	1	5	3.64
QF20	28	Vendors do not understand our needs	1	5	3.54

- **Analysis of the results**

All eight statements as reflected in Table 3.20 indicated relative high levels of agreement with factors identified as obstacles. The respondents indicated lack of training, awareness, and fear as being obstacles to adoption. The mean values ranged between 2.68 and 4.25 for all the constructs measured under this section.

- ➤ **IMPACT OF OPEN SOURCE ERP**

- **Purpose of question**

The purpose of question **G1-G4**, in Section G of the questionnaire to determine if respondents understood the impact open source ERP can have on their business. This was a validation exercise.

- **Results obtained**

Participants indicated that ERP has an impact on their business. There was strong disagreement with a statement that ERP has a negative contribution to business. The average mean for this statement was calculated relatively high on $\bar{x}$ = 2.32. The respondents indicated that ERP has a positive contribution ($\bar{x}$ = 3.86) and simplifies business processes ($\bar{x}$ = 3.71). Table 3.12 below indicates these results.

Table 3.9: Contribution to business

Variable	n	Parameter	Totally disagree	Totally agree	Mean
QG1	28	ERP has had a positive contribution to our business	1	5	3.86
QG2	28	ERP has had a negative contribution to our business	1	4	2.32
QG3	28	Reduced running costs for the business	2	5	3.36

- ➤ **RELIABILITY ANALYSIS**

The Cronbach's alpha values that were computed for the samples are summarised below. Cronbach's alpha coefficient was also used to measure reliability. This coefficient was calculated from averaging all the test items and then examining the degree of correlation within the instrument (Zikmund, 1999:223). The theory behind this measure

is that the observed score is equivalent to the true score plus the measurement error. According to Malhotra (2004:268), Cronbach alpha's coefficient values range from 0 to 1, with all values ranging below 0.60, indicating unsatisfactory reliability. Cronbach values ranging from 0.60 and greater indicate moderate reliability. Hence the higher the correlation coefficient, the greater the reliability of the measuring instrument (Malhotra 2004: 267).

Table 3.10: Reliability

SECTION	PARAMETER	NO. OF VARIABLES	CRONBACH ALPHA
C	Knowledge of Open Source Tools	23	0.806
D	Benefits of using ERP tools	28	0.867
E	ERP adoption decisions	24	0.915
F	Barriers to Open ERP adoption	20	0.834
G	Impact of ERP	28	0.401

The alpha values ranged from 0.806 for section C to 0.915 for section F indicating moderate to high levels of internal reliability in the research instrument that was utilised.

However, section G yielded unsatisfactory reliability as the value for the impact of ERP indicates a weakness in the system. This however can be explained by the fact that the respondents did not actually have ERP installed at the time of the survey.

3.9   CONCLUSION

Methodological issues as well as considerations with regard to gathering the data were discussed at the beginning of this chapter. The survey results were then presented using frequency tables as well as charts. The survey results were analysed in the context of the research objectives and the broader problem area. The goal was to discover if what is in the literature is consistent with what is taking place in the real world regarding ERP adoption within SMEs. The results underwent a series of tests to determine accuracy and reliability.

The survey also sourced information regarding the profiles of small and medium sized businesses and their challenges and what their perceptions of ERP were. The focus was on open source ERP whose adoption was the issue presented in the problem statement. On the knowledge of open source tools there seems to be a challenge. Respondents are not familiar with the existence of open source ERP tools or other open source tools available to them. This presents a challenge and makes it difficult for SMEs to respond and enjoy the holistic benefits offered by ERP.

The benefits of using and adopting ERP are well understood by the respondents. What therefore needs to happen is for these anticipated benefits to be realised. This will be possible with adoption of implementation guidelines that will be proposed in this study. The benefits expected of ERP are the driving forces in adoption decisions; however, the respondents indicated that management support is critical for adoption. Similarly they identified training and support as equally important. Respondents identified lack of training, support and lack of information as barriers to adoption of open source ERP. This lack of knowledge tends to enhance the fear of risks associated with this adoption failure.

3.10 CHAPTER SUMMARY

The results from the empirical study point to the need for change in businesses' approach in open source ERP adoption decisions. The majority of SME businesses surveyed (79%) are run by people below the age of forty years. These people (96%) have a minimum of a high school qualification and 89% of the sample indicated that they wish to grow their businesses in the next three years. This presents opportunities for open source vendors as this age group (Generation Y) is flexible with technology. The group is also comfortable with using technology and software tools such as word-processing. A majority of the respondents highlighted that they were familiar and they have heard about open source tools although they do not know how to use these tools fully. This means that there is need for an intervention directed at making these users aware of alternative tools to the system that they are currently using as well as their usage. There are considerable opportunities that open source ERP can give the SME population ranging from low cost compared to proprietary systems.

The benefits of ERP adoption that were identified by the respondents included enhanced business image, enhanced performance, better information gathering as well as communication. This would serve as key drivers and motivation for the futuristic adoption of ERP tools. The benefits identified which are consistent with literature were, inter alia reduced operational costs, reduced support costs, licence costs and faster customer service. Increased software reliability, security and reduced support costs were highlighted to be the ingredients of a good ERP system.

System reliability was considered important by respondents and the need for service and support were rated equally high to address their needs. The respondents realised that the ERP tools were essential for the survival of the business which will give it a competitive advantage. On adoption decisions, respondents identified the lack of skills as a barrier in adoption decisions together with the absence of suitable training on the systems. The respondents also think that open source ERP would not be easy to use and that it is not flexible or understandable. There is a strong sentiment that 'it is difficult to implement ERP' because of the lack of trainers in the field. External pressure does not seem to be a big driver for adoption decisions but top management support and employee support are identified as important.

The impact of open source ERP is minimal, according to respondents. This ties up with the first element where knowledge is concerned and the fact that some of the respondents did not have the full suite of ERP tools installed.
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CHAPTER 4

CONCLUSIONS AND RECOMMENDATIONS

4.1   INTRODUCTION

The literature study and survey procedure both indicated that small and medium enterprises are positive that an ERP has benefits for them. It was also clear that these businesses need a system that basically provides functionalities that address their business needs. However, the adoption of open source ERP is fraught with challenges yet it provides opportunities for the SME sector.

The challenges brought about by rapid changes in technology and the absence of awareness programs on the suitability of open source as an alternative development platform for ERP requires a new change in how vendors package their offerings. The purpose of this chapter is to conclude the empirical study by interpreting the results. The next step is to compare these results to the findings of the literature study.

After this comparison certain conclusions are drawn after which the way forward is plotted. This chapter seeks to evaluate the major findings of the research study with a view to bringing some key conclusions on the overall study.

4.2   LITERATURE STUDY

The primary objective for this study was to develop guidelines for the adoption of Open Source ERP tools by the SME sector in the South African environment. For this to happen successfully it was critical that the literature on the SME sector was consulted to learn about their perceptions of ERP tools in general but also open source ERP tools in particular. The literature study would also seek to identify critical success factors in ERP adoption including ingredients for SME success.

In order to achieve this goal a broad background to ERP was given in the literature study. This study consisted of clarifications on the concepts of ERP. An overview of ERP was given including a study on different ERP tools. The theoretical objectives of the study were thus achieved through analysis of relevant literature. This was the subject of Chapter Two. In this study the motivational factors identified for adoption of ERP were improved business processes, and increased and timely access to information. The improved access to information was identified as another key driver to ERP adoption. Associated with this was the discovery of critical success factors in ERP deployment. This included, top management support, availability of support, training and a good infrastructure. The literature study also looked at barriers to adoption of open source ERP. Challenges identified as major inhibitors of the successful implementation of ERP systems included lack of training, lack of support and awareness.

4.3   THE EMPIRICAL STUDY

For this to happen successfully it was critical that the manufacturing SME sector was consulted to learn about their perceptions of ERP tools. A questionnaire was therefore developed to capture these perceptions as well as expectations of the respondents who comprised managers, SME owners, IT specialists as well as software programme developers. From this study the barriers and drivers to ERP adoption would be determined. The results from literature were tested using a quantitative survey. The advantage of this approach was that it minimises bias. To achieve the empirical objectives conclusions were drawn from findings on responses from the questionnaires. The results of the empirical study were discussed in Chapter Three. The sample results indicated that the challenges that SME face in open source adoption stem from lack of knowledge, the lack of training, lack of awareness and lack of systems support. The key findings indicate that the adoption of open source ERP is limited by a lack of key vendors who would provide support.

4.4   STRUCTURE OF SMEs

The average manufacturing SME business in the Vaal Triangle is between one to more than three years old with an annual turnover in the R2million to R4million range. Operation is mainly within the food sector, chemical and equipment. The legal status of

the participating businesses is mainly close corporations and sole traders. The respondents running the businesses are people less than forty years of age.

This fact is important as it points to a future market for open source ERP tools and this group is aware of what they expect in a good ERP system. The fact that the respondents expect growth in their business indicate that there will be a need to align their businesses to the expected growth and since the respondents understand the role that ERP plays in simplifying processes it is critical that vendors prepare to meet these needs.

4.5   CONCLUSION

The findings show that the open source ERP developers need to consider the needs of the SME users. These users will need open source ERP tools that are flexible and easier to use. Such tools will have wider acceptance by SMEs. There is general agreement that a lack of training and support is a key inhibitor of Open Source ERP adoption. Furthermore, the empirical research conducted in this regard highlighted a variety of barriers inhibiting the adoption of open source ERP ranging from lack of knowledge, training, awareness and lack of support programs. Both the literature and the empirical study converge on this fact. It is therefore important that practical steps are taken to increase the use of ERP.

4.6   RECOMMENDATIONS

Recommendations for practice (Industry)
- SMEs may be provided with incentives to adopt open source ERP. These may be in the form of training packages and skills workshops to help overcome the barriers and improve implementation of open source ERP. ERP vendors may provide training in open source software as an alternative to proprietary software.
- There is need for increased formal education and training in open source software development and emphasis on ERP tools.
- Financial support should be provided for SME that adopt open source tools. This support can be in the form of government grants and budget allocations through structures such as SEDA and DTI.

- SME and university collaborations should exist whereby the latter needs to include software development tools in their curricula for SMEs so as to increase awareness. In adopting open source ERP SMEs need to consider the current offerings from proprietary systems.

- SMEs should make clear-cut comparisons of existing proprietary systems against open source systems by focusing on functional and technological requirements. This will help to reflect a cost benefit analysis as well as interoperability between the open source ERP and existing systems.

- Strengthen the Internet capacities of SMEs through nurturing ERP implementation at a local level (South African context) and then examining the feasibility of a local/regional mechanism to promote information sharing and capacity building with a view to enhancing the efficiency and competitiveness of SMEs.

4.7 IMPLEMENTATION FRAMEWORK AND GUIDELINES

The empirical study and literature study both indicate the need for guidelines in the adoption and implementation of open source ERP. It is recommended that the life cycle for implementation of ERP should go through these phases highlighted below, in that order. The flowchart for the proposed implementation is shown in Figure 4.1

Figure 4.1: Proposed implementation
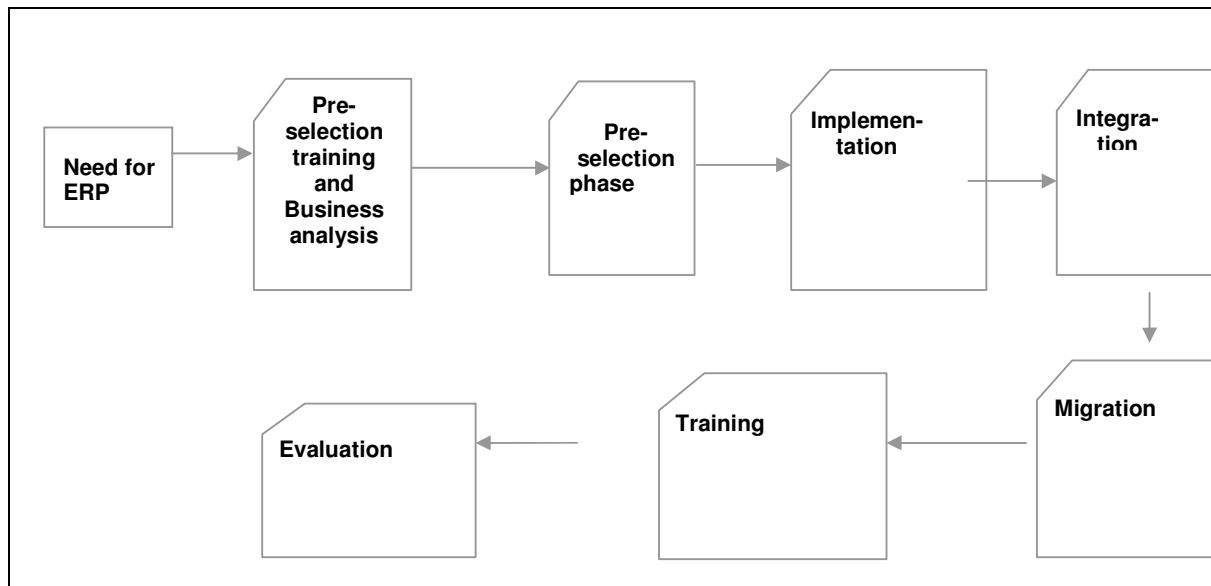
1. **Pre-selection Awareness and Training**

   It is clear from the empirical study that SMEs need extensive awareness training on ERP tools and the options available to them. In the pre-selection phase information about ERP and the support levels available for the open source option should be made available. It is critical that a comparative analysis is done with existing proprietary systems. It is important to use a few live prototypes of the system to ensure that users understand the functionalities.

2. **Selection Phase**

   In this phase it is important for vendors to work with SMEs. The selection phase requires the vendor and SME to understand the business processes. It is important that the users of the system are engaged. In most cases the new system has to capture most if not all the current processes hence it is important to have the input of end users. In this case a project team involving members of the client (small or medium sized business) as well as the supplier should be created for the implementation process. It is important during this phase to determine if the business needs can actually be met by acquisition of a new ERP system. When this has been established, new ERP tools are selected and customised to meet the identified needs of the users. This way the users will be able to fully utilise the tool's features.

3. **Implementation**

   In this phase the ERP project team should strive for the successful implementation of the system within time and within the available financial and human budget. Members of the project team should include a representative of end-users from each of the business functional areas. This person is there to ensure that the needs of users are captured during the project roll-out. This stage involves a lot of planning. The performance of the system depends entirely on how it is installed, configured and rolled out. One important issue to build into the system is that of *scalability* so that the business can still utilise the same installed as it expands. A proper change management plan needs to be in place and should focus on the benefits of the proposed change (Marnewick & Labuschagne, 2005:144). This will ensure that resistance to change is minimised.

4.   Integration

Adopting open source ERP by an SME requires that plans be in place to assimilate the new system into existing tools. This is because the new system may need to communicate with mail-servers and spreadsheets for report generation and customers' software. Integration of systems allows for compatibility and best-fit as the processes will be utilised.

5.   Migration

There needs to be a plan to migrate from the current older system to the new system. This can be done per individual module offered within the ERP package. The solution should allow migration and import of data from different file systems. This means the new open source ERP tool should provide an interface allowing multiple sources of data such as text file, Excel and more. The migration plan should also ensure that irrelevant data is eliminated.

6.   Training phase

In this phase users are taken through the operability of the new system. It is important that users are given as much information about the product as possible. This in particular applies to open source ERP as literature on specific tools is limited and there are few consultants. At this stage it is possible that the system specification can change as users will raise issues on operational capability. When completed it is also important to train users on the system. At this stage it will be important to ensure that the system is not complex; but understandable and with ease of use. This can be enhanced by the use of a basic user manual to ensure that users have easy reference material.

6.   Post implementation evaluation

At this stage the impact of the project on business operations is done. This allows any changes to be made. These changes may entail further customisation of the system. The user experience is also important at this stage. Post implementation is critical as it helps to monitor effectiveness of the ERP tools and compatibility with overall firm systems.

FUTURE WORK

From the study it is clear that a lot of research still needs to be done. It is important to investigate why universities and other tertiary institutes are not focusing on open source tools. The role of vendors in the development of the open source software development needs to be investigated as well as the financial impact of transition to the new system. From the study it is clear that users are aware of the benefits of ERP tools but the utilisation and uptake is low which means other mechanisms such as financial support for research and training need to be investigated.

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ENTERPRISE RESOURCE PLANNING IN MANUFACTURINF SMES IN THE VAAL TRIANGLE

PLEASE NOTE:
THIS QUESTIONNAIRE MUST ONLY BE COMPLETED BY SMES IN THE MANUFACTURING SECTOR IN THE VAAL REGION

All information will be treated as **STRICTLY CONFIDENTIAL** and will only be used for academic   purposes.

INSTRUCTIONS FOR COMPLETION:

1. Please answer the questions as objectively and honestly as possible.

2. Place a **cross (X)** in the space provided at each question which reflects your answer the most accurately. Use the following key: **1**= Strongly disagree; **2**= Disagree; **3**= Neutral; **4**= Agree; **5**= Strongly agree

B1	I always generate fresh business ideas	1	2	3	**4X**	5

In this section we would like to find out a little more about you. Please place a cross (x) in the appropriate block.

A1: **Please indicate your gender?**

Male	1
Female	2

A2: Indicate your age category

Under 30 years	1
30 – 39 years	2
40 – 49 years	3
50 years and above	4

A3 Indicate your highest level of education

Primary school education	1
High School education (Grade 12)	2
Undergraduate or equivalent degree	3
Postgraduate or equivalent degree	4
Other	5

SECTION B   BUSINESS PROFILE

In this section we would like to find out a little more about your business. Please place a cross (X) in the appropriate box

B1 When did you start your business

Less than twelve months back	1
Between 1-3 years ago	2
More than 3 years ago	3

B2 Is your business registered?

YES	1
NO	2

B3: What is the legal form of your business?

Sole trader	1
Partnership	2
Close corporation	3
Co-operative	4
Other	5

B4: In which sector is your business?

Chemicals	1
Food	2
Equipment	3
Oil/gas	4
Other	5

B5: Please indicate the number of full time employees in your business**?**

Fewer than 50 employees	1
Between 50 and 100 employees	2
Between 101 and 150 employees	3
Between 150 and 200 employees	4
More than 200 employees	5

B6: What is the estimated annual turnover for your business?

R2 million to < R4 million	1
R4 million to < R8 million	2
R8 million to < R16 million	3
R16 million to <R32 million	4

Over R3200	5

B7:**Which of the following would be a major objective for your business in the next three years?**

To reduce in size	1
To stay the same	2
To stay the same To grow	3

SECTION C: KNOWLEDGE OF OPEN SOURCE TOOLS

We would like to find out a little about the training you have received. Please indicate the extent to which you agree or disagree with the statements according to the scale provided below.

Strongly agree	*Agree*	*Neither agree or disagree*	*Disagree*	*Strongly disagree*
5	*4*	*3*	*2*	*1*

		Strongly Disagree	Disagree	Neither	Agree	Strongly Agree
C1	I am comfortable using office tools such as word-processing, spreadsheets	1	2	3	4	5
C2	I have received training on open source tools	1	2	3	4	5
C3	My organisation uses open source tools	1	2	3	4	5
C4	We have an IT training program for staff	1	2	3	4	5
C5	We always get updates on new software tools	1	2	3	4	5
C6	We know about Open source Foundation	1	2	3	4	5

C7	I am familiar with open source webservers	1	2	3	4	5
C8	I am familiar with Open source office suites	1	2	3	4	5
C9	I am familiar with Open source development tools	1	2	3	4	5
C10	I am familiar with open source support tools	1	2	3	4	5
C11	***3 years from now our use of ERP will decrease***	1	2	3	4	5
C12	3 years from now our use ofERP will increase	1	2	3	4	5

		Strongly Disagree	Disagree	Neither	Agree	Strongly Agree
C13	3 years from now our use of ERP will stay the same	1	2	3	4	5

SECTION D ERP BENEFITS

We would like to find out a little about the benefits that accrue to your business from using open source ERP. Below are a number of descriptors on the benefits of ERP. Please indicate the extent to which you agree or disagree with the statements according to the scale provided below.

An open source ERP tool enables:

		Strongly Disagree	Disagre Disagree	Neither	Agree	Strongly Agree
D1	A reduction in business operational costs	1	2	3	4	5
D2	Faster provision of customer services	1	2	3	4	5
D3	Reduction in license costs	1	2	3	4	5
D4	Reduction in hardware upgrade costs	1	2	3	4	5
D5	Reduction in support costs	1	2	3	4	5
D6	***Increase in software reliability***	1	2	3	4	5
D7	The business to have better security	1	2	3	4	5
D8	Availability of Support	1	2	3	4	5
D9	The business to reduce risks associated with support	1	2	3	4	5
D10	The business to gather information on production	1	2	3	4	5
D11	The business to gather information on markets	1	2	3	4	5
D12	The business to gather information on suppliers	1	2	3	4	5
D13	The business to gather information on competitors	1	2	3	4	5
D14	Business to be conducted from anywhere in Gauteng	1	2	3	4	5
D15	Business activities to be conducted 24 hours a day	1	2	3	4	5
D16	Personal contact between the organisation and our customers	1	2	3	4	5
D17	The business to eliminate the cost of intermediaries	1	2	3	4	5

		Strongly Disagree	Disagree	Neither	Agree	Strongly Agree
D18	The business to benefit from increased customer loyalty	1	2	3	4	5
D19	The organisation to acquire solid business relationships	1	2	3	4	5
D20	Improved communication flow within the organisation	1	2	3	4	5
D21	Improved communication flow among various stakeholders outside the organisation	1	2	3	4	5
D22	Improved productivity of managers	1	2	3	4	5
D23	The business to track and assess the effectiveness of its promotional campaigns	1	2	3	4	5
D24	Our organisation to enhance business performance	1	2	3	4	5
D25	Our organisation to enhance its image	1	2	3	4	5
D26	Our organisation to enjoy high profits	1	2	3	4	5
D27	Our organisation to enjoy increased market share	1	2	3	4	5
D28	Our organisation to survive	1	2	3	4	5

SECTION E ERP ADOPTION

We would like to find out a little about the adoption of ERP in your organisation. Please indicate the extent to which you agree or disagree with the statements.

Question (1-3): Our organisation has the

		Strongly Disagree	Disagree	Neither	Agree	Strongly Agree
E1	Financial resources to adopt ERP	1	2	3	4	5
E2	Technological resources to adopt ERP	1	2	3	4	5
E3	Adequate staff skills to adopt ERP	1	2	3	4	5

Question (E4-E7): Open source ERP technology is :

		Strongly Disagree	Disagree	Neither	Agree	Strongly
E4	Easy to use	1	2	3	4	5
E5	Flexible to use	1	2	3	4	5
E6	Understandable	1	2	3	4	5
E7	Possible to implement because there is an abundance of trainers	1	2	3	4	5

Question (8-11): In the decision to adopt ERP

		Strongly Disagree	Disagree	Neither	Agree	Strongly
E8	Our competitors are pressuring us	1	2	3	4	5
E9	Our industry is pressuring us	1	2	3	4	5
E10	Our suppliers are pressuring us	1	2	3	4	5
E11	Our government is pressuring us	1	2	3	4	5

Question (12-16): In adopting ERP

		Strongly Disagree	Disagree	Neither	Agree	Strongly
E12	Top management is very enthusiastic	1	2	3	4	5
E13	Our employees are very enthusiastic	1	2	3	4	5
E14	Our organisation will meet customer demands	1	2	3	4	5
E15	Our organisation will gain competitive advantage	1	2	3	4	5

Question (17-20): ERP is consistent with our organisation's

		Strongly Disagree	Disagree	Neither	Agree	Strongly
E17	Goals	1	2	3	4	5
E18	Values	1	2	3	4	5
E19	Culture	1	2	3	4	5
E20	Technology infrastructure	1	2	3	4	5

Question (21-25): Using ERP would enable employees to

		Strongly Disagree	Disagre Disagree	Neither	Agree	Strongly
E21	Improve job performance	1	2	3	4	5
E22	Increase productivity	1	2	3	4	5
E23	Increase effectiveness on the job	1	2	3	4	5
E24	Do their job with greater ease	1	2	3	4	5
E25	Increase motivation in the work place	1	2	3	4	5

SECTION F (BARRIERS/ CHALLENGES TO ERP ADOPTION)

		Strongly Disagree	Disagre Disagree	Neither	Agree	Strongly Agree
F1	Too expensive to implement	1	2	3	4	5
F2	Lacks vendor support	1	2	3	4	5
F3	Disorganised	1	2	3	4	5
F4	Not relevant to our line of business	1	2	3	4	5
F5	Not consistent with the size of our business	1	2	3	4	5
F6	***Too difficult to manage and maintain***	1	2	3	4	5
F7	Time-consuming to implement	1	2	3	4	5
F8	A security threat for our business	1	2	3	4	5
F9	Lack of application offerings in the market	1	2	3	4	5
F10	Lack of support & maintenance	1	2	3	4	5
F11	No training and advice on open source tools	1	2	3	4	5
F12	There is fear of Risks associated with ERP	1	2	3	4	5

Question (13-20): In the decision to adopt ERP

		Strongly Disagree	Disagree	Neither	Agree	Strongly
F13	**Few of our organisation's** Suppliers and customers use Open Source ERP	1	2	3	4	5
F14	**Few of our organisation's** Competitors use Open Source ERP	1	2	3	4	5
F15	**Our organisation** Does not know much about open source ERP	1	2	3	4	5
F16	**Our organisation** Is not aware of government open source	1	2	3	4	5

F17	**Our organisation** Lacks training and support from the ERP vendors	1	2	3	4	5
F18	Does not possess adequate staff skills in IT	1	2	3	4	5
F19	**Our market** Possesses an element of fear surrounding use of ERP in our organisation	1	2	3	4	5
F20	Vendors do not understand our needs	1	2	3	4	5

SECTION G IMPACT OF ERP

G1	**ERP has had a** Positive contribution to our business	1	2	3	4	5
G2	**ERP has had a n**egative contribution to our business	1	2	3	4	5
G3	Reduced running costs for the business	1	2	3	4	5
G4	Simplified business processes	1	2	3	4	5

Thank you for your time and cooperation.

Your views are much appreciated.

APPENDIX B

DESCRIPTIVE ANALYSIS RESULTS

Descriptive Statistics					
	N		Minimum	Maximum	Mean
QC1	26		2	5	4.15
QC2	27		1	5	2.85
QC3	27		1	5	2.74
QC4	27		1	5	3.07
QC5	27		1	5	3.00
QC6	26		1	5	2.42
QC7	27		1	5	2.81
QC8	27		1	5	2.96
QC9	26		1	4	2.69
QC10	26		1	5	2.88
QC11	26		1	5	2.19
QC12	27		1	5	3.74
QC13	28		1	5	2.46

Descriptive Statistics				
QD1	28	1	5	3.64
QD2	28	3	5	3.93
QD3	28	2	5	3.14
QD4	28	1	5	3.04
QD5	28	1	5	3.25
QD6	28	1	5	3.68
QD7	28	1	5	3.50
QD8	28	1	5	3.25
QD9	28	1	5	3.25
QD10	28	2	5	3.93
QD11	28	3	5	4.00
QD12	28	2	5	3.86
QD13	28	3	5	3.93
QD14	28	3	5	4.18
QD15	28	3	5	4.04
QD16	28	1	5	3.46
QD17	27	2	4	3.19
QD18	28	1	5	3.43
QD19	28	1	5	3.29
QD20	27	2	5	4.00
QD21	27	2	5	3.93
QD22	27	1	5	3.81
QD23	27	2	5	3.89
QD24	27	2	5	3.81
QD25	27	2	5	3.81
QD26	27	2	5	3.81
QD27	27	1	5	3.74
QD28	27	3	5	4.33

Descriptive Statistics				
QE1	28	1	5	3.00
QE2	28	1	5	2.86
QE3	27	1	5	2.74
QE4	28	1	5	2.50
QE5	28	1	5	2.57
QE6	28	1	5	2.71
QE7	28	1	5	2.25
QE8	28	1	5	3.04
QE9	28	1	5	2.96
QE10	28	1	5	2.71
QE11	28	1	5	2.68
QE12	28	1	5	3.32
QE13	28	1	5	3.43
QE14	28	2	5	3.64
QE15	28	2	5	3.79
QE17	28	1	5	3.68
QE18	28	2	5	3.75
QE19	28	2	5	3.64
QE20	28	3	5	4.00
QE21	28	3	5	4.18
QE22	28	2	5	4.04
QE23	28	2	5	4.00
QE24	28	2	5	4.04
QE25	28	2	5	3.96

Descriptive Statistics				
QF1	28	2	5	4.25
QF2	28	2	5	4.18
QF3	28	1	5	2.93
QF4	28	1	5	2.75
QF5	28	1	5	2.68
QF6	28	1	5	2.93
QF7	28	1	4	3.18
QF8	28	1	5	3.00
QF9	28	2	5	3.25
QF10	28	1	5	3.64
QF11	27	1	5	4.04
QF12	28	1	5	3.50
QF13	27	2	5	3.93
QF14	28	2	5	3.43
QF15	28	2	5	3.61
QF16	28	1	5	3.79
QF17	28	1	5	3.89
QF18	28	1	5	3.46
QF19	28	1	5	3.64
QF20	28	1	5	3.54

Descriptive Statistics				
QG1	28	1	5	3.86
QG2	28	1	4	2.32
QG3	28	2	5	3.36
QG4	28	2	5	3.71
Valid N (listwise)	18			

.

Frequency

Tables

QA1

		Frequency	Percent	Valid Percent
Valid	Male	16	57.1	57.1
	Female	12	42.9	42.9
	Total	28	100.0	100.0

QA2

		Frequency	Percent	Valid Percent
Valid	Under 30	12	42.9	42.9
	30 - 39	10	35.7	35.7
	40 - 49	4	14.3	14.3
	50 +	2	7.1	7.1
	Total	28	100.0	100.0

QA3

		Frequency	Percent	Valid Percent
Valid	High School	8	28.6	28.6
	Undergraduate/Equivalent	12	42.9	42.9
	Post Graduate/Equivalent	7	25.0	25.0
	Other	1	3.6	3.6
	Total	28	100.0	100.0

QB1

		Frequency	Percent	Valid Percent
Valid	Less than 12 months	4	14.3	14.3
	1 - 3 years	14	50.0	50.0
	3 years +	10	35.7	35.7
	Total	28	100.0	100.0

QB2

			Frequency	Percent	Valid Percent
Valid	Yes		22	78.6	81.5
	No		5	17.9	18.5
	Total		27	96.4	100.0
Missing	System		1	3.6	
Total			28	100.0	

QB3

			Frequency	Percent	Valid Percent
Valid	Sole Trader		10	35.7	35.7
	Partnership		5	17.9	17.9
	Close Corporation		9	32.1	32.1
	Co - Operative		3	10.7	10.7
	Other		1	3.6	3.6
	Total		28	100.0	100.0

QB4

			Frequency	Percent	Valid Percent
Valid	Chemical		4	14.3	14.3
	Food		10	35.7	35.7
	Equipment		6	21.4	21.4
	Oil/Gas		1	3.6	3.6
	Other		7	25.0	25.0
	Total		28	100.0	100.0

QB5

			Frequency	Percent	Valid Percent
Valid	Less than 50		25	89.3	89.3
	50 - 100		1	3.6	3.6
	101- 150		2	7.1	7.1
	Total		28	100.0	100.0

QB6

			Frequency	Percent	Valid Percent
Valid	2 million to < 4 million		21	75.0	77.8
	4 million to < 8 million		2	7.1	7.4
	32 million +		4	14.3	14.8
	Total		27	96.4	100.0
Missing	System		1	3.6	
Total			28	100.0	

QB7

			Frequency	Percent	Valid Percent
Valid	Reduce		1	3.6	3.7
	Same		2	7.1	7.4
	Grow		24	85.7	88.9
	Total		27	96.4	100.0
Missing	System		1	3.6	
Total			28	100.0	

QC1

			Frequency	Percent	Valid Percent
Valid	2		1	3.6	3.8
	3		4	14.3	15.4
	4		11	39.3	42.3
	5		10	35.7	38.5
	Total		26	92.9	100.0
Missing	System		2	7.1	
Total			28	100.0	

QC2

			Frequency	Percent	Valid Percent
Valid	1		3	10.7	11.1
	2		11	39.3	40.7
	3		3	10.7	11.1
	4		7	25.0	25.9
	5		3	10.7	11.1
	Total		27	96.4	100.0
Missing	System		1	3.6	
Total			28	100.0	

QC3

			Frequency	Percent	Valid Percent
Valid	1		4	14.3	14.8
	2		9	32.1	33.3
	3		5	17.9	18.5
	4		8	28.6	29.6
	5		1	3.6	3.7
	Total		27	96.4	100.0
Missing	System		1	3.6	
Total			28	100.0	

QC4

			Frequency	Percent	Valid Percent
Valid	1		3	10.7	11.1
	2		6	21.4	22.2
	3		6	21.4	22.2
	4		10	35.7	37.0
	5		2	7.1	7.4
	Total		27	96.4	100.0
Missing	System		1	3.6	
Total			28	100.0	

QC5

			Frequency	Percent	Valid Percent
Valid	1		3	10.7	11.1
	2		9	32.1	33.3
	3		4	14.3	14.8
	4		7	25.0	25.9
	5		4	14.3	14.8
	Total		27	96.4	100.0
Missing	System		1	3.6	
Total			28	100.0	

QC6

			Frequency	Percent	Valid Percent
Valid	1		10	35.7	38.5
	2		5	17.9	19.2
	3		2	7.1	7.7
	4		8	28.6	30.8
	5		1	3.6	3.8
	Total		26	92.9	100.0
Missing	System		2	7.1	
Total			28	100.0	

QC7

			Frequency	Percent	Valid Percent
Valid	1		5	17.9	18.5
	2		7	25.0	25.9
	3		5	17.9	18.5
	4		8	28.6	29.6
	5		2	7.1	7.4
	Total		27	96.4	100.0
Missing	System		1	3.6	
Total			28	100.0	

QC8

			Frequency	Percent	Valid Percent
Valid	1		4	14.3	14.8
	2		7	25.0	25.9
	3		4	14.3	14.8
	4		10	35.7	37.0
	5		2	7.1	7.4
	Total		27	96.4	100.0
Missing	System		1	3.6	
Total			28	100.0	

QC9

			Frequency	Percent	Valid Percent
Valid	1		5	17.9	19.2
	2		7	25.0	26.9
	3		5	17.9	19.2
	4		9	32.1	34.6
	Total		26	92.9	100.0
Missing	System		2	7.1	
Total			28	100.0	

QC10

			Frequency	Percent	Valid Percent
Valid	1		3	10.7	11.5
	2		9	32.1	34.6
	3		5	17.9	19.2
	4		6	21.4	23.1
	5		3	10.7	11.5
	Total		26	92.9	100.0
Missing	System		2	7.1	
Total			28	100.0	

QC11

			Frequency	Percent	Valid Percent
Valid	1		9	32.1	34.6
	2		7	25.0	26.9
	3		7	25.0	26.9
	4		2	7.1	7.7
	5		1	3.6	3.8
	Total		26	92.9	100.0
Missing	System		2	7.1	
Total			28	100.0	

QC12

			Frequency	Percent	Valid Percent
Valid	1		1	3.6	3.7
	2		2	7.1	7.4
	3		5	17.9	18.5
	4		14	50.0	51.9
	5		5	17.9	18.5
	Total		27	96.4	100.0
Missing	System		1	3.6	
Total			28	100.0	

QC13

			Frequency	Percent	Valid Percent
Valid	1		6	21.4	21.4
	2		9	32.1	32.1
	3		8	28.6	28.6
	4		4	14.3	14.3
	5		1	3.6	3.6
	Total		28	100.0	100.0

QD1

			Frequency	Percent	Valid Percent
Valid	1		1	3.6	3.6
	2		5	17.9	17.9
	3		3	10.7	10.7
	4		13	46.4	46.4
	5		6	21.4	21.4
	Total		28	100.0	100.0

QD2

			Frequency	Percent	Valid Percent
Valid	3		8	28.6	28.6
	4		14	50.0	50.0
	5		6	21.4	21.4
	Total		28	100.0	100.0

QD3

			Frequency	Percent	Valid Percent
Valid	2		7	25.0	25.0
	3		12	42.9	42.9
	4		7	25.0	25.0
	5		2	7.1	7.1
	Total		28	100.0	100.0

QD4

			Frequency	Percent	Valid Percent
Valid	1		1	3.6	3.6
	2		9	32.1	32.1
	3		9	32.1	32.1
	4		6	21.4	21.4
	5		3	10.7	10.7
	Total		28	100.0	100.0

QD5

			Frequency	Percent	Valid Percent
Valid	1		1	3.6	3.6
	2		6	21.4	21.4
	3		8	28.6	28.6
	4		11	39.3	39.3
	5		2	7.1	7.1
	Total		28	100.0	100.0

QD6

			Frequency	Percent	Valid Percent
Valid	1		1	3.6	3.6
	2		2	7.1	7.1
	3		8	28.6	28.6
	4		11	39.3	39.3
	5		6	21.4	21.4
	Total		28	100.0	100.0

QD7

			Frequency	Percent	Valid Percent
Valid	1		2	7.1	7.1
	2		2	7.1	7.1
	3		9	32.1	32.1
	4		10	35.7	35.7
	5		5	17.9	17.9
	Total		28	100.0	100.0

QD8

			Frequency	Percent	Valid Percent
Valid	1		1	3.6	3.6
	2		6	21.4	21.4
	3		9	32.1	32.1
	4		9	32.1	32.1
	5		3	10.7	10.7
	Total		28	100.0	100.0

QD9

		Frequency	Percent	Valid Percent
Valid	1	1	3.6	3.6
	2	3	10.7	10.7
	3	13	46.4	46.4
	4	10	35.7	35.7
	5	1	3.6	3.6
	Total	28	100.0	100.0

QD10

		Frequency	Percent	Valid Percent
Valid	2	3	10.7	10.7
	3	3	10.7	10.7
	4	15	53.6	53.6
	5	7	25.0	25.0
	Total	28	100.0	100.0

QD11

		Frequency	Percent	Valid Percent
Valid	3	10	35.7	35.7
	4	8	28.6	28.6
	5	10	35.7	35.7
	Total	28	100.0	100.0

QD12

		Frequency	Percent	Valid Percent
Valid	2	1	3.6	3.6
	3	9	32.1	32.1
	4	11	39.3	39.3
	5	7	25.0	25.0
	Total	28	100.0	100.0

QD13

		Frequency	Percent	Valid Percent
Valid	3	8	28.6	28.6
	4	14	50.0	50.0
	5	6	21.4	21.4
	Total	28	100.0	100.0

QD14

		Frequency	Percent	Valid Percent
Valid	3	8	28.6	28.6
	4	7	25.0	25.0
	5	13	46.4	46.4
	Total	28	100.0	100.0

QD15

		Frequency	Percent	Valid Percent
Valid	3	11	39.3	39.3
	4	5	17.9	17.9
	5	12	42.9	42.9
	Total	28	100.0	100.0

QD16

		Frequency	Percent	Valid Percent
Valid	1	2	7.1	7.1
	2	4	14.3	14.3
	3	6	21.4	21.4
	4	11	39.3	39.3
	5	5	17.9	17.9
	Total	28	100.0	100.0

QD17

			Frequency	Percent	Valid Percent
Valid	2		4	14.3	14.8
	3		14	50.0	51.9
	4		9	32.1	33.3
	Total		27	96.4	100.0
Missing	System		1	3.6	
Total			28	100.0	

QD18

			Frequency	Percent	Valid Percent
Valid	1		1	3.6	3.6
	2		3	10.7	10.7
	3		10	35.7	35.7
	4		11	39.3	39.3
	5		3	10.7	10.7
	Total		28	100.0	100.0

QD19

			Frequency	Percent	Valid Percent
Valid	1		1	3.6	3.6
	2		5	17.9	17.9
	3		10	35.7	35.7
	4		9	32.1	32.1
	5		3	10.7	10.7
	Total		28	100.0	100.0

QD20

			Frequency	Percent	Valid Percent
Valid	2		1	3.6	3.7
	3		6	21.4	22.2
	4		12	42.9	44.4
	5		8	28.6	29.6
	Total		27	96.4	100.0
Missing	System		1	3.6	
Total			28	100.0	

QD21

			Frequency	Percent	Valid Percent
Valid	2		1	3.6	3.7
	3		8	28.6	29.6
	4		10	35.7	37.0
	5		8	28.6	29.6
	Total		27	96.4	100.0
Missing	System		1	3.6	
Total			28	100.0	

QD22

			Frequency	Percent	Valid Percent
Valid	1		1	3.6	3.7
	2		1	3.6	3.7
	3		6	21.4	22.2
	4		13	46.4	48.1
	5		6	21.4	22.2
	Total		27	96.4	100.0
Missing	System		1	3.6	
Total			28	100.0	

QD23

			Frequency	Percent	Valid Percent
Valid	2		1	3.6	3.7
	3		8	28.6	29.6
	4		11	39.3	40.7
	5		7	25.0	25.9
	Total		27	96.4	100.0
Missing	System		1	3.6	
Total			28	100.0	

QD24

			Frequency	Percent	Valid Percent
Valid	2		1	3.6	3.7
	3		6	21.4	22.2
	4		17	60.7	63.0
	5		3	10.7	11.1
	Total		27	96.4	100.0
Missing	System		1	3.6	
Total			28	100.0	

QD25

			Frequency	Percent	Valid Percent
Valid	2		2	7.1	7.4
	3		8	28.6	29.6
	4		10	35.7	37.0
	5		7	25.0	25.9
	Total		27	96.4	100.0
Missing	System		1	3.6	
Total			28	100.0	

QD26

			Frequency	Percent	Valid Percent
Valid	2		2	7.1	7.4
	3		8	28.6	29.6
	4		10	35.7	37.0
	5		7	25.0	25.9
	Total		27	96.4	100.0
Missing	System		1	3.6	
Total			28	100.0	

QD27

			Frequency	Percent	Valid Percent
Valid	1		1	3.6	3.7
	2		2	7.1	7.4
	3		8	28.6	29.6
	4		8	28.6	29.6
	5		8	28.6	29.6
	Total		27	96.4	100.0
Missing	System		1	3.6	
Total			28	100.0	

QD28

			Frequency	Percent	Valid Percent
Valid	3		3	10.7	11.1
	4		12	42.9	44.4
	5		12	42.9	44.4
	Total		27	96.4	100.0
Missing	System		1	3.6	
Total			28	100.0	

QE1

			Frequency	Percent	Valid Percent
Valid	1		3	10.7	10.7
	2		5	17.9	17.9
	3		12	42.9	42.9
	4		5	17.9	17.9
	5		3	10.7	10.7
	Total		28	100.0	100.0

QE2

			Frequency	Percent	Valid Percent
Valid	1		4	14.3	14.3
	2		6	21.4	21.4
	3		11	39.3	39.3
	4		4	14.3	14.3
	5		3	10.7	10.7
	Total		28	100.0	100.0

QE3

			Frequency	Percent	Valid Percent
Valid	1		5	17.9	18.5
	2		7	25.0	25.9
	3		7	25.0	25.9
	4		6	21.4	22.2
	5		2	7.1	7.4
	Total		27	96.4	100.0
Missing	System		1	3.6	
Total			28	100.0	

QE4

			Frequency	Percent	Valid Percent
Valid	1		5	17.9	17.9
	2		13	46.4	46.4
	3		3	10.7	10.7
	4		5	17.9	17.9
	5		2	7.1	7.1
	Total		28	100.0	100.0

QE5

			Frequency	Percent	Valid Percent
Valid	1		7	25.0	25.0
	2		6	21.4	21.4
	3		8	28.6	28.6
	4		6	21.4	21.4
	5		1	3.6	3.6
	Total		28	100.0	100.0

QE6

			Frequency	Percent	Valid Percent
Valid	1		5	17.9	17.9
	2		8	28.6	28.6
	3		8	28.6	28.6
	4		4	14.3	14.3
	5		3	10.7	10.7
	Total		28	100.0	100.0

QE7

			Frequency	Percent	Valid Percent
Valid	1		12	42.9	42.9
	2		6	21.4	21.4
	3		3	10.7	10.7
	4		5	17.9	17.9
	5		2	7.1	7.1
	Total		28	100.0	100.0

QE8

			Frequency	Percent	Valid Percent
Valid	1		2	7.1	7.1
	2		5	17.9	17.9
	3		14	50.0	50.0
	4		4	14.3	14.3
	5		3	10.7	10.7
	Total		28	100.0	100.0

QE9

		Frequency	Percent	Valid Percent
Valid	1	3	10.7	10.7
	2	5	17.9	17.9
	3	12	42.9	42.9
	4	6	21.4	21.4
	5	2	7.1	7.1
	Total	28	100.0	100.0

QE10

		Frequency	Percent	Valid Percent
Valid	1	3	10.7	10.7
	2	9	32.1	32.1
	3	11	39.3	39.3
	4	3	10.7	10.7
	5	2	7.1	7.1
	Total	28	100.0	100.0

QE11

		Frequency	Percent	Valid Percent
Valid	1	3	10.7	10.7
	2	11	39.3	39.3
	3	8	28.6	28.6
	4	4	14.3	14.3
	5	2	7.1	7.1
	Total	28	100.0	100.0

QE12

		Frequency	Percent	Valid Percent
Valid	1	1	3.6	3.6
	2	3	10.7	10.7
	3	12	42.9	42.9
	4	10	35.7	35.7
	5	2	7.1	7.1
	Total	28	100.0	100.0

QE13

		Frequency	Percent	Valid Percent
Valid	1	1	3.6	3.6
	2	1	3.6	3.6
	3	12	42.9	42.9
	4	13	46.4	46.4
	5	1	3.6	3.6
	Total	28	100.0	100.0

QE14

		Frequency	Percent	Valid Percent
Valid	2	1	3.6	3.6
	3	12	42.9	42.9
	4	11	39.3	39.3
	5	4	14.3	14.3
	Total	28	100.0	100.0

QE15

		Frequency	Percent	Valid Percent
Valid	2	1	3.6	3.6
	3	9	32.1	32.1
	4	13	46.4	46.4
	5	5	17.9	17.9
	Total	28	100.0	100.0

QE17

		Frequency	Percent	Valid Percent
Valid	1	1	3.6	3.6
	3	12	42.9	42.9
	4	9	32.1	32.1
	5	6	21.4	21.4
	Total	28	100.0	100.0

QE18

			Frequency	Percent	Valid Percent
Valid	2		1	3.6	3.6
	3		12	42.9	42.9
	4		8	28.6	28.6
	5		7	25.0	25.0
	Total		28	100.0	100.0

QE19

			Frequency	Percent	Valid Percent
Valid	2		3	10.7	10.7
	3		11	39.3	39.3
	4		7	25.0	25.0
	5		7	25.0	25.0
	Total		28	100.0	100.0

QE20

			Frequency	Percent	Valid Percent
Valid	3		9	32.1	32.1
	4		10	35.7	35.7
	5		9	32.1	32.1
	Total		28	100.0	100.0

QE21

			Frequency	Percent	Valid Percent
Valid	3		2	7.1	7.1
	4		19	67.9	67.9
	5		7	25.0	25.0
	Total		28	100.0	100.0

QE22

		Frequency	Percent	Valid Percent
Valid	2	2	7.1	7.1
	3	3	10.7	10.7
	4	15	53.6	53.6
	5	8	28.6	28.6
	Total	28	100.0	100.0

QE23

		Frequency	Percent	Valid Percent
Valid	2	1	3.6	3.6
	3	5	17.9	17.9
	4	15	53.6	53.6
	5	7	25.0	25.0
	Total	28	100.0	100.0

QE24

		Frequency	Percent	Valid Percent
Valid	2	2	7.1	7.1
	3	3	10.7	10.7
	4	15	53.6	53.6
	5	8	28.6	28.6
	Total	28	100.0	100.0

QE25

		Frequency	Percent	Valid Percent
Valid	2	1	3.6	3.6
	3	7	25.0	25.0
	4	12	42.9	42.9
	5	8	28.6	28.6
	Total	28	100.0	100.0

QF1

		Frequency	Percent	Valid Percent
Valid	2	1	3.6	3.6
	3	4	14.3	14.3
	4	10	35.7	35.7
	5	13	46.4	46.4
	Total	28	100.0	100.0

QF2

		Frequency	Percent	Valid Percent
Valid	2	1	3.6	3.6
	3	4	14.3	14.3
	4	12	42.9	42.9
	5	11	39.3	39.3
	Total	28	100.0	100.0

QF3

		Frequency	Percent	Valid Percent
Valid	1	1	3.6	3.6
	2	8	28.6	28.6
	3	13	46.4	46.4
	4	4	14.3	14.3
	5	2	7.1	7.1
	Total	28	100.0	100.0

QF4

		Frequency	Percent	Valid Percent
Valid	1	3	10.7	10.7
	2	9	32.1	32.1
	3	10	35.7	35.7
	4	4	14.3	14.3
	5	2	7.1	7.1
	Total	28	100.0	100.0

QF5

			Frequency	Percent	Valid Percent
Valid	1		4	14.3	14.3
	2		7	25.0	25.0
	3		12	42.9	42.9
	4		4	14.3	14.3
	5		1	3.6	3.6
	Total		28	100.0	100.0

QF6

			Frequency	Percent	Valid Percent
Valid	1		2	7.1	7.1
	2		8	28.6	28.6
	3		10	35.7	35.7
	4		6	21.4	21.4
	5		2	7.1	7.1
	Total		28	100.0	100.0

QF7

			Frequency	Percent	Valid Percent
Valid	1		1	3.6	3.6
	2		4	14.3	14.3
	3		12	42.9	42.9
	4		11	39.3	39.3
	Total		28	100.0	100.0

QF8

			Frequency	Percent	Valid Percent
Valid	1		1	3.6	3.6
	2		8	28.6	28.6
	3		10	35.7	35.7
	4		8	28.6	28.6
	5		1	3.6	3.6
	Total		28	100.0	100.0

QF9

			Frequency	Percent	Valid Percent
Valid	2		6	21.4	21.4
	3		12	42.9	42.9
	4		7	25.0	25.0
	5		3	10.7	10.7
	Total		28	100.0	100.0

QF10

			Frequency	Percent	Valid Percent
Valid	1		1	3.6	3.6
	2		3	10.7	10.7
	3		7	25.0	25.0
	4		11	39.3	39.3
	5		6	21.4	21.4
	Total		28	100.0	100.0

QF11

			Frequency	Percent	Valid Percent
Valid	1		1	3.6	3.7
	2		2	7.1	7.4
	3		4	14.3	14.8
	4		8	28.6	29.6
	5		12	42.9	44.4
	Total		27	96.4	100.0
Missing	System		1	3.6	
Total			28	100.0	

QF12

			Frequency	Percent	Valid Percent
Valid	1		2	7.1	7.1
	2		1	3.6	3.6
	3		11	39.3	39.3
	4		9	32.1	32.1
	5		5	17.9	17.9
	Total		28	100.0	100.0

QF13

			Frequency	Percent	Valid Percent
Valid	2		2	7.1	7.4
	3		4	14.3	14.8
	4		15	53.6	55.6
	5		6	21.4	22.2
	Total		27	96.4	100.0
Missing	System		1	3.6	
Total			28	100.0	

QF14

			Frequency	Percent	Valid Percent
Valid	2		4	14.3	14.3
	3		9	32.1	32.1
	4		14	50.0	50.0
	5		1	3.6	3.6
	Total		28	100.0	100.0

QF15

			Frequency	Percent	Valid Percent
Valid	2		4	14.3	14.3
	3		8	28.6	28.6
	4		11	39.3	39.3
	5		5	17.9	17.9
	Total		28	100.0	100.0

QF16

			Frequency	Percent	Valid Percent
Valid	1		1	3.6	3.6
	2		3	10.7	10.7
	3		5	17.9	17.9
	4		11	39.3	39.3
	5		8	28.6	28.6
	Total		28	100.0	100.0

QF17

			Frequency	Percent	Valid Percent
Valid	1		1	3.6	3.6
	2		6	21.4	21.4
	3		1	3.6	3.6
	4		7	25.0	25.0
	5		13	46.4	46.4
	Total		28	100.0	100.0

QF18

			Frequency	Percent	Valid Percent
Valid	1		1	3.6	3.6
	2		6	21.4	21.4
	3		8	28.6	28.6
	4		5	17.9	17.9
	5		8	28.6	28.6
	Total		28	100.0	100.0

QF19

			Frequency	Percent	Valid Percent
Valid	1		1	3.6	3.6
	2		2	7.1	7.1
	3		10	35.7	35.7
	4		8	28.6	28.6
	5		7	25.0	25.0
	Total		28	100.0	100.0

QF20

			Frequency	Percent	Valid Percent
Valid	1		2	7.1	7.1
	2		2	7.1	7.1
	3		9	32.1	32.1
	4		9	32.1	32.1
	5		6	21.4	21.4
	Total		28	100.0	100.0

QG1

			Frequency	Percent	Valid Percent
Valid	1		1	3.6	3.6
	3		5	17.9	17.9
	4		18	64.3	64.3
	5		4	14.3	14.3
	Total		28	100.0	100.0

QG2

			Frequency	Percent	Valid Percent
Valid	1		6	21.4	21.4
	2		12	42.9	42.9
	3		5	17.9	17.9
	4		5	17.9	17.9
	Total		28	100.0	100.0

QG3

			Frequency	Percent	Valid Percent
Valid	2		5	17.9	17.9
	3		9	32.1	32.1
	4		13	46.4	46.4
	5		1	3.6	3.6
	Total		28	100.0	100.0

QG4

			Frequency	Percent	Valid Percent
Valid	2		1	3.6	3.6
	3		9	32.1	32.1
	4		15	53.6	53.6
	5		3	10.7	10.7
	Total		28	100.0	100.0

RELIABILITY ANALYSIS SUMMARY

KNOWLEDGE OF OPEN SOURCE TOOLS

Item-Total Statistics				
	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Squared Multiple Correlation	Cronbach's Alpha if Item Deleted
QC1	34.17	65.605	.152	.471	.812
QC2	35.61	57.431	.517	.801	.786
QC3	35.61	55.613	.650	.872	.774
QC4	35.30	58.767	.467	.712	.790
QC5	35.39	59.885	.368	.857	.799
QC6	35.83	57.787	.421	.771	.795
QC7	35.35	57.874	.490	.388	.788
QC8	35.22	54.542	.704	.959	.769
QC9	35.52	56.352	.673	.939	.774
QC10	35.35	56.419	.575	.796	.781
QC11	36.04	62.953	.236	.788	.809
QC12	34.65	69.692	-.131	.700	.833
QC13	35.61	58.067	.574	.725	.782

	BENEFITS OF ERP ADOPTION	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Squared Multiple Correlation	Cronbach's Alpha if Item Deleted
	Scale Mean if Item Deleted				
QD1	99.38	142.246	-.312	.	.873
QD2	99.15	126.935	.538	.	.849
QD3	99.88	128.426	.322	.	.853
QD4	100.08	125.034	.389	.	.852
QD5	99.85	128.615	.260	.	.856
QD6	99.38	123.126	.495	.	.848
QD7	99.62	122.726	.483	.	.848
QD8	99.85	128.535	.277	.	.855
QD9	99.85	131.975	.153	.	.858
QD10	99.19	128.882	.293	.	.854
QD11	99.08	126.314	.457	.	.850
QD12	99.23	129.145	.312	.	.854
QD13	99.12	125.866	.580	.	.847
QD14	98.88	123.626	.604	.	.846
QD15	99.04	125.398	.464	.	.849
QD16	99.62	128.566	.209	.	.859
QD17	99.88	131.146	.260	.	.855
QD18	99.65	123.675	.506	.	.848
QD19	99.85	125.815	.402	.	.851
QD20	99.08	131.914	.160	.	.858
QD21	99.15	127.175	.387	.	.851
QD22	99.27	128.925	.264	.	.855
QD23	99.19	123.522	.598	.	.846
QD24	99.27	126.045	.592	.	.847
QD25	99.27	122.045	.618	.	.844
QD26	99.27	123.565	.542	.	.847
QD27	99.23	118.665	.767	.	.839
QD28	98.77	125.385	.651	.	.846

ERP ADOPTION DECISIONS					
	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Squared Multiple Correlation	Cronbach's Alpha if Item Deleted
QE1	76.04	175.191	.488	.	.913
QE2	76.15	172.746	.533	.	.912
QE3	76.26	171.430	.562	.	.911
QE4	76.59	166.174	.818	.	.905
QE5	76.48	166.644	.748	.	.907
QE6	76.30	164.601	.764	.	.906
QE7	76.81	162.080	.782	.	.906
QE8	76.04	181.422	.326	.	.916
QE9	76.07	175.456	.507	.	.912
QE10	76.30	174.140	.558	.	.911
QE11	76.41	176.174	.515	.	.912
QE12	75.70	173.678	.686	.	.909
QE13	75.56	181.564	.408	.	.914
QE14	75.37	175.011	.733	.	.909
QE15	75.22	175.795	.686	.	.910
QE17	75.30	181.217	.346	.	.915
QE18	75.19	177.772	.564	.	.911
QE19	75.30	181.063	.352	.	.915
QE20	75.04	177.422	.601	.	.911
QE21	74.81	186.772	.257	.	.916
QE22	75.00	182.462	.349	.	.915
QE23	75.04	179.422	.541	.	.912
QE24	75.00	187.692	.115	.	.918
QE25	75.04	179.575	.467	.	.913

BARRIERS TO ADOPTION OF OPEN SOURCE ERP					
	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Squared Multiple Correlation	Cronbach's Alpha if Item Deleted
QF1	65.46	83.618	.592	.936	.814
QF2	65.58	82.574	.654	.950	.811
QF3	66.88	89.786	.149	.866	.833
QF4	67.04	90.758	.071	.985	.839
QF5	67.12	90.346	.096	.983	.837
QF6	66.88	92.746	-.025	.907	.843
QF7	66.58	86.014	.453	.819	.820
QF8	66.69	86.382	.375	.835	.823
QF9	66.50	84.580	.446	.901	.820
QF10	66.08	82.554	.591	.969	.813
QF11	65.77	80.745	.559	.971	.813
QF12	66.31	79.022	.697	.970	.806
QF13	65.85	93.015	-.021	.955	.839
QF14	66.31	87.742	.355	.932	.824
QF15	66.12	82.746	.574	.795	.814
QF16	65.96	83.158	.433	.832	.820
QF17	65.96	82.038	.399	.972	.823
QF18	66.27	79.085	.641	.976	.808
QF19	66.08	81.754	.642	.921	.811
QF20	66.19	82.082	.551	.870	.814

Impact of ERP

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.344	.401	4