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# Enterprise Resource Planning (ERP)

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# Enterprise Resource Planning (ERP) Solution Selection Criteria in Medium-Sized South African Companies

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A Research Report submitted to the Faculty of Commerce, Law and Management, University of the Witwatersrand, Johannesburg, in partial fulfilment of the requirements for the degree of Master of Business Administration

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## Abstract

The purpose of this study was to identify the factors that medium-sized South African companies consider important in the acquisition of an Enterprise Resource Planning (ERP) solution. Through an extensive literature review, fourteen ERP selection criteria were identified. A questionnaire incorporating these criteria was developed. Eighty survey respondents were asked to rate the criteria on a scale of zero to ten.

The original fourteen criteria are considered by medium-sized businesses when selecting an ERP system. The three most important assessment areas are reliability, service (support), and compatibility. Manufacturing and non-manufacturing companies rate reliability, service and support, and compatibility as the three most important criteria, but have a different perspective on the importance of the remaining criteria

## Declaration

I, Mohohlo Malie, declare that this research report is my own, unaided work. It is submitted in partial fulfilment of the requirements for the degree of Master of Business Administration in the University of the Witwatersrand, Johannesburg. It has not been submitted before for any degree or examination in this or any other university.

_____

Mohohlo Malie

3 December, 2006

## Dedication

In loving memory of my grandmother Leah Malie.

## Acknowledgements

I would like to thank Professor Neil Duffy whose guidance insights and patience have been very valuable to me.

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# Chapter 1: Introduction

## Background to the research

In recent years, the Enterprise Resource Planning (ERP) market has undergone significant change. From a structural perspective there has been significant consolidation.

Three of the five leading mid-market ERP vendors in 2000 (JD Edwards, PeopleSoft and Baan) no longer existed as independent companies in 2005. The ERP market has also shown signs of maturation. With many large companies having completed significant ERP implementations, sales in this market segment have slowed down in recent years. In response to this trend, leading ERP vendors have sought out new customers in the "mid-market". Product and marketing strategies have been redesigned in order to match the needs of these medium-sized companies.

Historically, ERP systems have been targeted at large organisations that are willing and able to spend tens or hundreds of millions of dollars on an integrated software system. Focused attention on the mid-market is a relatively new challenge - one which the software industry is still reorganising to meet.

While there are challenges facing ERP vendors in positioning, developing channels, marketing, pricing and supporting mid-market clients there are also challenges that clients will face. The ERP mark*et al*ready has hundreds of products, services and methodologies that may not all be applicable to the mid-tier. Customers will have to be armed with the right tools to avoid fatal errors and make purchases that will generate good returns.

The purpose of this study is to identify the factors that medium-size companies consider important in the acquisition of an Enterprise Resource Planning (ERP) solution. Insights developed from this research can be used to develop guidelines for structured selection of ERP solutions.

As the global economy has become increasingly integrated, the level of competition for investment between emerging economies has intensified. The stakes are usually very high because of the amounts of fixed investments involved, as well the socio-economic impact this has. Businesses in developing nations are under extreme pressure to lower costs, while raising output, quality and reliability.

Companies invariably turn to technology in their efforts to achieve or sustain competitive advantage. There is a constant need to streamline internal processes, cut costs, raise quality and achieve tighter levels of integration. One way of realising these objectives is through the use of Enterprise Resource Planning solutions.

The selection of an enabling technology platform becomes an important strategic issue because the realisation of these competitive targets largely depends on whether a company's systems can provide the required support. The process of selecting, purchasing and implementing an enterprise solution is a major strategic decision which can either enhance or compromise the strategic position of a company. On the one hand a good enterprise solution can:

1. Enable tighter partner integration, allowing for improved planning and sharing of information.
2. Improve supply chain visibility allowing for savings in logistics.
3. Integrate internal processes and increase reliability and efficiency, which can help to improve the strategic position of the company. This could be through greater pricing flexibility, improved product quality, higher reliability of supply or lower operating costs.

On the other hand, a poor choice in the selection of an enterprise solution can negatively impact (or destroy) a company.

Enterprise Resource Planning (ERP) systems are software products that integrate some or all of the functions of a business. For many companies ERP systems are an attractive option to custom development because:

1. The systems are delivered as integrated units, saving the customer the trouble of having to integrate technologies from many vendors.
2. Many companies are not likely to have the resources or the inclination to develop home-grown solutions or to integrate offerings from multiple vendors.
3. ERP systems allow enterprises to make the multi-functional process and organisational changes that may be needed to remain competitive or achieve a competitive advantage.
4. There is a wide range of products (more than 200) to select from. There is also a growing level of competition for middle-market clients (many first tier suppliers fall into this category)

On the other hand, it must be remembered that ERP implementations can be very risky and are often considered as "a wrong purchase…[that] can adversely affect the organisation…even to the point of jeopardising the very existence of the organisation" (Verville and Bernadas 2005:665). Leading companies such as Dell and Allied Waste have abandoned ERP projects after initially making large investments in the technology (Beheshti, 2006).

While it is clear that the implementation of ERP systems is an important step towards remaining competitive on a global level, it is also clear that the actual selection of an ERP must be a carefully considered process.

## Definitions of key concepts

### ERP System

ERP "…systems are designed to address the problem of fragmentation of information or 'islands of information' in business organisations" (Muscatello, Small and Chen, 2003:850). ERP systems integrate company functions and enable efficient sharing of enterprise data (Hicks and Stecke, 1995).

For the purpose of this research, an ERP system will be any system that aims to automate one or more functions of a business. A key requirement is that it must be possible to integrate this system with software from other vendors. The reason for choosing this slightly loose definition is because in some situations the enterprise solution is made up of offerings from a number of different vendors. This may be for historical reasons or may be due to the fact that a best-of-breed solution is required for part of the business. Examples from the author's experience include:

- Industrial Development Corporation of South Africa (IDC), which has a mixture of software from SAP, EMC and AFA Systems.
- In the consumer goods sector, Procter and Gamble employs software from SAP, Oracle and Siebel.
- In the public sector the Johannesburg Roads Agency (JRA) also employs a mixture of software which includes Peoplesoft (an Oracle product) for supporting HR, Finance and Procurement, while Hansen is the preferred solution for operations planning and execution management.

### Medium-size company

There are various definitions of a medium-size company. Section 9 of the National Small Business Amendment Act (2003) provides guidance on company size based on headcount and revenue. A minimum headcount specified for a medium-size company is 200 employees.

In the United Kingdom (UK) a company with a staff complement between 50 and 250 employees is deemed to be medium-sized. The European Union (EU) also applies a similar standard based on company headcount. The UK and the EU also set a revenue range for medium-size companies. In the UK the range is 5.6 million to 22.8 million Pounds. In the EU the range is 10 million to 43 million Euros (University of Strathclyde, 2006). ERP vendors largely rely on headcount as a basis for categorising companies. There is no universally accepted range for any size category.

For the purpose of this research, a company will be deemed to be medium-sized if it has a headcount of between 50 and 500 employees.

A schedule of definitions is included in Appendix 5.

## Importance of the research

### Academic

Ettlie, Perotti and Joseph (2005) found that acquisition strategy accounted for a large proportion of the variance seen in the adoption performance for ERP Systems. While there is a large amount of research on the criteria for successful ERP adoption, a large amount of this research is specifically focused on implementation. “The issue of the acquisition process of ERP software is for the most part being ignored” (Verville *et al*; 2005:666). This research project will contribute to further academic knowledge in the area of ERP adoption.

### Practical: ERP vendors

The sale, implementation and on-going support requirements for software products require a carefully designed ecosystem of channel partners, value-added resellers and independent software vendors to properly service the needs of customers. The design, assembly and optimisation of such an ecosystem are costly, both in terms of money as well as time and effort wasted in tweaking the model to fit client needs. An improved understanding of customer priorities can help to better design the total vendor offering.

### Practical: ERP buyers

Somers and Nelson (2001) indicate that a successful ERP implementation begins with the selection of the right ERP. On the client side there are a large number of factors to be considered when making an important decision such as the purchase of an ERP system. The risks are high, as this is a decision that could either strengthen or cripple a business. Having clear guidance on what issues are likely to be important in the selection process is a useful tool for raising the likelihood of a positive outcome.

## Research problem and sub-problems

### Research Problem

What criteria do medium-sized South African companies use in the selection of an ERP solution?

### Sub-problems

The sub problems identified were as follows:

**Sub-problem 1**

What are the selection criteria to be considered when selecting an ERP solution?

**Sub-problem 2**

What is the relative importance of the selection criteria considered in selecting an ERP solution?

**Sub-problem 3**

ERP systems evolved from manufacturing resource planning (MRPII) systems and have been highly refined for manufacturing applications. Do manufacturing companies emphasise different selection criteria when compared to non-manufacturing companies?

**Sub-problem 4**

Given the rapid pace of change in the information technology sector, what new selection criteria are likely to emerge in the next two to four years?

## Limitations of the research

- This research was limited to medium-sized companies.
- No attempt was be made to compare the selection criteria of medium-sized companies to any other size of company, or to companies outside the geographic scope of the research.
- Factors around the decision of whether to buy or build an ERP solution were not considered.
- The researcher focused on the criteria that are considered during the procurement phase of ERP adoption. The actual procurement process was not analysed.

## Outline of the report

The following chapters of this research proposal will be structured in the following manner:

### Chapter 2

The literature review will cover all identified ERP factors. Propositions based on the literature review will be provided at the end of the chapter.

### Chapter 3

This chapter discusses and provides support for the research design implemented in the research. This includes the sampling procedures, the methods of data collection and the techniques used in the data analysis.

### Chapter 4

This chapter presents the research findings and statistical outputs.

### Chapter 5

This chapter presents an interpretation of the results within the context of the literature review and the research propositions.

### Chapter 6

This chapter discusses the main findings of the research, their implications for the industry and suggestions for future research.

# Chapter 2: Literature review

## Overview

Various researchers have done work to identify ERP package selection criteria. The work of Hecht (1997), Bernroider and Koch (2001), Kumar, Maheshwari and Kumar (2003), Verville and Hallingten (2002) is integrated and complemented by Baki and Cakar (2005), who presented seventeen selection criteria for ERP package selection. Sahay and Gupta (2003) offered a form of partial ranking by separating selection criteria into two groups as shown in Figure 1.

Verville *et al* (2005) observed that the issue of ERP software acquisition was largely being ignored by researchers. A review of the literature further indicates that research in the area of ERP acquisition is largely focused on the acquisition process (Verville *et al*, 2005). The literature was found to be limited in the area of ERP acquisition criteria. In addition to this it has been observed that the majority of research conducted in this area has been concentrated in Europe and the United States of America (Shehab, Sharp, Supramaniam and Spedding, 2004). A summary of the research is included in Table 1 (Shehab *et al*, 2004).

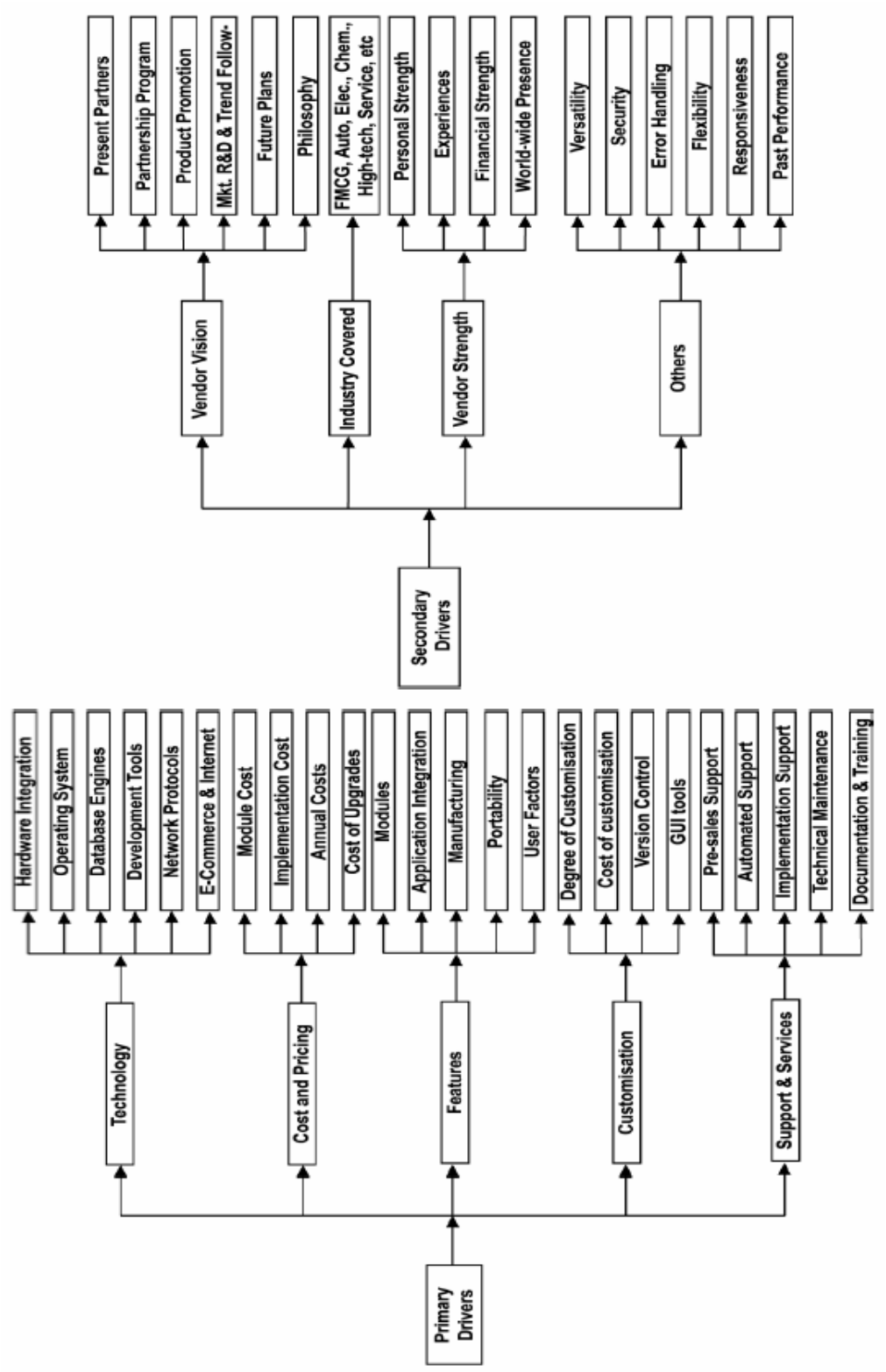



**Figure 1: Decision Drivers (Sahay *et al*, 2003)**

| Author(s) | Type and field of study | Size of organisations | Selection factors considered |
|---|---|---|---|
| Siriginidi (2000) | Theoretical | Large size | Stability and history of the ERP supplier<br>Last 12-month track record of ERP sales<br>Implementation support from suppliers<br>Improvement in ERP packages including stability of the product and functionality |
| Bernroide and Koch (2001) | Empirical Austrian | Mid and large size | Implementation time<br>Adaptability and flexibility of software<br>Costs<br>Vendor support<br>Team size and structure<br>Market position of vendor<br>Customer and supplier needs |
| Everdingen *et al.* (2000) | Empirical European | Midsize | Fit with business process<br>Flexibility<br>User-friendliness<br>Costs<br>Scalability<br>Supplier support and training<br>Product functionality and quality<br>Implementation speed<br>Interface with other systems<br>Price<br>Market leadership<br>Corporate image and international orientation |
| Sprott (2000) | Theoretical | Large size | Applicability<br>Integration<br>Adaptability<br>Upgradability |
| Chen (2001) | Theoretical | Large size | Competitive strategy<br>Targeted market segments<br>Customer requirements<br>Manufacturing environment<br>Characteristics of the manufacturing process<br>Supply chain strategy and available resources |
| Rao, 2000 | Theoretical | SMEs | Affordability<br>Domain knowledge of suppliers<br>Local support<br>Technical upgradable<br>Incorporation of latest technologies |
| Verville and Halingten (2002) | Empirical USA | Large size | Vendor evaluation<br>Functional and technical aspects of the softwarel |

**Table 1: Selection factors (Shehab *et al*, 2004)**

## ERP selection criteria

### Cost

Several researchers have identified cost as a key consideration in enterprise application selection. Hecht (1997), Abedanjo (2003), Verville *et al* (2002), Sahay *et al* (2003), Siriginidi (2000), Beheshti (2006), Bernroider *et al* (2001), Everdingen, Hillegersberg and Waarts (2000), Sarkis and Sundarraj (2000) are good examples. Cost is a consideration for all companies seeking to adopt ERP. When analysing cost, buyers need to look beyond the initial cost of acquisition, as "installation and on-going costs can reach seven to ten times the initial software cost" (Hecht, 1997:58). The components of cost to be considered include:

#### *Cost of acquisition*

This is the cost of actually purchasing the software from the ERP vendor. This component includes the cost of the procurement process which may require detailed needs analysis, business process mapping and benchmarking that may have to be performed by external transaction advisors. In recent years the open-source community has launched several ERP projects. These include products such as ERP5 (www.erp5.com) and Compiere (www.compiere.org), which may provide an alternative to commercial products and a viable option for medium-sized companies.

#### *Implementation cost*

This is the cost of installing the ERP software and conducting all the change management and customisation activities that are required before going live.

#### *Cost of ownership*

This is the cost of maintaining the software on an ongoing basis. This often includes annual licence payments to the ERP vendor and suppliers of dependent components such as databases and operating systems. This component could also include the cost of maintaining external support contracts, internal specialised ERP staff and possibly even staff for maintaining dependent systems that may have been needed just to make the ERP work.

## Functionality

"Software features and their functionality are the most significant issue of all" (Sahay *et al*, 2003:101). The functionality of the software encapsulates the key elements of value that is being procured. Other researchers have also made similar findings (Hech, 1997; Baki and Çakar, 2005; Adebanjo, 2003).

The extent to which the functionality has been customised to meet the needs of the local business environment is also a key consideration. "The business models underlying most ERP packages reflect European or U.S. industry practices" (Soh, Kien and Tay-Yap, 2000:48). Soh *et al* (2000) also point out that in some application areas, such as finance and accounting, there are globally accepted practices that help to promote a degree of standardisation, while in other application areas, practices may differ between countries.

## Technical criteria

Technical issues largely refer to aspects of product design that are not of direct interest to end users.

Sahay *et al* (2003) point out that compatibility with existing hardware and software infrastructure is an important consideration in the purchase decision. Technical factors such as operating system independence (also known to as platform neutralility) and international support (multiple languages, currencies, character sets, etc.) are highlighted by Bernroider *et al* (2001) as well as Sarkis *et al* (2000).

Sarkis *et al* (2000) also add scalability and security to the list of technical considerations.

The range of technical considerations will vary significantly from one organisation to another. Additional technical issues that might be considered include compliance to technical standards such as communication protocols, data exchange and storage standards. Siriginidi (2000) highlights the importance of a technically upgradeable product that uses the latest technology.

## Service and support

Because of the breadth and complexity of issues that must be addressed in the implementation of an ERP it is important that the quality of service provided by the ERP vendor during and after implementation is of a high quality.

In a study by Bernroider *et al* (2001), 100% of small to medium-sized companies rated "good support" as either being very important (42.1%) or important (57.9%). Other researchers also hold the view that service and support is an important ERP selection criterion (Sahay *et al*, 2003; Sarkis *et al*, 2000; Hecht, 1997).

## Vision

"It is desirable to purchase from suppliers who will maintain or improve their competitive position in terms of their products and services" (Porter, 1980:123).

Vision includes the initiatives and investments that a vendor plans to pursue in the future. These are important to a buyer because they involve key decisions around product evolution, key technical issues, future pricing, efforts to influence the general ERP sector and the availability of complementary factors such as support, training and add-on modules. The Gartner group considers vision important enough to make it a dimension of its "Magic Quadrant" (Figure 2) – a tool which is used for rating product vendors (Maynard and Genovese, 2005). Vision is a key factor in the ERP selection process (Sahay *et al*, 2003; Hecht, 1997).

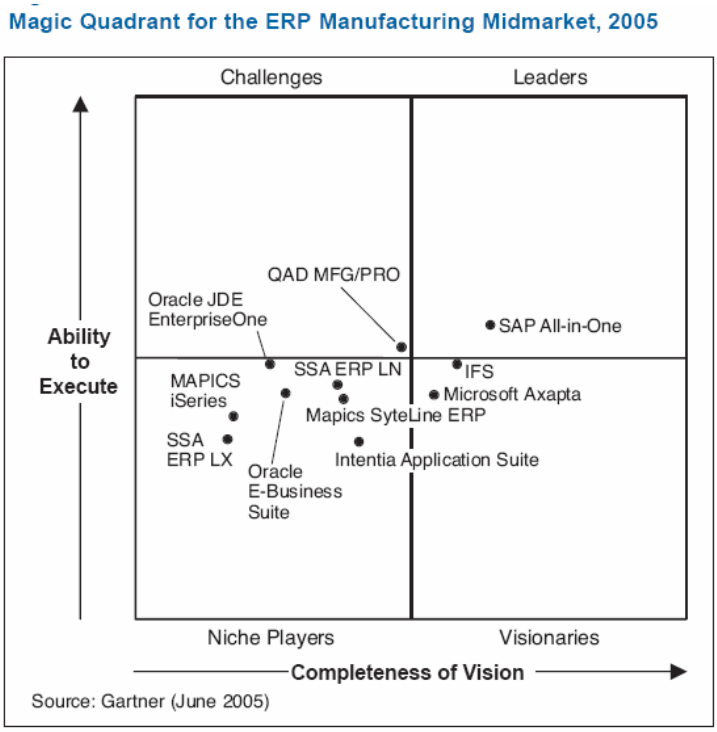



**Figure 2: Magic Quadrant for the ERP manufacturing mid-market (Maynard *et al*, 2005)**

## System reliability

"Faults in the system can occur due to disconnected lines, system crashes, or an inappropriate, unreliable or wrong response. Such faults not only decrease productivity but also diminish the confidence in the system" (Sarkis *et al*, 2000:210).

In some businesses, even a few minutes of downtime can cost millions of rands. With the increasing use of the Internet as an enabler of commerce, online businesses such as Amazon (an online retailer) cannot afford to lose system service or experience material degradation in service quality.

### Compatibility with other systems

ERP solutions will often be integrated with other systems in order to satisfy the unique needs of an organisation. It is important that the ERP package selected can be easily integrated with existing and future software and hardware products (Sprott, 2000; Sahay *et al*, 2003).

### Ease of customisation (flexibility)

Verville *et al* (2002) observed reluctance on the part of clients to change to fit the system. It was the view of an IT Director in one case that "…it is a lot harder to change a process that to change a software, and users…want …to change the software" and not their process (Verville *et al*, 2002: 192).

Bernroider *et al* (2001) made similar observations; finding that 94.7% of small to medium-sized companies rated adaptability and flexibility of software as either important (26.3%) to very important (68.4%).

Other researchers have also highlighted customisation as a key factor in ERP procurement (Sahay *et al*, 2003; Sarkis *et al*, 2002; Baki *et al*, 2005).

### Market position of the vendor

"Selecting suppliers who will continue to be able to meet the firm's needs will minimize the costs of changing suppliers" (Porter, 1980:123).

In a study by Bernroider *et al* (2001), 55.6% of small- to medium-sized enterprises rated the market position of vendors as being an important factor in ERP vendor selection.

ERP implementations often take a long time to complete and involve large investments of money and effort. The purchase of an ERP system is a long term commitment which means that the "ERP provider must be a long-term partner" (Baki *et al*, 2005:86). This implies that the long-term viability of the vendor is an important selection criterion.

The market position of the vendor is also an important factor because the "road map" or vision of the vendor is a consideration in the purchase decision. Buyers must consider the capability of the vendor to continue delivering value-adding features over the long-term. If the vendor does not hold a strong market position, their vision may be compromised by a number of factors, which could include:

- Being hostage to the needs of a key customer or industry cluster.
- Being taken over by a competitor; as was the case with Baan, PeopleSoft and JD Edwards.
- Being ineffective in driving key industry initiatives that could enable the vendor's vision (e.g. industry standards around protocols, data standards, integration, etc.).

### Compatibility with organisation structure (organisational fit)

ERP vendors provide mechanisms for customisation. These customisation features can be employed to make the ERP fit the organisation. ERP customisation has been observed to be a major contributor to ERP implementation costs. It is desirable to select the package that will most closely match the organisation structure and capacity.

"Selected software should be implemented simply with current organisational structure and human resources. On the other hand, the software requiring more and qualified personnel in the implementation stage may not be preferred" (Baki *et al*, 2005:80).

Sarkis *et al* (2000) make a similar point in referring to what they term "intrafirm adaptability".

"Not only should these new systems match the current hardware and software…but they should also, more importantly, match the sophistication levels of would-be users" (Sarkis *et al*, 2000:208)

### Specialised industry knowledge

The software vendor must have knowledge of the industry in which the software is to be deployed (Siriginidi, 2000; Baki *et al*, 2005; Sahay *et al*, 2003).

### Client references

"Because ERP requires a substantial amount of capital investment, the feasibility study involves a greater degree of effort than the typical capital investment analysis" (Beheshti, 2006:192).

External parties can assist in providing objective information about the performance of vendor products and services (Baki *et al*, 2005).

Objective, valid data about vendor products and services can be difficult to find (Hecht, 1997). Given this fact, it is important that buyers do not rely exclusively on the information supplied by the ERP vendor. Some companies rely on consulting firms to assist in product selection. Piturro (1990) warns that consultants are not always fully independent – a fact that can cloud their ability to provide objective input.

### Fit with parent/allied organisation systems (corporate compliance)

Global enterprises and large groups of companies often have minimal technology standards and guidelines for technology acquisition. The benefits of pursuing corporate standardisation include improved negotiating power with key vendors, a greater ability to redeploy resources without retraining, and ease of collaboration across functions and divisions.

Bernroider *et al* (2001) found that 68.4% of small- to medium-sized companies did not consider guidelines from a controlling company to be important in the ERP purchase decision. This was in contrast to responses from large companies in the same study. In the study, 42% of large companies considered guidelines from a controlling company to be important (18.9%) to very important (24.2%).

### Implementation time

The cost of ERP implementation includes the indirect cost that companies incur by allocating key staff to the ERP initiative. Resources are often taken away from normal business and assigned to the ERP project on a full time basis – this can result in significant interruptions to normal business operations.

"It usually takes at least a year to implement an ERP system. In some instances it can be shorter than that, possibly in smaller companies; however that is extremely rare" (Beheshti, 2006:189).

In a study conducted by Bernroider *et al* (2001), 95% of small to medium-sized companies considered implementation time to be a key factor in ERP selection.

Extended implementations run the risk of losing key project personnel. Mustacello *et al* (2003) reported instances of ERP implementations that had failed due to resignations of key project team members and leadership.

## Relative importance of criteria

Price, features and support have been widely and consistently highlighted as important selection criteria across a number of different studies.

Sahay *et al* (2003) separated ERP selection criteria into two broad categories. The criteria they considered to be most important included price features and support. Most vendor selection criteria were ranked as secondary.

Bernroider *et al* (2001) identified a total of 29 ERP selection criteria using the Delphi technique. In subsequent field research, criteria related to price, features and support were rated by respondents as important or very important.

Similar findings were made by Baki *et al* (2005) and Everdingen *et al* (2000).

## Emerging issues and future selection criteria

A careful consideration of future developments in the ERP software market is critical for ERP selection purposes. In a rapidly evolving sector like the software sector, the key players in one phase of industry development may not go on to lead subsequent phases of industry growth and evolution (Grove, 1997; Moore, 1991; Christensen, 1997; Christensen and Raynor, 2003).

Price, features and support have been identified as important selection criteria in the ERP selection process (Baki *et al*, 2005; Everdingen *et al*, 2000; Bernroider *et al*, 2001; Sahay *et al*, 2003). While there is no literature to suggest that these selection criteria may lose their importance in the future, there are indications that market developments will give rise to related and possibly important areas of assessment.

## Open-source software

“Open-source software is computer software whose source code is available under a copyright licence that permits users to study, change, improve the software, and redistribute it in modified or unmodified form” (Wikipedia, 2006).

Two of the important features of open-source software are that it is often free to acquire the software programs, and secondly; there are no maintenance fees to be paid to keep the programs up to date. "… CIOs are thinking … differently. We're evaluating package by package and asking … if there's any value at all in paying maintenance" (Berinato, 2005).

Price considerations have been a major influence in the continued growth of open-source software in commercial organisations. Open-source software can now be found in a wide range of mission-critical applications which include operating systems (Linux and Free BSD), databases (such as MySQL which is supported by SAP), web servers (Apache) and programming tools and languages used to build enterprise systems (PHP and Python). Affordability is often put forward as a major reason for adopting open-source software.

In recent years, a number of open-source projects have been initiated with a view to providing open-source alternatives to commercial ERP solutions. Some of these solutions, (such as Compiere, Tiny ERP and ERP5) are backed by commercial organisations that develop the software and make it freely available, while focusing on earning revenue by providing support. The effect of this trend is that open-source software is likely to have a much lower cost of acquisition and ownership. SAP (the leading ERP vendor worldwide) already recognises the significance of open-source software, and actively contributes to the development of open-source database software (MySQL), which can be implemented as part of a SAP solution.

Disruptive innovation deals with scenarios where new competitors with comparatively limited resources attack powerful incumbents with offerings that present new value propositions through lower prices or greater simplicity (Christensen, Anthony and Roth, 2004). Very often these technologies have the effect of partially or completely reorganising an industry, giving rise to new sources of supply, revenue and competitive advantage. Open-source software clearly represents a disruptive innovation that is based on a new value proposition. A discussion of open-source penetration into the ERP solution stack is included in Appendix 8.

## Software architecture

The architecture of software sets the constraints under which a software package is developed, enhanced, customised and provisioned. In practical terms this impacts issues such as the hardware, software and network requirements of the software.

“Computers have progressed from mainframes and terminals to distributed client-server architectures” (Bontis and Chung, 2000:247). Multi-tier architectures allow software to be separated into discreet components, allowing a solution to be assembled from a mix of different vendor offerings.

In recent times, the Internet has had an impact on the way in which software is accessed, as well as the commercial models around which the makers of the software generate revenue. Many companies that have significant software engineering capabilities do not earn revenue from the sale of their software (amongst these are Google, Yahoo and Amazon).

“Two architectural renewal movements are transforming the market simultaneously — technology stack leverage and the movement to Service-Oriented Architectures (SOA)” (Hamerman and Wang, 2005:10).

Advances in technology, infrastructure and software standards are continuously producing new business models across industries. In the software industry emerging trends and standards are enabling new software provisioning models which are largely built for the Internet.

“One factor that will take some air out of ERP's bubble … is the growing relevance of SOA and the disruptive influence it will have on the ERP market…” (Woodie, 2004).

Salesforce.com is a company that makes its CRM software available on a pay-per-use model over the Internet. ERP vendors like SAP have Internet-enabled their products so that they can be installed remotely by Application Service Providers (ASP) and accessed over the Internet. More recently, advances in open standards (largely sponsored by Microsoft, IBM and other major industry players) make it possible for vendors to ship their software in the form of discrete web services – a development that allows enterprise solutions to be crafted from a mix of services from different software vendors.

“The technology transformation to a Service-Oriented Architecture (SOA) will have the largest effect on redefining the ERP mid-market since the term ‘ERP’ was coined” (Maynard and Genovese, 2005).

These emerging changes in software architecture will have an impact on the commercial models of the vendors as well as the array of features, pricing models, enhancements and services that are available to future buyers of ERP solutions.

## Differences in the importance of selection criteria for manufacturing and non-manufacturing companies

ERP represents the fourth stage in the evolution of software that has been largely targeted at manufacturing enterprises (Muscatello *et al*, 2003).

While features for manufacturing enterprises are widely available and well developed, major investment in non-manufacturing features has only happened in recent years. Non-manufacturing features are largely scarce and underdeveloped when compared to manufacturing features.

A major example can be seen in Customer Relationship Management (CRM) features. SAP's CRM offering has only been developed in recent years, Oracle recently acquired Siebel (a leading maker of CRM software) and Microsoft are currently on the second release of their CRM product. In addition to these vendors, other companies have recently begun offering open-source (Sugar CRM) and Internet-based (Salesforce.com) CRM products.

Bernroider *et al* (2001) report that 84% of large companies rate software adaptability as being important or very important. On the other hand, 96% of small- to medium-sized companies in the same survey consider software adaptability to be important or very important. This could indicate that more large companies (a segment largely made up of manufacturing companies) are finding the available ERP features adequate for their needs while smaller companies (where non-manufacturing companies are represented in larger numbers) often have to customise the solution to add missing or underdeveloped features.

## Research propositions

The following propositions have been derived from the research literature.

**Proposition 1**

When selecting an ERP system, medium-sized South African companies will consider the following fourteen selection criteria:

- Affordability
- Corporate compliance
- Implementation time
- Organisational fit
- Reliability
- Compatibility
- Functionality
- Technical criteria
- Flexibility of the solution
- Service and support
- Vision of the vendor
- Market position of the vendor
- Industry knowledge of the vendor
- References of the vendor

**Proposition 2**

When medium-sized South African companies select an ERP system, the three most important selection criteria will be:

- Price
- Functionality
- Service and support

**Proposition 3**

Manufacturing companies will rate some selection criteria (such as software adaptability) differently to non-manufacturing companies.

**Proposition 4**

In the future, the following selection criteria will become important in the selection of ERP systems:

- Open-source alternatives
- The architecture of the software

# Chapter 3: Research approach

## Methodology

The proposed approach was that of a telephonic survey using a snowball sampling technique. Snowball sampling (a nonprobability method) was used because the desired sample characteristic (IT decision makers) was difficult to find and the cost implications were outside of the scope of the research budget. The sample relied on referrals from initial subjects to generate additional subjects.

The disadvantage of using this technique is the possible introduction of bias as the technique reduces the likelihood that the sample will represent a good cross section from the population. As mentioned, respondents were contacted telephonically and were asked to rate selection criteria on a four-point scale, stating whether they deem criteria to be very important, important, rather important or irrelevant. The reason for making use of a forced Likert rating scale was to eliminate the often large existence of unsure answers provided by respondents in a rushed environment.

A sample questionnaire is included in Appendix 1. Professional interviewers were utilised used to gather responses. Interviewers were selected for two main reasons:

1. The target respondent (i.e. executives and senior managers) are individuals with significant time pressures. A professional interviewer can expedite the process by providing immediate clarification of questions and terminology.
2. Professional interviewers ensure a high level of quality in the feedback received, especially where telephonic interviewing is concerned.

## Research population

The population for this survey was senior IT employees who either make the decisions or the recommendations when selecting an ERP solution.

There is no universally accepted definition of a medium-sized company in South Africa. Statistics South Africa and Ntsika Enterprise Promotion Agency (Ntsika, 1999) – a government agency which forms part of the Department of Trade and Industry, categorise companies into five groups. The Small Business Act (Republic of South Africa, 1996) has provided an official definition of four size categories (micro, very small, small and medium). This categorisation is not followed by the official state agencies in that they either add new categories ("survivalist category") or ignore some ("very small category") without explanations.

As there is no accurate and exact data available in terms of the number of businesses that fall into each size category, the population size is estimated using the available information.
Table 2 (below) shows the classification of company size by headcount according to Ntsika (1999). The classifications shown in Table 2 were applied in the analysis of Table 3 in order to arrive at an estimate of the number of companies that employ between 100 and 500 employees.

| **Average number of employees in South African firms by size class, 1995 and 1997** | | | | | | |
|---|---|---|---|---|---|---|
| **Average no. of employees** | **Survivalist** | **Micro** | **Very Small** | **Small** | **Medium** | **Large** |
| In 1995 | 1 | 2 | 5 | 21 | 79 | 456 |
| In 1997 | 1 | 2 | 6 | 21 | 80 | 525 |
| Difference | 0 | 0 | 1 | 0 | 1 | 69 |
| **Source: Adapted from Ntsika (1999:50).**<br>**Note that combined data sources are used** | | | | | | |

**Table 2: Average number of employees in South African firms (Ntsika, 1999:50)**

Applying the definitions outlined in Table 2 to the data summarized in Table 3 (especially that of Statistics SA and Ntsika), it is estimated that there are 65,000 businesses within South Africa that employ between 100 and 500 staff members.

| Different indicators for the size of the SME sector | | | | | | |
|---|---|---|---|---|---|---|
| **Source** | **Survivalist** | **Micro** | **Very Small** | **Small** | **Medium** | **Large** |
| Ntsika 1999 | 184,400 | 466,100 | 180,000 | 58,900 | 11,322 | 6,017 |
| Statistics SA, 2000/Ntsika 2000 | Informal: 1,138,854 | 330,271 | 94,804 | ***52,620*** | ***12,249*** | 1,628,797 |
| Business Partners | 2,3 million | 600,000 | | 35,000 | n/a | 2,9 million |
| Management Sciences Group Survey, 1999 | Micro: 960,740; Informal: 862,580 | Formal: 445,880 (of which 357,780 private) | | | | 2,3 million |
| Eskom Survey, 1999 | 900,000+ in-home businesses; 3 million if one includes farmers | | | | n/a | 3 million |
| Global Entrepreneurship Monitor, SA 2001 | Between 0.73 and 1.15 million | 1,709,142 | | | | Between 2.44 and 2.86 million |
| **Source: TIPS, 2002** | | | | | | |

**Table 3: Different indicators for the size of the SME sector (TIPS, 2002)**

## Sample size

The sample size was **80** respondents. The sample size has been selected in line with time and budgetary constraints. A minimum of 30 manufacturing and 30 non-manufacturing companies were approached in order to produce robust cell sizes in each of the respondent categories. The sample frame was as follows:

| | | GTN | KZN | EC | WC | Total |
|---|---|---|---|---|---|---|
| **Manufacturing** | | 23 | 2 | 0 | 5 | 30 |
| **Non-manufacturing** | Retail | 20 | 3 | 2 | 0 | 25 |
| | Services | 29 | 5 | 1 | 0 | 25 |
| **Total** | | 62 | 10 | 3 | 5 | **80** |

## Pilot surveys

10 pilot surveys were initially conducted to test reliability and validity of the survey constructs and analysis revealed that the questionnaire used, results achieved and methodology were valid. The final 70 interviews were, therefore, conducted in the same manner. Reliability and validity are discussed below.

## Data collection

Data was collected telephonically and filter questions were used to eliminate respondents that did not qualify (refer to Appendix 1). A snowball sample was used to collect information about other possible respondents. The questionnaire was in field for a total of two weeks, which meant that data was not affected by factors such as time lag.

## Questionnaire

The questionnaire or measuring instrument was developed based on findings from the literature review and aimed to gain comprehensive insight into the four propositions. The questionnaire took, on average, 10 minutes to complete per respondent.

## Reliability and validity

### Internal validity

Leedy and Ormrod (2005) define internal validity as a measure of the extent to which the study allows the researcher to draw accurate conclusions about relationships in the data. In order to ensure internal validity the research instrument was reviewed (post pilot surveys) to confirm its appropriateness for the desired application.

### External validity

External validity is a measure of the extent to which research findings can be extended to situations beyond the original study (Leedy *et al*, 2005).

The sample size was selected in order to ensure that findings can be applied beyond the scope of the sample.

### Reliability

Reliability is a measure of the consistent use of the research instrument (Leedy *et al*, 2005). In order to increase the reliability of the research, the instrument was pilot-tested and professional interviewers were used to conduct interviews.

A mathematical test of reliability was also used. Cronbach's alpha (Cronbach, 1951) is a measure of reliability. More specifically, alpha is a lower bound for the true reliability of the survey. Mathematically, reliability is defined as the proportion of the variability in the responses to the survey that is the result of differences in the respondents. That is, answers to a reliable survey will differ because respondents have different opinions, not because the survey is confusing nor has multiple interpretations. The computation of Cronbach's alpha is based on the number of items on the survey (k) and the ratio of the average inter-item covariance to the average item variance.

Using the Cronbach's alpha it was determined that the questions asked and that the overall constructs used were reliable in measuring the expected outcomes as the alpha was greater than 0.7 (Refer to Appendix 3 for calculations).

The survey instrument was subjected to a pilot test before it was distributed. This was conducted based on the recommendations of Leady *et al* (2005), who suggested using a brief pilot study to test the validity and reliability of the measurement instrument.

The pilot was tested on a sample of 10 respondents in both the manufacturing and non-manufacturing sectors. The pilot respondents were asked to check for clarity of instructions and any ambiguities in the statements. Any necessary modifications were then made before the survey was distributed.

Reliability of the constructs was tested both after the pilots are completed and at the end of the survey.

## Data analysis

The first step in the analysis phase of the research was to understand the data. Therefore, descriptive statistics and frequencies were used to provide an overview of the dataset and enable to the author to determine relevant and useful techniques that should be used to further understand the data.

The major measurement scales utilised were itemised Likert rating scales. Although these are technically considered to be ordinal in nature, they were assumed to be interval for the majority of analyses (Malhotra, 1999). Due to the fact that the data was not normally distributed (confirmed via a Kolmogorv-Smirnov Goodness-of-Fit Test – refer to Appendix 4), these scales were treated as ordinal and thus tested using nonparametric analysis. This type of testing was more appropriate (and accurate) than parametric testing for this type of data.

Other tests included Cronbach's Alpha Test, which was used to determine reliability of constructs. Moreover, the level of importance for each statement was obtained by multiplying the numbers of responses on each Likert value for each issue. Thereafter, the means and standard deviations were calculated. Based on the mean value, the most important reason regarding the use of derivatives was determined.

In order to rank the nonparametric variables, a Kendall's W Test was used. Kendall's W is a measure of the agreement of the rankings of variables across cases (SPSS Inc., 2005).

Manufacturing companies rated some assessment areas differently to non-manufacturing companies, and in order to test this, a Mann Whitney U Test was conducted. The Mann-Whitney U test is the nonparametric equivalent of an independent samples t-test (the survey data is not distributed normally – refer to the Kolmogorov Smirnov Good-of-Fit Test in Appendix 4), and compared the differences in the location of the two populations based on observations from the two independent samples.

All statistical analysis was performed using the statistical package SPSS, version 14.0 (SPSS Inc., 2005).

# Chapter 4: Research findings

## Introduction

This chapter presents the statistical analysis and results of the survey, as well as the descriptive and complex statistics carried out on the responses received.

## Geographic spread

A total of 80 firms were interviewed. 77.5% of the firms were in Gauteng province with the balance in KwaZulu-Natal (10%), Western Cape (6.3%) and Eastern Cape (3.8%).

**Province**

| | | Frequency | Percent | Cumulative Percent |
|---|---|---|---|---|
| Valid | Gauteng | 62 | 77.5 | 77.5 |
| | KZN | 10 | 12.5 | 90.0 |
| | Western Cape | 5 | 6.3 | 96.3 |
| | Eastern Cape | 3 | 3.8 | 100.0 |
| | Total | 80 | 100.0 | |

**Table 4: Geographic spread**

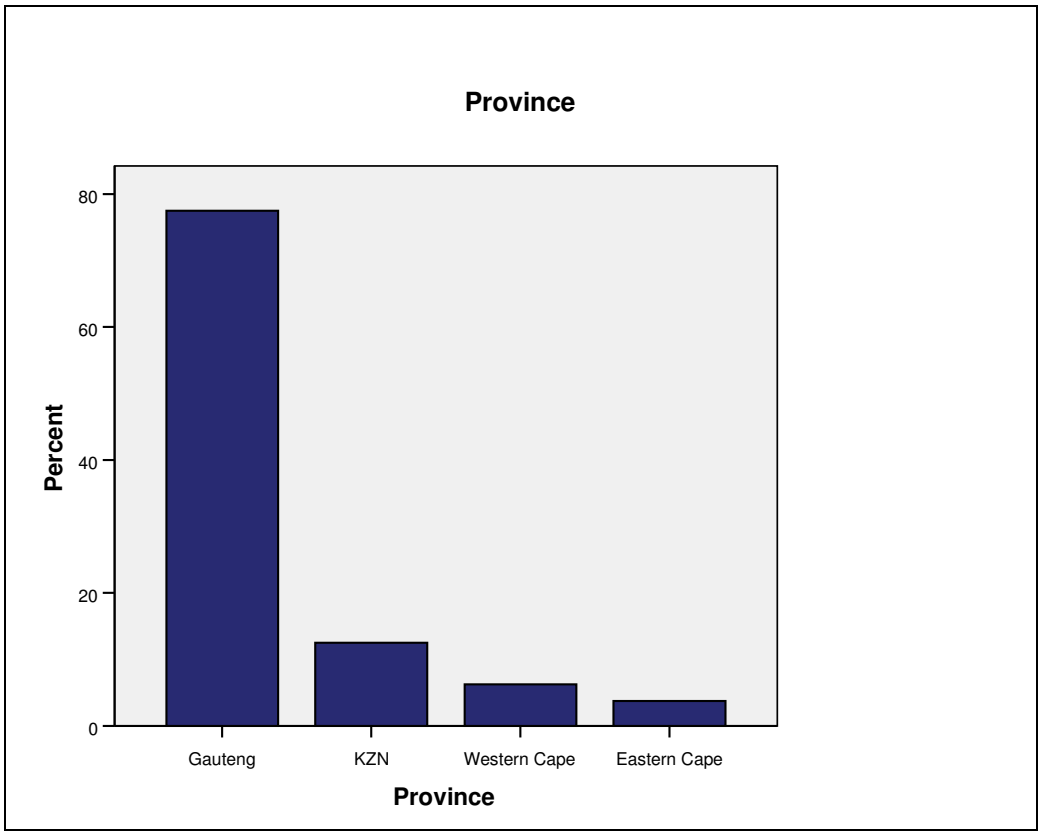



**Figure 3: Geographic spread**

## Type of firm

As seen in Table 5 and Figure 4 below, 62.5% of respondents were interviewed in the non-manufacturing segment. The reason for this skew between the segments was due to the sub-split of the non-manufacturing segment into retail and non-retail organisations.

| | | Frequency | Percent | Cumulative Percent |
|---|---|---|---|---|
| Valid | Non-manufacturing | 50 | 62.5 | 62.5 |
| | Manufacturing | 30 | 37.5 | 100.0 |
| | Total | 80 | 100.0 | |

**Table 5: Type of firm**

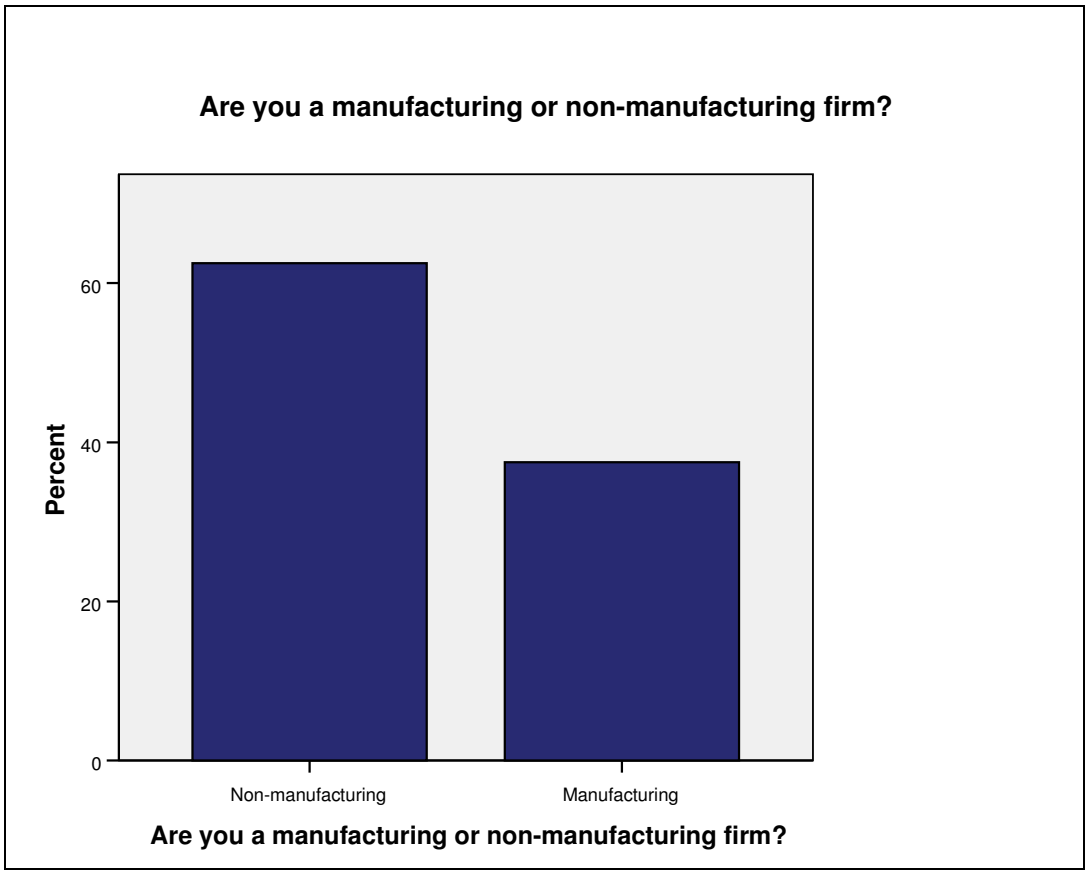



**Figure 4: Type of firm**

## Type of non-manufacturing firm

Non-manufacturing firms were divided into retail and non-retail and were tested (see below) to further understand the relationship between these two segments. 50% were retail and 50% non-retail.

| | | Frequency | Percent | Cumulative Percent |
|---|---|---|---|---|
| Valid | N/A | 30 | 37.5 | 37.5 |
| | Retail | 25 | 31.3 | 68.8 |
| | Non-retail | 25 | 31.3 | 100.0 |
| | Total | 80 | 100.0 | |

**Table 6: Type of non-manufacturing firm**




**Figure 5: Type of non-manufacturing firm**

## Incidence of ERP solutions

Almost 70% of respondents already had an ERP solution in place, with 31.3% interested in implementing a system within the next two years.

| | | Frequency | Percent | Cumulative Percent |
|---|---|---|---|---|
| Valid | Yes | 55 | 68.8 | 68.8 |
| | No | 25 | 31.3 | 100.0 |
| | Total | 80 | 100.0 | |

**Table 7: Incidence of ERP solutions**

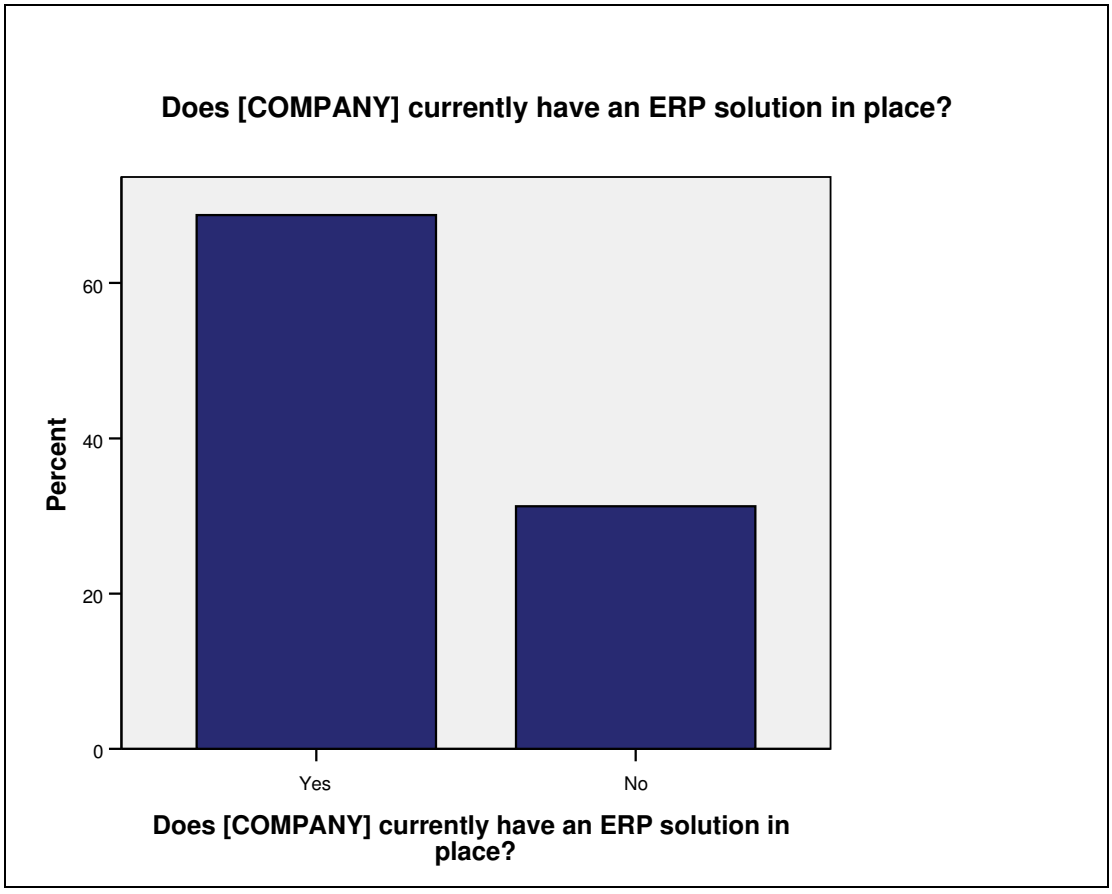



**Figure 6: Incidence of ERP solutions**

## Proposition 1

When selecting an ERP system, medium-sized South African companies will consider criteria in the following fourteen assessment areas:

- Affordability
- Corporate compliance
- Implementation time
- Organisational fit
- Reliability
- Compatibility
- Functionality
- Technical criteria
- Flexibility of the solution
- Service and support
- Vision of the vendor
- Market Position of vendor
- Industry knowledge of the vendor
- References of the vendor

The first step in understanding whether the above criteria were considered by medium-sized businesses was to test the validity of the constructs used. While this was an extension of the Cronbach's alpha test conducted above, the fourteen constructs were analysed in isolation.

**Reliability Statistics**

| Cronbach's Alpha | N of Items |
|---|---|
| .897 | 14 |

**Table 9: Cronbach's Alpha**

This indicated that, overall, the constructs used to test the criteria used when selecting and ERP system were reliable in measuring the expected outcomes (greater than 0.7).

Once the validity of the constructs had been confirmed, the mean scores for each of the criteria were analysed.

| Criteria | Total (n = 80) | Manufacturing (n = 30) | Non-manufacturing (n = 50) |
|---|---|---|---|
| **Reliability** | 9.09 | 9.67 | 8.74 |
| **Service and support** | 8.71 | 9.37 | 8.32 |
| **Compatibility** | 8.61 | 9.13 | 8.30 |
| **Vision of vendor** | 8.53 | 8.90 | 8.30 |
| **Industry knowledge** | 8.46 | 8.77 | 8.28 |
| **Flexibility** | 8.31 | 8.97 | 7.92 |
| **Vendor references** | 8.30 | 8.57 | 8.14 |
| **Organisational fit** | 8.24 | 8.90 | 7.84 |
| **Functionality** | 8.24 | 8.80 | 7.90 |
| **Infrastructure** | 8.19 | 8.93 | 7.74 |
| **Implementation time** | 8.09 | 8.50 | 7.84 |
| **Market position of vendor** | 8.06 | 8.63 | 7.72 |
| **Affordability** | 7.99 | 8.13 | 7.90 |
| **Corporate compliance** | 7.66 | 7.70 | 7.64 |
| **Average** | 8.32 | 8.78 | 8.04 |

**Table 10: Criteria mean scores**

As the average mean score for the total sample was 8.32 (a 10-point scale was used to measure the importance of the criteria – refer to Appendix 1), and the minimum scores in each of the sub-segments did not go below 7.64, it was concluded that these criteria are considered by medium-sized South African businesses when selecting an ERP system.

The final step taken was to identify any other factors or criteria of importance that were used when selecting and ERP system.

| Manufacturing | N | Mean | Non-manufacturing | N | Mean |
|---|---|---|---|---|---|
| **Fully integrated system** | 1 | 10.00 | **Stability** | 1 | 9.00 |
| **Availability and support in Africa** | 1 | 10.00 | **Value for money** | 1 | 9.00 |
| **Good relationship with vendor** | 1 | 10.00 | **Linking with the Net (eBusiness)** | 1 | 9.00 |
| **Linking to financial software** | 1 | 10.00 | **Portability** | 1 | 9.00 |
| **Trans History updates linked** | 1 | 9.00 | **Database complies with company's requirements** | 1 | 9.00 |
| **Multiple operating compatibility** | 1 | 9.00 | **Responsiveness** | 1 | 9.00 |
| | | | **Data report** | 1 | 9.00 |
| | | | **Synchronise with other systems** | 2 | 8.50 |
| | | | **Availability and support in Africa** | 2 | 8.50 |
| | | | **User friendly** | 1 | 8.00 |

**Table 11: Additional factors of importance**

The above table confirms the fact that the original fourteen criteria were an adequate, and important, means of selecting an ERP system. Many of the factors mentioned over-and-above the original fourteen could fit into one of those criteria. Moreover, there was no dominant factor or criteria mentioned over the fourteen criteria.

## Proposition 2

When medium-sized South African companies select an ERP system, the three most important assessment areas will be:

- Price
- Functionality
- Service and Support

The first step was to understand the mean scores for the overall sample and the two segments across the fourteen criteria.

It was evident that reliability, service and support, and compatibility were consistent across all test groups, and not price, functionality and service and support as originally predicted. However, there was a need to test the significance of these results by conducting a Kendall's W Test.

| | Total (n = 80) | Manufacturing (n = 30) | Non-manufacturing (n = 50) |
|---|---|---|---|
| **1** | Reliability | Reliability | Reliability |
| **2** | Service and support | Service and support | Service and support |
| **3** | Compatibility | Compatibility | Compatibility |
| **4** | Vision of vendor | Flexibility | Vision of vendor |
| **5** | Industry knowledge | Infrastructure | Industry knowledge |
| **6** | Flexibility | Vision of vendor | Vendor references |
| **7** | Vendor references | Organisational fit | Flexibility |
| **8** | Organisational fit | Functionality | Functionality |
| **9** | Functionality | Industry knowledge | Affordability |
| **10** | Infrastructure | Market position of vendor | Organisational fit |
| **11** | Implementation time | Vendor references | Implementation time |
| **12** | Market position of vendor | Implementation time | Infrastructure |
| **13** | Affordability | Affordability | Market position of vendor |
| **14** | Corporate compliance | Corporate compliance | Corporate compliance |

**Table 12: Criteria commonality**

It was interesting to note that medium-sized businesses in the manufacturing and non-manufacturing sectors differed in the importance they place on the other criteria. The significance of these differences was tested in Proposition 3.

## Kendall's W Test

In order to compute Kendall's W, values of the variables were ranked for each case (SPSS Inc., 2005). Table lists the average rank for each variable. Low ranks correspond to low values of the variables. If the rankings across cases differed, the mean ranks would be similar to each other. Kendall's W is a measure of the agreement of the rankings of variables across cases. It is important to note that the mean rank is not the mean for that variable but rather the average rank for that variable.

| | Mean Rank |
|---|---|
| Reliability | 9.881 |
| Service and support | 8.550 |
| Compatibility | 8.219 |
| Vision of vendor | 8.175 |
| Industry knowledge | 7.744 |
| Organisational fit | 7.350 |
| Flexibility | 7.256 |
| Functionality | 7.200 |
| Vendor references | 7.194 |
| Implementation time | 7.156 |
| Infrastructure | 7.119 |
| Market position of vendor | 6.800 |
| Affordability | 6.594 |
| Corporate compliance | 5.763 |

**Table 13: Kendall's W mean ranks**

**Test Statistics**

| | |
|---|---|
| N | 80 |
| Kendall's W(a) | .734 |
| Chi-Square | 77.125 |
| df | 13 |
| Asymp. Sig. | .000 |

a Kendall's Coefficient of Concordance

**Table 14: Kendall's W Test statistics**

Kendall's W is a measure of the agreement of the rankings of variables across cases (SPSS Inc., 2005). A Kendall's W value near 0 indicates little agreement across cases and a value near 1 indicates high agreement across cases (SPSS Inc., 2005). A value of **0.734** indicated that there was high agreement in terms of the assigned orders across the factors. A chi-square value of **77.13** and an asymptotic significance level of less than **0.05** indicated that there was a significantly high probability of this ordering occurring in the future.

It was evident from these results that medium-size businesses considered:

- Reliability
- Service and support, and
- Compatibility

when selecting an ERP system.

## Proposition 3

Manufacturing companies will rate some assessment areas (such as software adaptability) differently to non-manufacturing companies.

In order to test this proposition, a Mann Whitney U Test was conducted.

### Mann-Whitney U Test

The Mann-Whitney U test is the nonparametric equivalent of an independent samples t-test (the survey data is not distributed normally – see Appendix 4), and compared the differences in the location of two populations based on observations from the two independent samples (SPSS Inc., 2005).

**Ranks**

| | Are you a manufacturing or non-manufacturing firm? | N | Mean Rank | Sum of Ranks |
|---|---|---|---|---|
| Affordability | Manufacturing | 30 | 43.28 | 1298.50 |
| | Non-manufacturing | 50 | 38.83 | 1941.50 |
| | Total | 80 | | |
| Corporate compliance | Manufacturing | 30 | 42.28 | 1268.50 |
| | Non-manufacturing | 50 | 39.43 | 1971.50 |
| | Total | 80 | | |
| Implementation time | Manufacturing | 30 | 46.75 | 1402.50 |
| | Non-manufacturing | 50 | 36.75 | 1837.50 |
| | Total | 80 | | |
| Organisational fit | Manufacturing | 30 | 51.28 | 1538.50 |
| | Non-manufacturing | 50 | 34.03 | 1701.50 |
| | Total | 80 | | |
| Reliability | Manufacturing | 30 | 48.87 | 1466.00 |
| | Non-manufacturing | 50 | 35.48 | 1774.00 |
| | Total | 80 | | |
| Compatibility | Manufacturing | 30 | 48.77 | 1463.00 |
| | Non-manufacturing | 50 | 35.54 | 1777.00 |
| | Total | 80 | | |
| Functionality | Manufacturing | 30 | 49.40 | 1482.00 |
| | Non-manufacturing | 50 | 35.16 | 1758.00 |
| | Total | 80 | | |

| | | | | |
|---|---|---|---|---|
| Infrastructure | Manufacturing | 30 | 49.83 | 1495.00 |
| | Non-manufacturing | 50 | 34.90 | 1745.00 |
| | Total | 80 | | |
| Flexibility | Manufacturing | 30 | 51.08 | 1532.50 |
| | Non-manufacturing | 50 | 34.15 | 1707.50 |
| | Total | 80 | | |
| Service and support | Manufacturing | 30 | 49.57 | 1487.00 |
| | Non-manufacturing | 50 | 35.06 | 1753.00 |
| | Total | 80 | | |
| Vision of vendor | Manufacturing | 30 | 46.13 | 1384.00 |
| | Non-manufacturing | 50 | 37.12 | 1856.00 |
| | Total | 80 | | |
| Market position of vendor | Manufacturing | 30 | 49.18 | 1475.50 |
| | Non-manufacturing | 50 | 35.29 | 1764.50 |
| | Total | 80 | | |
| Industry knowledge | Manufacturing | 30 | 45.93 | 1378.00 |
| | Non-manufacturing | 50 | 37.24 | 1862.00 |
| | Total | 80 | | |
| Vendor references | Manufacturing | 30 | 46.48 | 1394.50 |
| | Non-manufacturing | 50 | 36.91 | 1845.50 |
| | Total | 80 | | |

**Table 15: Mann Whitney U Test sum of ranks**

The above table lists summary statistics for the Mann-Whitney U Test. In this test, the two groups were combined and the data was ranked. Mean rank listed the average of the ranks for each group. If the groups had the same location, these values would have been similar. To test the whether the locations differed; the Mann-Whitney U and Wilcoxon W Tests were used. Please note that this test did not determine relative importance of criteria but rather differences between groups.

| Manufacturing vs. Non-manufacturing | Mann-Whitney U | Wilcoxon W | Z | Asymp. Sig. (2-tailed) |
|---|---|---|---|---|
| **Affordability** | 666.5 | 1941.5 | -0.853 | 0.394 |
| **Corporate compliance** | 696.5 | 1971.5 | -0.540 | 0.589 |
| **Implementation time** | 562.5 | 1837.5 | -1.909 | 0.056 |
| **Organisational fit** | 426.5 | 1701.5 | -3.297 | **0.001** |
| **Reliability** | 499 | 1774 | -2.783 | **0.005** |
| **Compatibility** | 502 | 1777 | -2.555 | **0.011** |
| **Functionality** | 483 | 1758 | -2.723 | **0.006** |
| **Infrastructure** | 470 | 1745 | -2.852 | **0.004** |
| **Flexibility** | 432.5 | 1707.5 | -3.272 | **0.001** |
| **Service and support** | 478 | 1753 | -2.845 | **0.004** |
| **Vision of vendor** | 581 | 1856 | -1.758 | 0.079 |
| **Market position of vendor** | 489.5 | 1764.5 | -2.646 | **0.008** |
| **Industry knowledge** | 587 | 1862 | -1.670 | 0.095 |
| **Vendor references** | 570.5 | 1845.5 | -1.829 | 0.067 |

**Table 16: Mann Whitney U Test significance**

Although all of the fourteen factors were important to medium-sized businesses in South Africa, manufacturing and non-manufacturing businesses differed significantly along the following criteria:

- Organisational fit
- Reliability
- Compatibility
- Functionality
- Infrastructure
- Flexibility
- Service and support
- Market position of vendor

After the reliability, service and support, and compatibility, the manufacturing sector considered **flexibility**, **infrastructure** and **organisational fit** to be important criteria for selecting an ERP system, whereas the non-manufacturing sector considered the **vision of the vendor**, **industry knowledge** and **vendor references** to be important criteria for selecting an ERP system

| | Manufacturing (n = 30) | | Non-manufacturing (n = 50) |
|---|---|---|---|
| **Reliability** | 9.67 | **Reliability** | 8.74 |
| **Service and support** | 9.37 | **Service and support** | 8.32 |
| **Compatibility** | 9.13 | **Compatibility** | 8.30 |
| **Flexibility** | 8.97 | **Vision of vendor** | 8.30 |
| **Infrastructure** | 8.93 | **Industry knowledge** | 8.28 |
| **Organisational fit** | 8.90 | **Vendor references** | 8.14 |
| **Vision of vendor** | 8.90 | **Flexibility** | 7.92 |
| **Functionality** | 8.80 | **Functionality** | 7.90 |
| **Industry knowledge** | 8.77 | **Affordability** | 7.90 |
| **Market position of vendor** | 8.63 | **Organisational fit** | 7.84 |
| **Vendor references** | 8.57 | **Implementation time** | 7.84 |
| **Implementation time** | 8.50 | **Infrastructure** | 7.74 |
| **Affordability** | 8.13 | **Market position of vendor** | 7.72 |
| **Corporate compliance** | 7.70 | **Corporate compliance** | 7.64 |

**Table 17: Criteria importance per sector**

## Proposition 4

In the future, the following assessment areas will become important in the selection of ERP systems:

- Open-source alternatives
- The architecture of the software

The table below indicated that the following criteria were most likely to become important in the future when selecting an ERP system:

- The ability of the system to expand as the medium-sized businesses changes to a large business
- The ability of the system to retain cutting-edge characteristics
- The ability of the system to become mobile
- The ability of the system to remain affordable

| Manufacturing | N | Mean | Non-manufacturing | N | Mean |
|---|---|---|---|---|---|
| **Ability of ERP to expand with the company** | 2 | 10.00 | **Ability of ERP to expand with the company** | 1 | 10.00 |
| **Open-source options** | 1 | 10.00 | **Latest technology/Architecture** | 5 | 9.00 |
| **More competition** | 2 | 9.5 | **Dynamics within industry (changing environment)** | 1 | 9.00 |
| **Increasing costs** | 1 | 8.00 | **Globalising systems** | 2 | 9.00 |
| **Client accessing software** | 1 | 8.00 | **Increasing costs** | 1 | 9.00 |
| | | | **Connections to banks** | 1 | 9.00 |
| | | | **Mobility/External Access when travelling** | 5 | 8.75 |
| | | | **Supply/Availability** | 1 | 8.00 |
| | | | **Small business ERP implementation will negatively affect large businesses** | 1 | 8.00 |
| | | | **Sales modules i.e. opportunities** | 1 | 8.00 |

**Table 18: Future factors of importance**

## Retail vs. non-retail analysis

In order to test any possible differences between the sub-segments of retail (n = 25) versus non-retail (n = 25), a Mann Whitney U Test was utilised once again.

| Ranks | Retail or non-retail? | N | Mean Rank | Sum of Ranks |
|---|---|---|---|---|
| | Retail | 25 | 23.54 | 588.50 |
| Affordability | Non-retail | 25 | 27.46 | 686.50 |
| | Total | 50 | | |
| | Retail | 25 | 22.26 | 556.50 |
| Corporate compliance | Non-retail | 25 | 28.74 | 718.50 |
| | Total | 50 | | |
| | Retail | 25 | 24.62 | 615.50 |
| Implementation time | Non-retail | 25 | 26.38 | 659.50 |
| | Total | 50 | | |
| | Retail | 25 | 24.60 | 615.00 |
| Organisational fit | Non-retail | 25 | 26.40 | 660.00 |
| | Total | 50 | | |
| | Retail | 25 | 25.54 | 638.50 |
| Reliability | Non-retail | 25 | 25.46 | 636.50 |
| | Total | 50 | | |
| | Retail | 25 | 26.22 | 655.50 |
| Compatibility | Non-retail | 25 | 24.78 | 619.50 |
| | Total | 50 | | |
| | Retail | 25 | 25.68 | 642.00 |
| Functionality | Non-retail | 25 | 25.32 | 633.00 |
| | Total | 50 | | |
| | Retail | 25 | 25.14 | 628.50 |
| Infrastructure | Non-retail | 25 | 25.86 | 646.50 |
| | Total | 50 | | |
| | Retail | 25 | 25.80 | 645.00 |
| Flexibility | Non-retail | 25 | 25.20 | 630.00 |
| | Total | 50 | | |
| | Retail | 25 | 25.30 | 632.50 |
| Service and support | Non-retail | 25 | 25.70 | 642.50 |
| | Total | 50 | | |
| | Retail | 25 | 25.60 | 640.00 |
| Vision of vendor | Non-retail | 25 | 25.40 | 635.00 |
| | Total | 50 | | |
| | Retail | 25 | 24.48 | 612.00 |
| Market position of vendor | Non-retail | 25 | 26.52 | 663.00 |
| | Total | 50 | | |
| | Retail | 25 | 25.40 | 635.00 |
| Industry knowledge | Non-retail | 25 | 25.60 | 640.00 |
| | Total | 50 | | |
| | Retail | 25 | 24.76 | 619.00 |
| Vendor references | Non-retail | 25 | 26.24 | 656.00 |
| | Total | 50 | | |

**Table 19: Mann Whitney U Test – retail vs. non-retail**

| Retail vs. Non-Retail | Mann-Whitney U | Wilcoxon W | Z | Asymp. Sig. (2-tailed) |
|---|---|---|---|---|
| **Affordability** | 263.5 | 588.5 | -0.981 | 0.327 |
| **Corporate compliance** | 231.5 | 556.5 | -1.599 | 0.110 |
| **Implementation time** | 290.5 | 615.5 | -0.434 | 0.664 |
| **Organisational fit** | 290 | 615 | -0.445 | 0.656 |
| **Reliability** | 311.5 | 636.5 | -0.021 | 0.984 |
| **Compatibility** | 294.5 | 619.5 | -0.358 | 0.720 |
| **Functionality** | 308 | 633 | -0.089 | 0.929 |
| **Infrastructure** | 303.5 | 628.5 | -0.178 | 0.859 |
| **Flexibility** | 305 | 630 | -0.150 | 0.881 |
| **Service and support** | 307.5 | 632.5 | -0.100 | 0.921 |
| **Vision of vendor** | 310 | 635 | -0.050 | 0.960 |
| **Market position of vendor** | 287 | 612 | -0.503 | 0.615 |
| **Industry knowledge** | 310 | 635 | -0.050 | 0.960 |
| **Vendor references** | 294 | 619 | -0.366 | 0.714 |

**Table 20: Mann Whitney U Test significance – retail vs. non-retail**

There were no significant differences between the retail and non-retail sub-segments within the non-manufacturing segment.

# Chapter 5: Discussion

## Proposition 1

The results above confirmed that the original fourteen criteria were an adequate and important means of selecting an ERP system. Many of the factors mentioned over-and-above the original fourteen could fit into one of those criteria. Moreover, there was no dominant factor or criteria mentioned over the fourteen criteria.

**Therefore, proposition 1 was supported.**

Reliability was rated most highly by medium-sized companies; this could be an indicator of the strategic nature of ERP purchases. It was critical for the software to deliver the value that it promised, and reliability was a key factor in this equation. Unreliable systems not only "…decrease productivity, but also diminish … confidence in the System" (Sarkis *et al*, 2000:210).

With reliability being the leading ERP selection criterion it makes logical sense that service and support was also highly rated. This could also indicate that there is a strong correlation between the two selection criteria.

Service and support is rated second out of a total of fourteen criteria. This is consistent with findings and views of other researchers such as Bernroider *et al* (2001), Sahay *et al* (2003), Sarkis *et al* (2000) and Hecht (1997).

## Proposition 2

It was evident from the results that medium-size businesses considered service and support, reliability, and compatibility most highly when selecting an ERP solution.

**Therefore, proposition 2 was partially supported**.

It was interesting to note that price (affordability) received one of the lowest mean ratings (7.99), appearing thirteenth out of fourteen ERP selection criteria. One reason for this could be explained by the fact that other criteria closely related to price were rated highly:

- Reliability was a key driver of cost of ownership; this criterion received the highest rating overall and could be instrumental in leading customers to ERP solutions that have lower ownership costs.
- Compatibility was a driver of acquisition cost. High levels of compatibility with other software systems enable customers to engineer acquisition costs by selecting ERP modules from a range of different vendors. Compatibility also enables customers to select a mix of technologies that are also compatible with internal skill sets.

Another factor that might explain the reason for the low rating of affordability could be that customers, having observed the high rate of failed ERP projects, are more closely focused on successful ERP adoption and less on inexpensive ERP adoption. It would be interesting to investigate whether customers are willing to pay a higher acquisition price if they perceive a greater chance of successful ERP adoption.

## Proposition 3

Further application of the Mann-Whitney U Test revealed that there were no significant differences between the retail and non-retail sub-segments within the non-manufacturing segment.

**Therefore, proposition 3 was supported.**

For manufacturing companies the top half of the ERP selection criteria list was dominated by criteria that provide guidance on the likelihood of a successful implementation. These were factors that focused largely on the current state of the solution, such as how reliable it was, the quality of support available and the extent to which it could be customised. Out of the top seven ERP selection criteria, only one (vision of the vendor) was focused on the future state of the ERP solution.

Non-manufacturing firms appeared to place a stronger emphasis on the future (rather than current) state of the ERP offering. Three out of the top seven ERP selection criteria were focused on matters that relate to future plans for the ERP solution, the extent to which the vendor understands customer's industry and the extent to which they were able to prove this.

The fact that both manufacturing and non-manufacturing firms applied the same selection criteria for ERP selection suggests that they have a common scope of concerns. The fact that the ERP selection criteria were rated differently by manufacturing and non-manufacturing firms suggested that the two market segments emphasised different concerns when selecting ERP solutions.

Manufacturing firms appeared to be predominantly concerned with ensuring successful ERP adoption while non-manufacturing firms appeared to give equal weighting to ensuring a successful ERP adoption and enhancing that with a steady flow of value-adding features in the future. One reason for this difference between manufacturing and non-manufacturing firms could flow from the fact the ERP systems were initially developed for manufacturing firms and were thus richer in manufacturing features than non-manufacturing features.

This state of affairs could also suggest that medium-sized non-manufacturing companies that have recently adopted ERP were early adopters while their manufacturing peers were part of the later majority of all manufacturing companies.

If this was true, this could also mean that the recent growth in the middle market was actually the intersection of two distinct markets that were evolving in different ways; that is – the manufacturing market captures smaller companies as it matures, while the non-manufacturing market captures larger companies as it matures.

The illusion of a single expanding middle market could simply be that both markets were passing through a phase where they were serving similar sized companies.

## Proposition 4

Given the low number of respondents who proposed new selection criteria, it was concluded that respondents largely felt that the current set of selection criteria would continue to remain relevant in the foreseeable future.

This may also suggest that respondents were largely ignorant or unconcerned about developments that may impact future selection criteria. This could be further explained by the fact that 70% of respondents had already implemented their ERP. This means that assessment criteria were no longer a current business issue.

**Therefore, proposition 4 was not supported.**

# Chapter 6: Conclusions

## Summary of results

Proposition 1 was supported. Reliability was rated most highly by medium-sized companies; this could be an indicator of the strategic nature of ERP purchases. It was critical for the software to deliver the value that it promised, and reliability was a key factor in this equation. Unreliable systems not only "…decrease productivity, but also diminish … confidence in the System" (Sarkis *et al*, 2000:210).

With reliability being the leading ERP selection criterion it makes logical sense that service and support was also highly rated. This could also indicate that there is a strong correlation between the two selection criteria.

Service and support is rated second out of a total of fourteen criteria. This is consistent with findings and views of other researchers such as Bernroider *et al* (2001), Sahay *et al* (2003), Sarkis *et al* (2000) and Hecht (1997).

Proposition 2 was partially supported. It was interesting to note that price (affordability) received one of the lowest mean ratings (7.99), appearing thirteenth out of fourteen ERP selection criteria. One reason for this could be explained by the fact that other criteria closely related to price were rated highly:

- Reliability is a key driver of cost of ownership.
- Compatibility is a driver of acquisition cost.

Another factor that might explain the reason for the low rating of affordability could be that customers, having observed the high rate of failed ERP projects, are more closely focused on successful ERP adoption and less on inexpensive ERP adoption.

Proposition 3 was supported. Manufacturing firms appeared to be predominantly concerned with ensuring successful ERP adoption while non-manufacturing firms appeared to give equal weighting to ensuring a successful ERP adoption and enhancing that with a steady flow of value-adding features in the future.

One reason for this difference between manufacturing and non-manufacturing firms could flow from the fact the ERP systems were initially developed for manufacturing firms and were thus richer in manufacturing features than non-manufacturing features.

This state of affairs could also suggest that medium-sized non-manufacturing companies that have recently adopted ERP were early adopters while their manufacturing peers were part of the later majority of all manufacturing companies.
If this was true, this could also mean that the recent growth in the middle market was actually the intersection of two distinct markets that were evolving in different ways; that is – the manufacturing market captures smaller companies as it matures, while the non-manufacturing market captures larger companies as it matures.

The illusion of a single expanding middle market could simply be that both markets were passing through a phase where they were serving similar sized companies.

Proposition 4 was not supported. Given the low number of respondents who proposed new selection criteria, it was concluded that respondents largely felt that the current set of selection criteria would continue to remain relevant in the foreseeable future.

This may also suggest that respondents were largely ignorant or unconcerned about developments that may impact future selection criteria. This could be further explained by the fact that 70% of respondents had already implemented their ERP. This means that assessment criteria were no longer a current business issue.

## Recommendations

The Economist (October 28th, 2006) reported that SAP wants to expand its customer base from 35,000 customers to 100,000 customers by "moving downstream". The same article referred to the 19.5 billion USD that Oracle has spent in pursuit of the same objective.

ERP vendors have traditionally served a relatively small number of clients who were willing to pay a higher price for highly specialised software products and services. As ERP vendors expand in the middle market there will be a higher number of customers who are willing and able to pay lower prices. ERP vendors clearly hope to sustain growth by building volume, but this will also mean that the cost of delivery will have to be reduced significantly. The table below reviews some of the strategies that ERP vendors have adopted in order to drive down costs and discusses these strategies in light of the findings of this research.

| Strategy | Research findings | Recommendation |
|---|---|---|
| Reduce the number of product configurations and customisation options in favour of standard product blueprints. SAP has been a strong supporter of this approach. | This strategy is likely to face some challenges. Out of fourteen ERP selection criteria, flexibility was ranked fourth and seventh by manufacturing and non-manufacturing firms respectively. Functionality was ranked eighth by both groups. It is clear from this research that the available features, as well as the flexibility to tailor these features are important to medium-sized South African firms. | ERP vendors should continue to emphasise the development of features that are relevant to midsize companies.<br><br>Product customisation tools should be based on widely available skills and technical skill sets in order to offer clients flexibility without compromising affordability. |
| Reduce complexity for customers by hosting the software on shared servers – this means that infrastructure costs (hardware, storage, and operating software) and | Reliability and product support were ranked first and second respectively out of the fourteen selection criteria. This suggests that | Vendors should ensure that their products provide flexibility around deployment. This means that it should be possible to access the software on a fully hosted, partially |

| | | |
|---|---|---|
| the associated manpower costs can be lowered by building scale. This also means that software distribution, installation and configuration costs can also be reduced. Microsoft and Salesforce.com are investing heavily in this strategy. | clients are likely to perceive a high level of value if the cost of meeting these criteria can be lowered.<br><br>Hosted applications offer the possibility of providing high levels of system reliability and support at lower price points because of the economies of scale.<br><br>On the other hand – respondents clearly value product flexibility. The need for flexibility could have an impact on the deployment scenario. | hosted or on-site basis.<br><br>This will allow clients to access high levels of support and reliability at a low price point without compromising deployment flexibility. |
| Control larger parts of the value chain by delivering more of the constituent software components (also referred to as the stack and include – Operating Systems, Databases, and Application Server etc.). This allows the vendor to control costs more tightly and potentially pass benefits on to the client. Microsoft, Oracle and SAP all supply components that make all (Microsoft) or part of the software stack. | The research findings show that customers place a high premium on flexibility. Advances in open standards have made it possible for clients to control solution costs by mixing offerings from different vendors (some of which may be acquired at no cost).<br>This might explain why affordability was ranked thirteenth while flexibility was ranked sixth overall and fourth by manufacturing firms.<br><br>On the other hand, it is also possible that a unified stack | Vendors should continue to drive interoperability and compatibility across all levels of the solution stack.<br><br>Products that are tightly bound to a particular platform (e.g. that are bound to an operating system, application server or database) are likely to be perceived as inflexible (and possibly expensive). |

| | | |
|---|---|---|
| | – made up of components supplied by a single vendor, may offer better reliability and product support. These were the two most highly rated selection criteria. | |
| Build systems that are increasingly based on open standards; allowing greater interoperability between vendor offerings. This would effectively allow clients to customise their solutions by selecting a mixture of offerings, instead of the more expensive route of building custom features onto a single vendor's offering. | Compatibility was rated third highest out of the fourteen selection criteria.<br><br>Customers clearly place a high premium on the capability of systems to interoperate. | Vendors should continue the development of open standards, technologies and protocols that enable improved interoperability between enterprise systems. |

Manufacturing and non-manufacturing firms emphasise different priorities when applying the ERP selection criteria.

Although all of the fourteen ERP selection criteria were important to medium-sized businesses in South Africa, manufacturing and non-manufacturing firms agreed exactly on the first three and differed in their rating of eight of the fourteen ERP selection criteria. It was clear that manufacturing and non-manufacturing companies emphasised different themes in the selection criteria. Non-manufacturing firms appeared to place a greater emphasis on the realisation of potential future gains from ERP investment. For these companies, vision of the vendor, industry knowledge of vendor references were the next three important selection criteria after reliability, support and compatibility.

Manufacturing firms, on the other hand, appeared to emphasise the criteria that determined how ERP can be made to work in their specific situations. Flexibility, infrastructure considerations and organisational fit were the next three important selection criteria after reliability, support and compatibility.

Non-manufacturing firms appeared to a hold a view that ERP still had a lot to offer them in the form of new features and capabilities, while manufacturing firms appear to be more focused on accessing the gains that have been realised by their larger counterparts. Because of this:

- ERP vendors must recognise the emphasis of these different strategic themes when making decisions about research, marketing and pricing.
- ERP vendors should allocate more resources towards developing features and proving the value of ERP to non-manufacturing firms.

## Advice for ERP buyers

- When using the list of fourteen ERP selection criteria, buying companies should not blindly evaluate systems based on an equal weighting of the selection criteria. In the evaluation process the criteria should be weighted to match the strategic priorities of the buying organisation.
- Before adopting ERP, non-manufacturing firms need to take a conscious decision about their stance towards ERP. Companies that have a high risk tolerance and a real opportunity to achieve and sustain a material competitive lead should go ahead with ERP adoption. Companies that are less risk tolerant or perceive lower strategic benefit should review the timing of their ERP projects.
- Companies should review their internal readiness for ERP and use this to guide the selection of their ERP solution. Specifically, the level of internal readiness should be considered in the weighting of ERP selection criteria.

## Suggestions for further research

There is evidence showing that medium-sized South African manufacturers emphasise different criteria when compared to their non-manufacturing counterparts. Further research needs to be done to confirm this observation and understand the underlying reasons.

This could be useful for directing future market and product development efforts and develop an understanding of the factors that influence the difference in prioritisation between manufacturing and non-manufacturing firms.

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# Appendix 1: Questionnaire

| Questionnaire Information | | | | |
|---|---|---|---|---|
| Q1.1 | Interviewer name: | | | Continue |
| Q1.2 | Date of interview: | | | Continue |
| Q1.3 | Time of interview: | | | Continue |
| Q1.4 | Telephone number (including dialling code): | | | Continue |
| Q1.5 | Name of company: | | | Continue |
| Q1.6 | Respondent: (Name and Title) | | | Continue |
| Q1.7 | Province: | | | **Check quota** |
| **Filters – A** | | | | |
| Q2.1 | Good day. My name is……..and I am conducting a survey for a research firm. Are you a medium-sized company with about 100 to 500 employees? | Less than 100 | 1 | **Close** |
| | | Between 100 and 500 | 2 | Continue |
| | | More than 500 | 3 | **Close** |
| Q2.2 | Are you a manufacturing or non-manufacturing firm? | Manufacturing | 1 | **Check quota** Skip to Q2.4 |
| | | Non-manufacturing | 2 | **Check quota** Continue |
| Q2.3 | Are you a retail or non-retail business? | Retail | 1 | **Check quota** Continue |
| | | Non-retail | 2 | **Check quota** Continue |
| Q2.4 | Please may I speak with the person in charge of your IT department/division? | Yes | 1 | Skip to Q3.1 |
| | | No | 2 | Continue |
| Q2.5 | Can I get the contact details of this person? | **Name:** | | |
| | | **Direct line:** | | |
| | | **Position:** | | |
| | | **Best time to call back:** | | |
| **Filters – B** | | | | |
| Q3.1 | Good day. My name is……..and I am conducting a survey on the use and implementation of ERP solutions in companies. This interview should last about 5 minutes and all your answers will be confidential. May I continue? | Yes | 1 | Continue |
| | | No | 2 | **Close** |
| Q3.2 | Does [**COMPANY**] currently have an ERP solution in place? | Yes | 1 | Go to 3.4 |
| | | No | 2 | Continue |

| | | | | |
|---|---|---|---|---|
| Q3.3 | Is [**COMPANY**] currently implementing or considering implementing an ERP solution within the next two years?<br><br>**ERP system = Enterprise Resource Planning system: it integrates or combines different software into one system** | Yes | 1 | Continue |
| | | No | 2 | **Close** |
| Q3.4 | How long has it been since [COMPANY] completed its ERP implementation? | Less than five years (please state) | 1 | Continue |
| | | More than five years (please state) | 2 | **Close** |

**Attribute Rating**

Q4.1 When choosing an ERP system, on a scale of 0 to 10, where 0 is totally unimportant and 10 is extremely important, how important is/are (the)…..?

| | **Attribute** | **0** | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** | **10** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Q4.1.1 | Cost of an ERP system | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| Q4.1.2 | Your firm's procurement rules, technical guidelines or standards (i.e. you must buy certain brands or technologies) | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| Q4.1.3 | The speed of installation (how long it will take to complete the ERP implementation) | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| Q4.1.4 | Fit of the system with your current IT skills (including the level of sophistication of your end users and the level of maturity of your business processes) | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| Q4.1.5 | Reliability of the system | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| Q4.1.6 | Compatibility with other transactional systems (both with internal systems and infrastructure as well as external partner systems) | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| Q4.1.7 | Specialised features (especially those that are of importance in your industry) | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| Q4.1.8 | Technical criteria such as support for multiple operating systems, databases, languages, currencies, character sets (e.g. Chinese or Arabic) etc. (This can also include other technical considerations like deployment options and scalability) | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| Q4.1.9 | Flexibility – specifically around the ease of customisation modify and extend existing functionality to support your unique business situation | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| Q4.1.10 | After sales support | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| Q4.1.11 | The future direction in which the product will be developed (AKA the product road map, or the vision of the vendor) | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| Q4.1.12 | Size and economic strength of the vendor | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| Q4.1.13 | The level of knowledge that the vendor has about your industry. | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| Q4.1.14 | References of the vendor (i.e. what other customers have to say about the vendor's product, service, pricing etc.) | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |

**Unaided Attribute Rating**

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Q5.1 | Are there any other important factors that I have left out? What are they? How important are they using the same 10-point scale? | | | | | | | | | | | |
| | **Attribute** | **0** | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** | **10** |
| Q5.1.1 | | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| Q5.1.2 | | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| Q5.1.3 | | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| Q5.1.4 | | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| Q5.1.5 | | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| **Future Influences** | | | | | | | | | | | | |
| Q6.1 | In the next 2 to 4 years do you think there will be new factors that will become important? What are they? How important are they using the same 10-point scale? | | | | | | | | | | | |
| | **Attribute** | **0** | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** | **10** |
| Q6.1.1 | | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| Q6.1.2 | | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| Q6.1.3 | | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| Q6.1.4 | | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| Q6.1.5 | | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| **Contacts** | | | | | | | | | | | | |
| Q7.1 | Have you been to see, or are you planning to go and see other companies that have already implemented an ERP solution? Can you please provide me with the details of those companies so that we can conduct a survey with them as well? | | | | | | | | | | | |
| | **Company** | **Telephone number** | | | **Contact person** | | | | | | | |
| Q7.1.1 | | | | | | | | | | | | |
| Q7.1.2 | | | | | | | | | | | | |
| Q7.1.3 | | | | | | | | | | | | |
| Q7.2 | **[IF ERP SOLUTION IMPLEMENTED]** Have any companies been to see your ERP solution? Can you please provide me with the details of those companies so that we can conduct a survey with them as well? | | | | | | | | | | | |
| | **Company** | **Telephone number** | | | **Contact person** | | | | | | | |
| Q7.2.1 | | | | | | | | | | | | |
| Q7.2.2 | | | | | | | | | | | | |
| Q7.2.3 | | | | | | | | | | | | |
| **Close** | | | | | | | | | | | | |
| Thank you very much for your time. Would you like us to contact you with news of the findings of this survey?<br><br>Email address:_____ | | | | | | | | | | | | |

## End of questionnaire

## Appendix 2: Respondent list

| | Company | Position |
|---|---|---|
| 1 | Alstom Electric Elements | IT Manager |
| 2 | BNM Engineering | IT Manager |
| 3 | Hannan Engineering | IT Manager |
| 4 | Bavory Foods | ERP Admin&Dev |
| 5 | Minova | IT Support |
| 6 | Digicare Holdings (pty) Ltd | IT Manager |
| 7 | All Hair Labs | Ops Co-ordinator |
| 8 | Boxlee | Fin Manager |
| 9 | Dust-a-side | Logistics Manager |
| 10 | Pilot Furniture Manufactures | Factory Manager |
| 11 | Z F Lemorder SA (Pty( Ltd | IT Manager |
| 12 | David Brown Gear Industries (Pty) Ltd | IT Manager |
| 13 | Johnson Diversey S.A (Pty) Ltd | IT Manager |
| 14 | Dulux | IT Manager |
| 15 | Lexmark | IT/Sales Manager |
| 16 | Pirtek | Head of IT Dept |
| 17 | 3M SA | IT Support |
| 18 | Sabenza Forwarding & Shipping | Snr Analyst Dev. |
| 19 | Billabong SA | IT Specialist |
| 20 | Famous Brands | IS Manager |
| 21 | Metro Home Improvements | IT Network |
| 22 | Valu Truck Logistics | IT Manager |
| 23 | Shield Buying and Distibution | IT Manager |
| 24 | The Work Group | Branch Manager |
| 25 | L'oreal | Systems Integrator |
| 26 | Nashua | IT Manager |
| 27 | LG Airconditioning | IT Supervisor |
| 28 | Motion Business (Pty) Ltd | IT Manager |
| 29 | Habib Overseas Bank | IT Manager |
| 30 | Spartan Truck Hire | IT Manager |
| 31 | Tourwest | IT Manager |
| 32 | Panasonic | IT HOD |
| 33 | Avis | IT Manager |
| 34 | Prestige Minolta | IT Manager |
| 35 | Bester Transport | IT Manager |
| 36 | Umzantis Africa Electrical | IT Manager |
| 37 | Choice Technology | IT & Fin Manager |
| 38 | Brakpan City Council | IT Manager |
| 39 | Forensic Security&Sol CC | Director |
| 40 | Grafitti | Director |
| 41 | Premier Group | Snr ERP Specialist |
| 42 | BIC | IT Manager |
| 43 | Landis&Gyr | IT Manager |

| | | |
|---|---|---|
| 44 | Defy | IT Manager |
| 45 | Frame Manchester Manf | Ops Manager MIS |
| 46 | Sea Harvest | IT Manager |
| 47 | Brinant Security PTY Ltd | IT Control |
| 48 | INVIROTECH | IT Manager |
| 49 | Value City Wholesalers | IT Manager |
| 50 | Port Shepstone Bargain Wholesalers CC | IT Manager |
| 51 | Save Wholesalers C&C Pty Ltd | IT Manager |
| 52 | Country Mushrooms | IT Manager |
| 53 | Noag's Market | IT Manager |
| 54 | Vegeworth PTY LTD | IT Department |
| 55 | Safcor PTY LTD | IT Manager |
| 56 | Rainbow Roof Sheeters | IT Manager |
| 57 | SBITechnologies | IT Manager |
| 58 | H.S.Security (Pty) | IT Manager |
| 59 | Financial Services Board | IT Manager |
| 60 | F G Lapasta | IT Department |
| 61 | Elorax | IT Specialist |
| 62 | Impact Plus Trading | IT Manager |
| 63 | Continental Star | IT Manager |
| 64 | This and that craft | IT Manager |
| 65 | African Consolodated | Manager |
| 66 | Delmonte.S.A | IT Manager |
| 67 | Svenmill Fabrics | Co Sec Financial Director |
| 68 | Swiftbox | IT Manager |
| 69 | Bayer Crop Signs | IT Manager |
| 70 | Gingwe Coal(Pty)ltd | IT Manager |
| 71 | Transfarm Pretoria | IT Manager |
| 72 | Exitement Store | IT Manager |
| 73 | I & J | IT Manager |
| 74 | Barker Footware | Fin Director |
| 75 | Maxi Pass (Pty)Ltd | IT Manager |
| 76 | G C Bears | IT Manager |
| 77 | Jasper Consultants | IT Manager |
| 78 | AB Western Enterprizes | IT Manager |
| 79 | Howden Africa Holdings | IT Manager |
| 80 | Vetsak | IT Department |

# Appendix 3: Reliability test using Cronbach's Alpha

Reliability refers to the property of a measurement instrument that causes it to give similar results for similar inputs.

Cronbach's alpha (Cronbach, 1951) measures how well a set of items (or variables) measures a single unidimensional latent construct. When data have a multidimensional structure, Cronbach's alpha will usually be low.

Technically speaking, Cronbach's alpha is not a statistical test - it is a coefficient of reliability (or consistency). Note that a reliability coefficient of .70 or higher is considered as "acceptable" (SPSS Inc., 2005).

Cronbach's alpha (Cronbach, 1951) is a measure of reliability. More specifically, alpha is a lower bound for the true reliability of the survey. Mathematically, reliability is defined as the proportion of the variability in the responses to the survey that is the result of differences in the respondents. That is, answers to a reliable survey will differ because respondents have different opinions, not because the survey is confusing nor has multiple interpretations. The computation of Cronbach's alpha is based on the number of items on the survey (k) and the ratio of the average inter-item covariance to the average item variance.

$$\alpha = \frac{k(\overline{cov} / \overline{var})}{1 + (k-1)(\overline{cov} / \overline{var})}$$

Under the assumption that the item variances are all equal, this ratio simplifies to the average inter-item correlation, and the result is known as the Standardized item alpha (or Spearman-Brown stepped-up reliability coefficient) (Cronbach, 1951).

$$\alpha = \frac{k\bar{r}}{1 + (k-1)\bar{r}}$$

Reliability of the constructs were tested both after the 10 pilots were completed and at the end of the survey. The results are as follows:

**Reliability Statistics**

| | Cronbach's Alpha | N of Items |
|---|---|---|
| **After 10 pilots** | **.776** | 20 |
| **At the end of the survey** | **.869** | 20 |

This indicates that, overall, the constructs used (i.e. questions asked) were reliable in measuring the expected outcomes both after the 10 pilots and at the end of the survey (greater than 0.7).

# Appendix 4: Kolmogorov-Smirnov Goodness-Of-Fit Test

The Kolmogorov-Smirnov Goodness-of-Fit test procedure compares the observed cumulative distribution function for a variable with a specified theoretical distribution, e.g. normal. The Kolmogorov-Smirnov Z is computed from the largest difference (in absolute value) between the observed and theoretical cumulative distribution functions.

As mentioned, many parametric tests require normally distributed variables, and this goodness-of-fit test tests whether the observations could reasonably have come from a normal distribution.

**One-Sample Kolmogorov-Smirnov Test**

| Questions[1] | Normal Parameters | | Most Extreme Differences | | | Kolmogorov-Smirnov Z | Asymp. Sig. (2-tailed) |
|---|---|---|---|---|---|---|---|
| | Mean | Std. Deviation | Absolute | Positive | Negative | | |
| **Q.2.2** | 1.625 | 0.487 | 0.404 | 0.275 | -0.404 | 3.616 | **0.000** |
| **Q.2.3** | 2.063 | 0.832 | 0.245 | 0.212 | -0.245 | 2.192 | **0.000** |
| **Q.3.2** | 1.313 | 0.466 | 0.436 | 0.436 | -0.251 | 3.900 | **0.000** |
| **Q.3.3** | 2.375 | 0.933 | 0.436 | 0.251 | -0.436 | 3.900 | **0.000** |
| **Q.3.4** | 1.650 | 0.943 | 0.430 | 0.430 | -0.249 | 3.844 | **0.000** |
| **Q.4.1.1** | 7.988 | 1.547 | 0.178 | 0.147 | -0.178 | 1.594 | **0.012** |
| **Q.4.1.2** | 7.663 | 1.909 | 0.170 | 0.110 | -0.170 | 1.522 | **0.019** |
| **Q.4.1.3** | 8.088 | 1.976 | 0.195 | 0.167 | -0.195 | 1.743 | **0.005** |
| **Q.4.1.4** | 8.238 | 1.601 | 0.221 | 0.135 | -0.221 | 1.973 | **0.001** |
| **Q.4.1.5** | 9.088 | 1.324 | 0.330 | 0.245 | -0.330 | 2.949 | **0.000** |
| **Q.4.1.6** | 8.613 | 1.463 | 0.204 | 0.171 | -0.204 | 1.829 | **0.002** |
| **Q.4.1.7** | 8.238 | 1.781 | 0.203 | 0.161 | -0.203 | 1.818 | **0.003** |
| **Q.4.1.8** | 8.188 | 1.917 | 0.202 | 0.172 | -0.202 | 1.804 | **0.003** |
| **Q.4.1.9** | 8.313 | 1.356 | 0.196 | 0.166 | -0.196 | 1.756 | **0.004** |
| **Q.4.1.10** | 8.713 | 1.511 | 0.240 | 0.197 | -0.240 | 2.150 | **0.000** |
| **Q.4.1.11** | 8.525 | 1.599 | 0.247 | 0.178 | -0.247 | 2.208 | **0.000** |
| **Q.4.1.12** | 8.063 | 1.767 | 0.173 | 0.136 | -0.173 | 1.551 | **0.016** |
| **Q.4.1.13** | 8.463 | 1.440 | 0.195 | 0.143 | -0.195 | 1.741 | **0.005** |
| **Q.4.1.14** | 8.300 | 1.672 | 0.187 | 0.155 | -0.187 | 1.675 | **0.007** |

As the significance levels (last column on the right) of the Z-scores (second-last column on the right) are all below 0.05, the data is **NOT normally distributed**. Therefore, the data can be tested using **nonparametric tests**, which does not make the assumption that the data is normally distributed data.

It is important to note that non-normally distributed data does not mean the quality of your data is at fault but is simply a measure of how your data falls within the measurement.

1 Q5.1 and Q6.1 are nonparametric in nature due to the low responses.

## Appendix 5: Descriptive statistics terms

| | |
|---|---|
| **N** | The valid sample size per variable or question |
| **Missing** | Missing data points in the variable |
| **Mean** | Average of the specified consideration set |
| **Mode** | The value that occurs most frequently in the consideration set |
| **Median** | The value above which half of the values fall and below which half of the values fall |
| **Skewness** | A characteristic of a distribution that assesses its symmetry about the mean (i.e. either a positive or negative skew from the mean)<br><br>The normal distribution is symmetric and has a skewness value of zero<br>• A distribution with a significant positive skewness has a long right tail<br>• A distribution with a significant negative skewness has a long left tail<br><br>Although skewness provides some indication of departure from normality, the Kolmogorov-Smirnov Goodness-of-Fit test provides a more reliable indication |
| **Kurtosis** | A measure of the relative peakedness of the curve defined by the frequency distribution (i.e. height of curve in relation to a normal distribution, either flatter or more peaked) |
| **Variance** | The mean squared deviation from the mean |
| **Standard deviation** | The square root of the variance<br><br>This is a useful measure as it is provides an indication of the spread of the data, i.e. how varied the responses (or attitudes and perceptions) were, as well as providing a measure of the likelihood of the results occurring should the same study were to be repeated many times |
| **Frequency distribution** | A mathematical distribution whose objective is to obtain a count of the number of responses associated with different values of one variable and to express these counts in percentage terms |

**Source:** **Mahotra, 1999**
**Mimmack, Meyer, Manas, 2000**
**SPSS Inc., 2005**

# Appendix 6: Measures of location, shape and variability

| | Minimum | Maximum | Sum | Mean | Std. Deviation | Variance | Skewness | Kurtosis |
|---|---|---|---|---|---|---|---|---|
| **Province** | 1 | 4 | 177 | 2.213 | 0.610 | 0.372 | 1.573 | 2.952 |
| **Q.2.2** | 1 | 2 | 130 | 1.625 | 0.487 | 0.237 | -0.526 | -1.768 |
| **Q.2.3** | 1 | 3 | 165 | 2.063 | 0.832 | 0.692 | -0.119 | -1.549 |
| **Q.3.2** | 1 | 2 | 105 | 1.313 | 0.466 | 0.218 | 0.825 | -1.355 |
| **Q.3.3** | 1 | 3 | 190 | 2.375 | 0.933 | 0.870 | -0.825 | -1.355 |
| **Q.3.4** | 1 | 3 | 132 | 1.650 | 0.943 | 0.889 | 0.762 | -1.457 |
| **Q.4.1.1** | 5 | 10 | 639 | 7.988 | 1.547 | 2.392 | -0.294 | -0.815 |
| **Q.4.1.2** | 1 | 10 | 613 | 7.663 | 1.909 | 3.644 | -0.900 | 1.066 |
| **Q.4.1.3** | 0 | 10 | 647 | 8.088 | 1.976 | 3.904 | -1.417 | 2.767 |
| **Q.4.1.4** | 4 | 10 | 659 | 8.238 | 1.601 | 2.563 | -0.665 | -0.619 |
| **Q.4.1.5** | 5 | 10 | 727 | 9.088 | 1.324 | 1.752 | -1.441 | 1.292 |
| **Q.4.1.6** | 3 | 10 | 689 | 8.613 | 1.463 | 2.139 | -1.162 | 1.578 |
| **Q.4.1.7** | 2 | 10 | 659 | 8.238 | 1.781 | 3.171 | -1.128 | 1.317 |
| **Q.4.1.8** | 0 | 10 | 655 | 8.188 | 1.917 | 3.673 | -1.646 | 3.819 |
| **Q.4.1.9** | 5 | 10 | 665 | 8.313 | 1.356 | 1.838 | -0.529 | -0.198 |
| **Q.4.1.10** | 4 | 10 | 697 | 8.713 | 1.511 | 2.283 | -1.097 | 0.439 |
| **Q.4.1.11** | 5 | 10 | 682 | 8.525 | 1.599 | 2.556 | -0.742 | -0.604 |
| **Q.4.1.12** | 2 | 10 | 645 | 8.063 | 1.767 | 3.123 | -0.831 | 0.403 |
| **Q.4.1.13** | 5 | 10 | 677 | 8.463 | 1.440 | 2.075 | -0.549 | -0.729 |
| **Q.4.1.14** | 0 | 10 | 664 | 8.300 | 1.672 | 2.795 | -1.742 | 6.212 |

**Note:**

The table above is displayed graphically via frequencies in the next section. The variance is a measure of the dispersion around the mean and as the scores above are means of means, the dispersion around the mean is smaller.

The variance and the closely-related standard deviation are measures of how spread out a distribution is. In other words, they are measures of variability. The variance is computed as the average squared deviation of each number from its mean (SPSS Inc., 2005).

The most common formula used is as follows:

$$s^2 = \frac{\sum (X - M)^2}{N - 1}$$

where S is equal to the standard deviation, N is equal to the sample size and M is the mean of the sample.

# Appendix 7: Frequencies and histograms

## Province

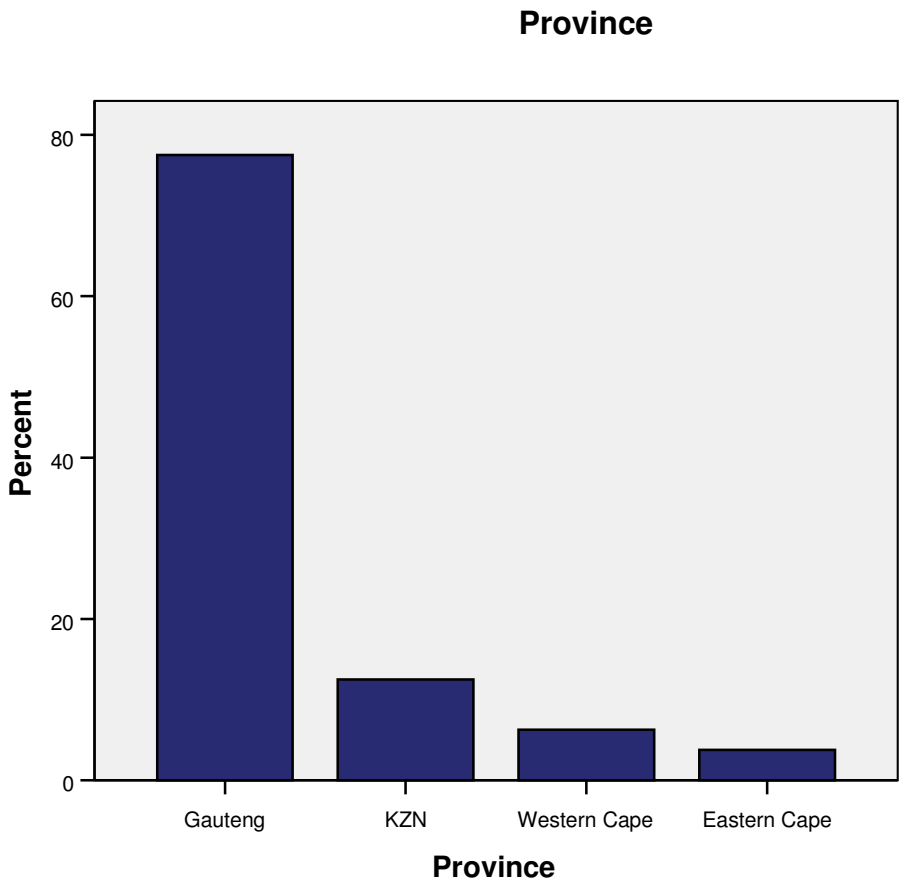
**Statistics**

Province

| | | |
|---|---|---|
| N | Valid | 80 |
| | Missing | 0 |
| Mean | | 2.21 |
| Mode | | 2 |

**Province**

| | | Frequency | Percent | Valid Percent | Cumulative Percent |
|---|---|---|---|---|---|
| Valid | Gauteng | 62 | 77.5 | 77.5 | 77.5 |
| | KZN | 10 | 12.5 | 12.5 | 90.0 |
| | Western Cape | 5 | 6.3 | 6.3 | 96.3 |
| | Eastern Cape | 3 | 3.8 | 3.8 | 100.0 |
| | Total | 80 | 100.0 | 100.0 | |




## Are you a manufacturing or non-manufacturing firm?

**Statistics**

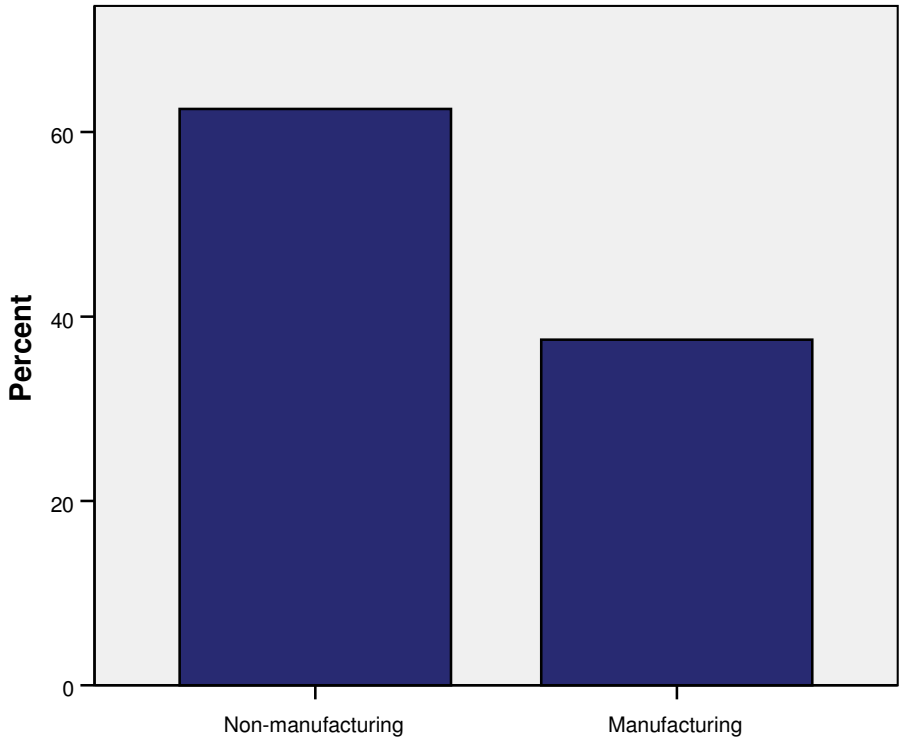
Are you a manufacturing or non-manufacturing firm?

| | | |
|---|---|---|
| N | Valid | 80 |
| | Missing | 0 |
| Mean | | 1.63 |
| Mode | | 2 |

**Are you a manufacturing or non-manufacturing firm?**

| | | Frequency | Percent | Valid Percent | Cumulative Percent |
|---|---|---|---|---|---|
| Valid | Non-manufacturing | 50 | 62.5 | 62.5 | 62.5 |
| | Manufacturing | 30 | 37.5 | 37.5 | 100.0 |
| | Total | 80 | 100.0 | 100.0 | |

**Are you a manufacturing or non-manufacturing firm?**




**Are you a manufacturing or non-manufacturing firm?**

## Are you a retail or non-retail business?

**Statistics**

Are you a retail or non-retail business?

| | | |
|---|---|---|
| N | Valid | 80 |
| | Missing | 0 |
| Mean | | 2.06 |
| Mode | | 3 |

**Are you a retail or non-retail business?**

| | | Frequency | Percent | Valid Percent | Cumulative Percent |
|---|---|---|---|---|---|
| Valid | N/A | 30 | 37.5 | 37.5 | 37.5 |
| | Retail | 25 | 31.3 | 31.3 | 68.8 |
| | Non-retail | 25 | 31.3 | 31.3 | 100.0 |
| | Total | 80 | 100.0 | 100.0 | |




## Does [COMPANY] currently have an ERP solution in place?

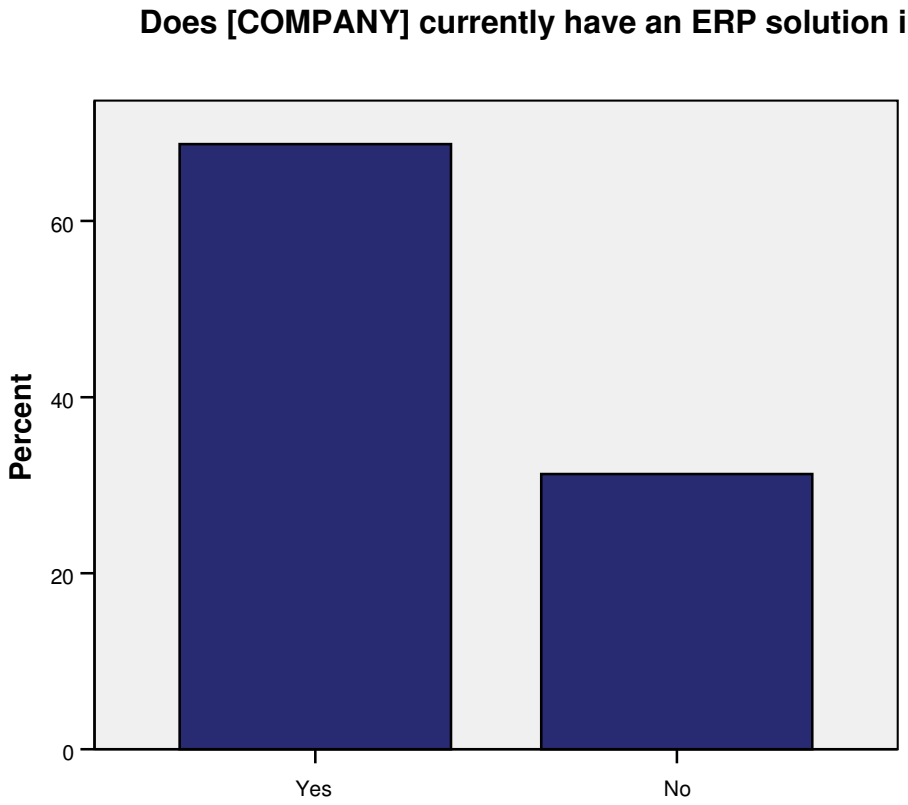
**Statistics**

Does [COMPANY] currently have an ERP solution in place?

| | | |
|---|---|---|
| N | Valid | 80 |
| | Missing | 0 |
| Mean | | 1.31 |
| Mode | | 1 |

**Does [COMPANY] currently have an ERP solution in place?**

| | | Frequency | Percent | Valid Percent | Cumulative Percent |
|---|---|---|---|---|---|
| Valid | Yes | 55 | 68.8 | 68.8 | 68.8 |
| | No | 25 | 31.3 | 31.3 | 100.0 |
| | Total | 80 | 100.0 | 100.0 | |




## Is [COMPANY] currently implementing or considering implementing an ERP solution within the next two years?

**Statistics**

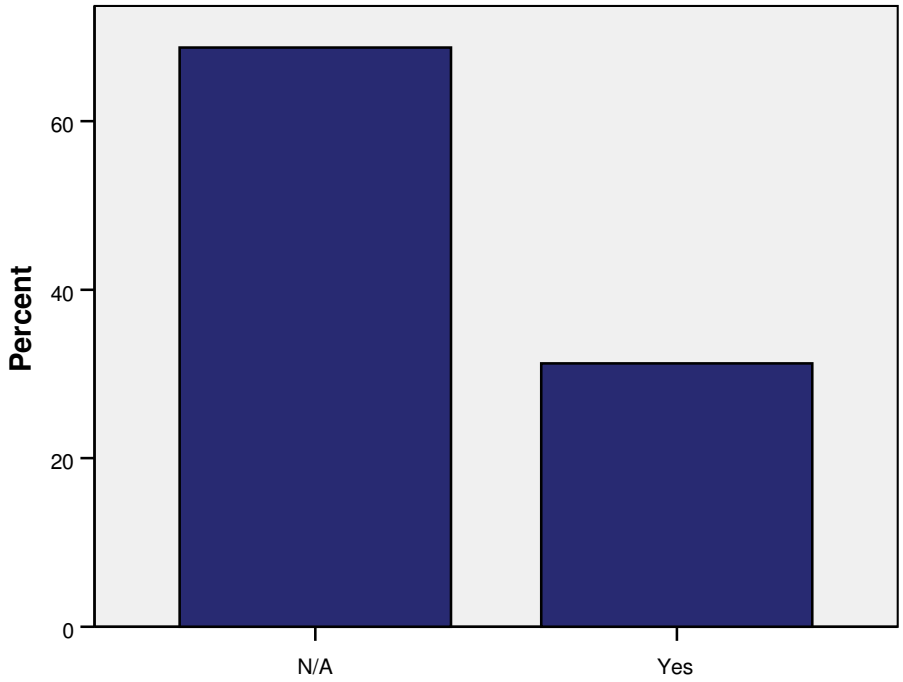
Is [COMPANY] currently implementing or considering implementing an ERP solution within the next two years?

| | | |
|---|---|---|
| N | Valid | 80 |
| | Missing | 0 |
| Mean | | 2.38 |
| Mode | | 3 |

**Is [COMPANY] currently implementing or considering implementing an ERP solution within the next two years?**

| | | Frequency | Percent | Valid Percent | Cumulative Percent |
|---|---|---|---|---|---|
| Valid | N/A | 55 | 68.8 | 68.8 | 68.8 |
| | Yes | 25 | 31.3 | 31.3 | 100.0 |
| | Total | 80 | 100.0 | 100.0 | |

**Is [COMPANY] currently implementing or considering implementing an ERP solution within the next two years?**




**Is [COMPANY] currently implementing or considering implementing an ERP solution within the next two years?**

## How long has it been since [COMPANY] completed its ERP implementation?

**Statistics**

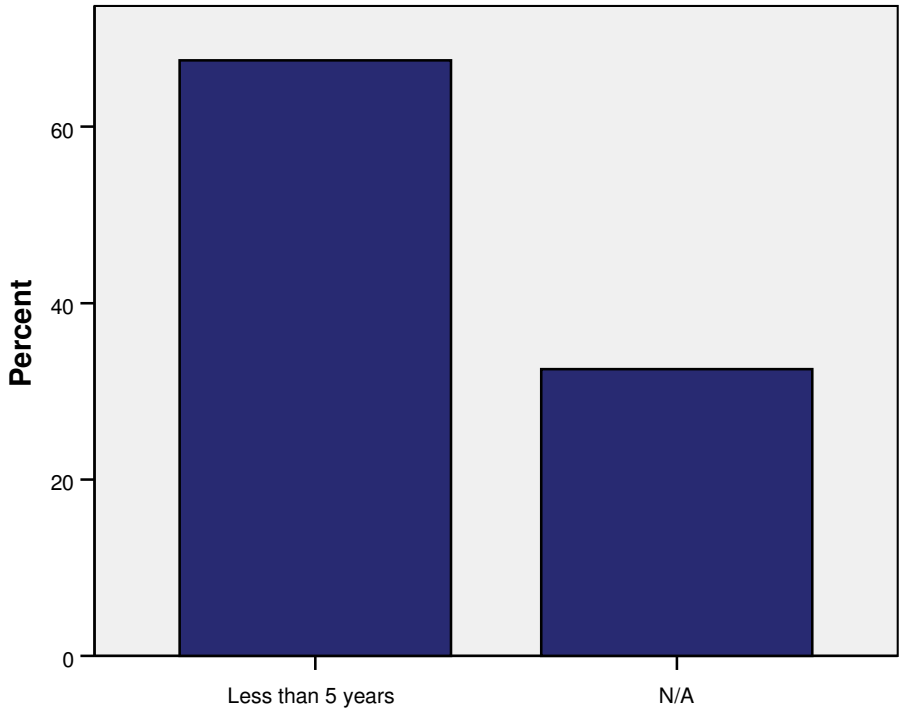
How long has it been since [COMPANY] completed its ERP implementation?

| | | |
|---|---|---|
| N | Valid | 80 |
| | Missing | 0 |
| Mean | | 1.65 |
| Mode | | 1 |

**How long has it been since [COMPANY] completed its ERP implementation?**

| | | Frequency | Percent | Valid Percent | Cumulative Percent |
|---|---|---|---|---|---|
| Valid | Less than 5 years | 54 | 67.5 | 67.5 | 67.5 |
| | N/A | 26 | 32.5 | 32.5 | 100.0 |
| | Total | 80 | 100.0 | 100.0 | |

**How long has it been since [COMPANY] completed its ERP implementation?**




**How long has it been since [COMPANY] completed its ERP implementation?**

## Cost of an ERP system

**Statistics**

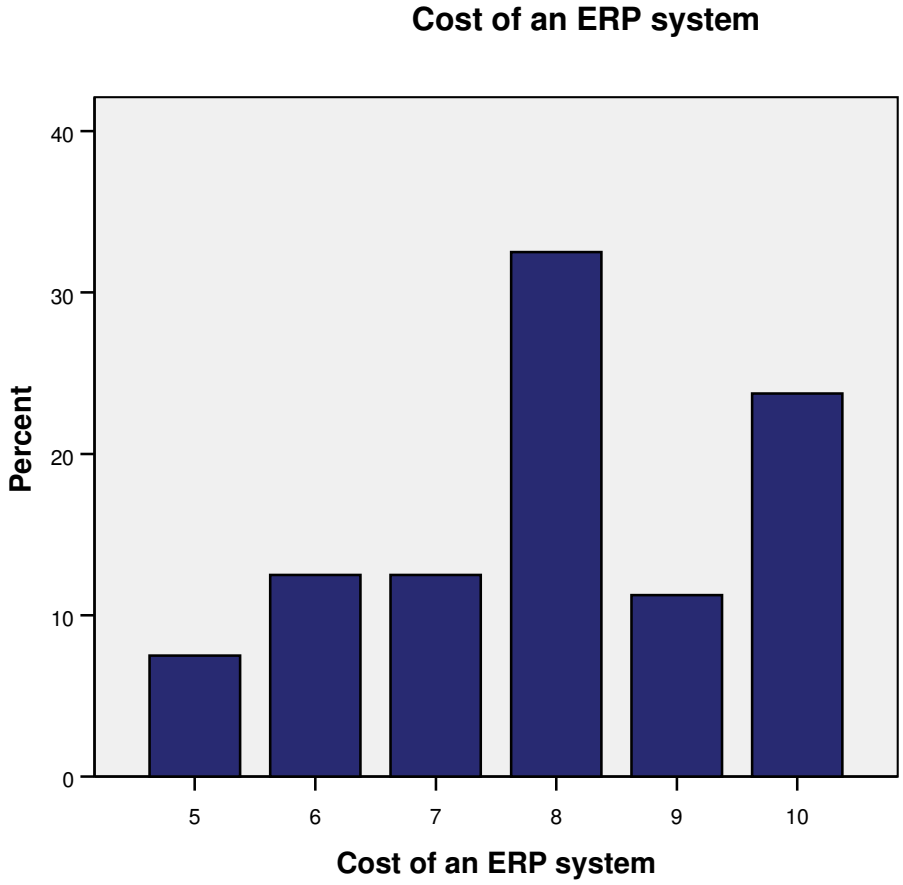
Cost of an ERP system

| | | |
|---|---|---|
| N | Valid | 80 |
| | Missing | 0 |
| Mean | | 7.99 |
| Median | | 8.00 |
| Mode | | 8 |

**Cost of an ERP system**

| | | Frequency | Percent | Valid Percent | Cumulative Percent |
|---|---|---|---|---|---|
| Valid | 5 | 6 | 7.5 | 7.5 | 7.5 |
| | 6 | 10 | 12.5 | 12.5 | 20.0 |

| | | | | | |
|---|---|---|---|---|---|
| | 7 | 10 | 12.5 | 12.5 | 32.5 |
| | 8 | 26 | 32.5 | 32.5 | 65.0 |
| | 9 | 9 | 11.3 | 11.3 | 76.3 |
| | 10 | 19 | 23.8 | 23.8 | 100.0 |
| | Total | 80 | 100.0 | 100.0 | |




## Your firm's procurement rules, technical guidelines or standards (i.e. you must buy certain brands or technologies)

**Statistics**

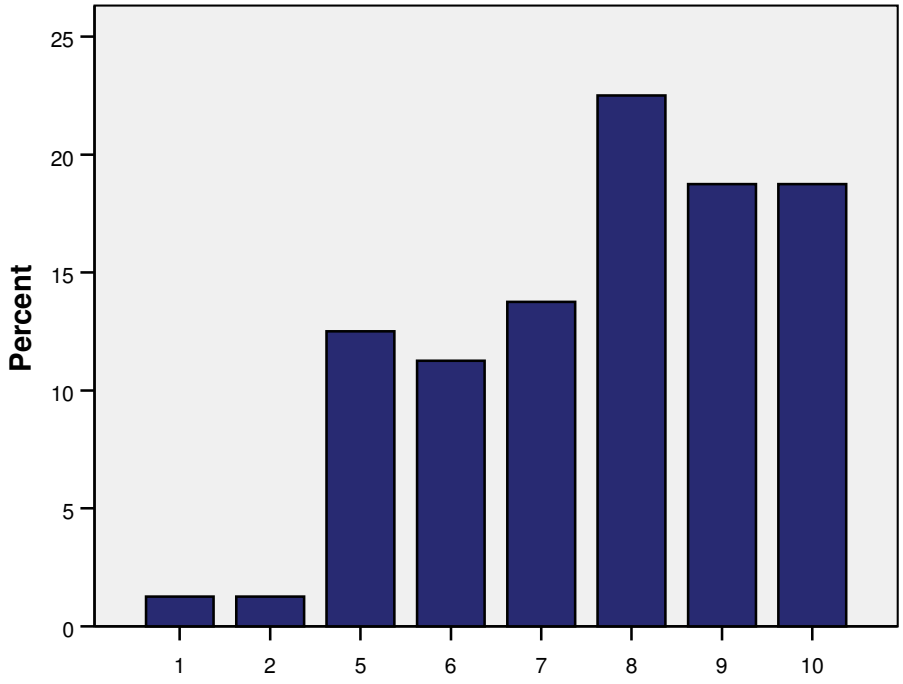
Your firm's procurement rules, technical guidelines or standards (i.e. you must buy certain brands or technologies)

| | | |
|---|---|---|
| N | Valid | 80 |
| | Missing | 0 |
| Mean | | 7.66 |
| Median | | 8.00 |
| Mode | | 8 |

**Your firm's procurement rules, technical guidelines or standards (i.e. you must buy certain brands or technologies)**

| | | Frequency | Percent | Valid Percent | Cumulative Percent |
|---|---|---|---|---|---|
| Valid | 1 | 1 | 1.3 | 1.3 | 1.3 |
| | 2 | 1 | 1.3 | 1.3 | 2.5 |
| | 5 | 10 | 12.5 | 12.5 | 15.0 |
| | 6 | 9 | 11.3 | 11.3 | 26.3 |
| | 7 | 11 | 13.8 | 13.8 | 40.0 |
| | 8 | 18 | 22.5 | 22.5 | 62.5 |
| | 9 | 15 | 18.8 | 18.8 | 81.3 |
| | 10 | 15 | 18.8 | 18.8 | 100.0 |
| | Total | 80 | 100.0 | 100.0 | |

**Your firm's procurement rules, technical guidelines or standards (i.e. you must buy certain brands or technologies)**




## The speed of installation (how long it will take to complete the ERP implementation)

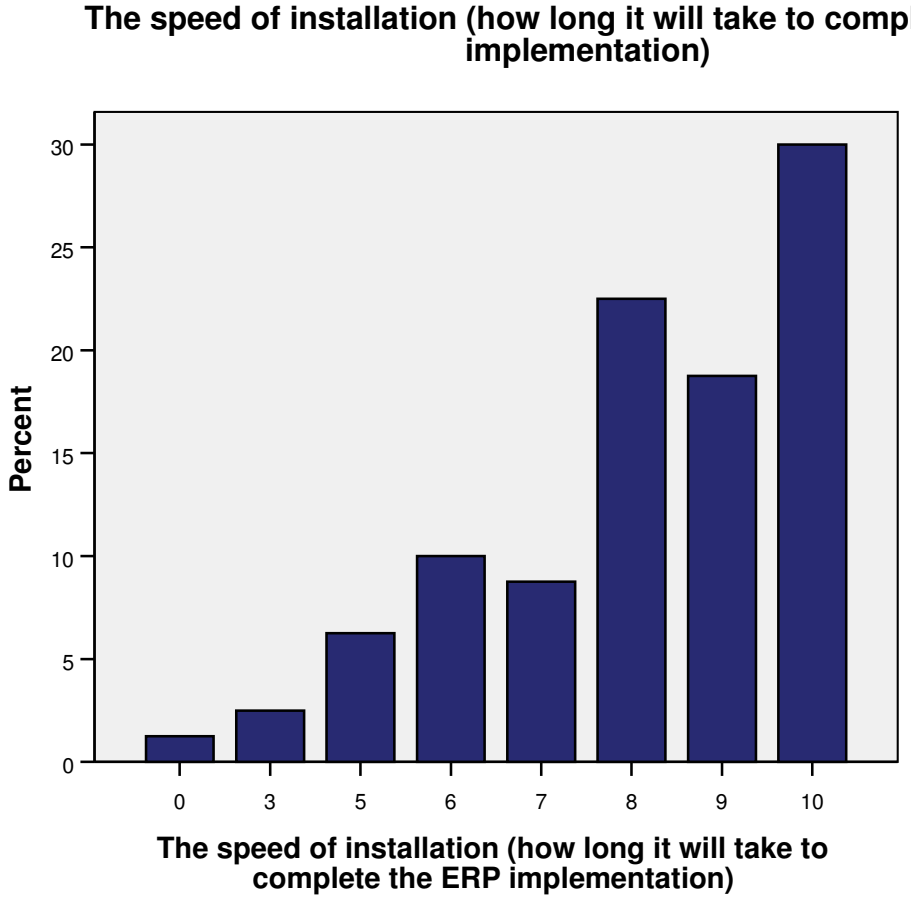
**Statistics**

The speed of installation (how long it will take to complete the ERP implementation)

| | | |
|---|---|---|
| N | Valid | 80 |
| | Missing | 0 |
| Mean | | 8.09 |
| Median | | 8.00 |
| Mode | | 10 |

**The speed of installation (how long it will take to complete the ERP implementation)**

| | | Frequency | Percent | Valid Percent | Cumulative Percent |
|---|---|---|---|---|---|
| Valid | 0 | 1 | 1.3 | 1.3 | 1.3 |
| | 3 | 2 | 2.5 | 2.5 | 3.8 |
| | 5 | 5 | 6.3 | 6.3 | 10.0 |
| | 6 | 8 | 10.0 | 10.0 | 20.0 |
| | 7 | 7 | 8.8 | 8.8 | 28.8 |
| | 8 | 18 | 22.5 | 22.5 | 51.3 |
| | 9 | 15 | 18.8 | 18.8 | 70.0 |
| | 10 | 24 | 30.0 | 30.0 | 100.0 |
| | Total | 80 | 100.0 | 100.0 | |




## Fit of the system with your current IT skills (including the level of sophistication of your end users and the level of maturity of your business processes)

**Statistics**

Fit of the system with your current IT skills (including the level of sophistication of your end users and the level of maturity of your business processes)

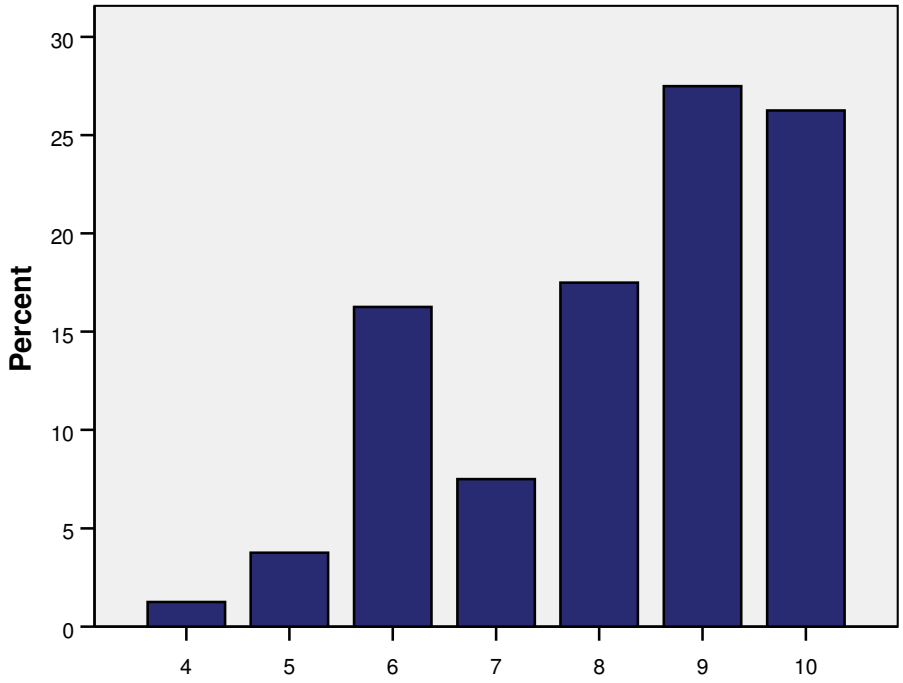
| | | |
|---|---|---|
| N | Valid | 80 |
| | Missing | 0 |
| Mean | | 8.24 |
| Median | | 9.00 |
| Mode | | 9 |

**Fit of the system with your current IT skills (including the level of sophistication of your end users and the level of maturity of your business processes)**

| | | Frequency | Percent | Valid Percent | Cumulative Percent |
|---|---|---|---|---|---|
| Valid | 4 | 1 | 1.3 | 1.3 | 1.3 |

| | | | | | |
|---|---|---|---|---|---|
| | 5 | 3 | 3.8 | 3.8 | 5.0 |
| | 6 | 13 | 16.3 | 16.3 | 21.3 |
| | 7 | 6 | 7.5 | 7.5 | 28.8 |
| | 8 | 14 | 17.5 | 17.5 | 46.3 |
| | 9 | 22 | 27.5 | 27.5 | 73.8 |
| | 10 | 21 | 26.3 | 26.3 | 100.0 |
| | Total | 80 | 100.0 | 100.0 | |

**Fit of the system with your current IT skills (including the level of sophistication of your end users and the level of maturity of your business processes)**




**Fit of the system with your current IT skills (including the level of sophistication of your end users and the level of maturity of your business processes)**

## Reliability of the system

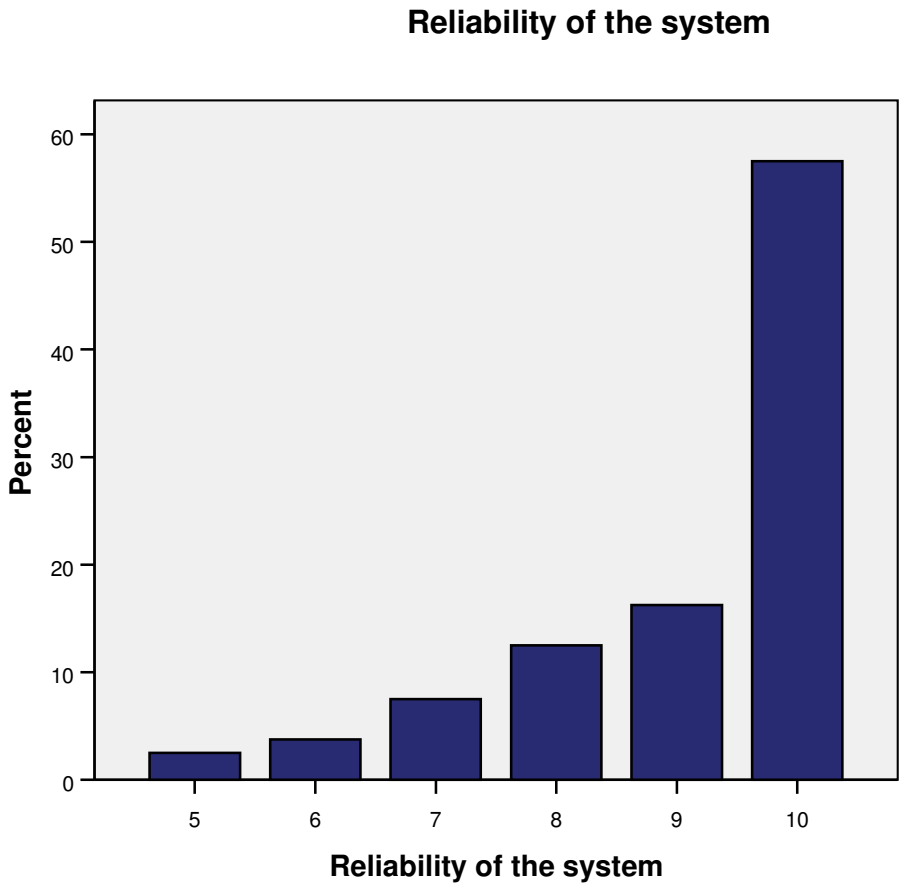
**Statistics**

Reliability of the system

| | | |
|---|---|---|
| N | Valid | 80 |
| | Missing | 0 |
| Mean | | 9.09 |
| Median | | 10.00 |
| Mode | | 10 |

**Reliability of the system**

| | | Frequency | Percent | Valid Percent | Cumulative Percent |
|---|---|---|---|---|---|
| Valid | 5 | 2 | 2.5 | 2.5 | 2.5 |
| | 6 | 3 | 3.8 | 3.8 | 6.3 |
| | 7 | 6 | 7.5 | 7.5 | 13.8 |
| | 8 | 10 | 12.5 | 12.5 | 26.3 |
| | 9 | 13 | 16.3 | 16.3 | 42.5 |
| | 10 | 46 | 57.5 | 57.5 | 100.0 |
| | Total | 80 | 100.0 | 100.0 | |




## Compatibility with other transactional systems (both with internal systems and infrastructure as well as external partner systems)

**Statistics**

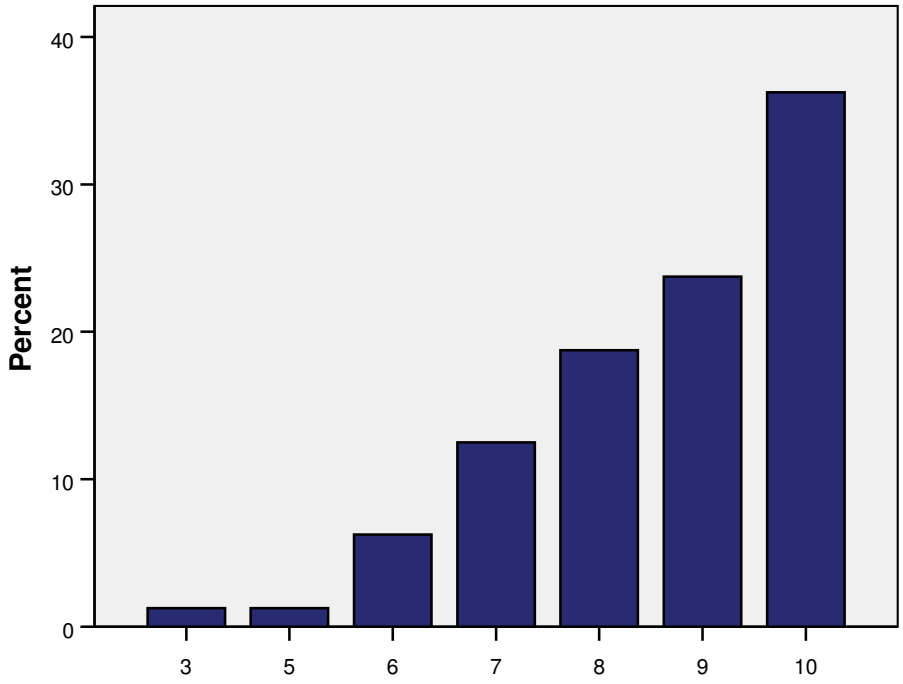
Compatibility with other transactional systems (both with internal systems and infrastructure as well as external partner systems)

| | | |
|---|---|---|
| N | Valid | 80 |
| | Missing | 0 |
| Mean | | 8.61 |
| Median | | 9.00 |
| Mode | | 10 |

**Compatibility with other transactional systems (both with internal systems and infrastructure as well as external partner systems)**

| | | Frequency | Percent | Valid Percent | Cumulative Percent |
|---|---|---|---|---|---|
| Valid | 3 | 1 | 1.3 | 1.3 | 1.3 |
| | 5 | 1 | 1.3 | 1.3 | 2.5 |
| | 6 | 5 | 6.3 | 6.3 | 8.8 |
| | 7 | 10 | 12.5 | 12.5 | 21.3 |
| | 8 | 15 | 18.8 | 18.8 | 40.0 |
| | 9 | 19 | 23.8 | 23.8 | 63.8 |
| | 10 | 29 | 36.3 | 36.3 | 100.0 |
| | Total | 80 | 100.0 | 100.0 | |

**Compatibility with other transactional systems (both with internal systems and infrastructure as well as external partner systems)**




## Specialised features (especially those that are of importance in your industry)

**Statistics**

Specialised features (especially those that are of importance in your industry)

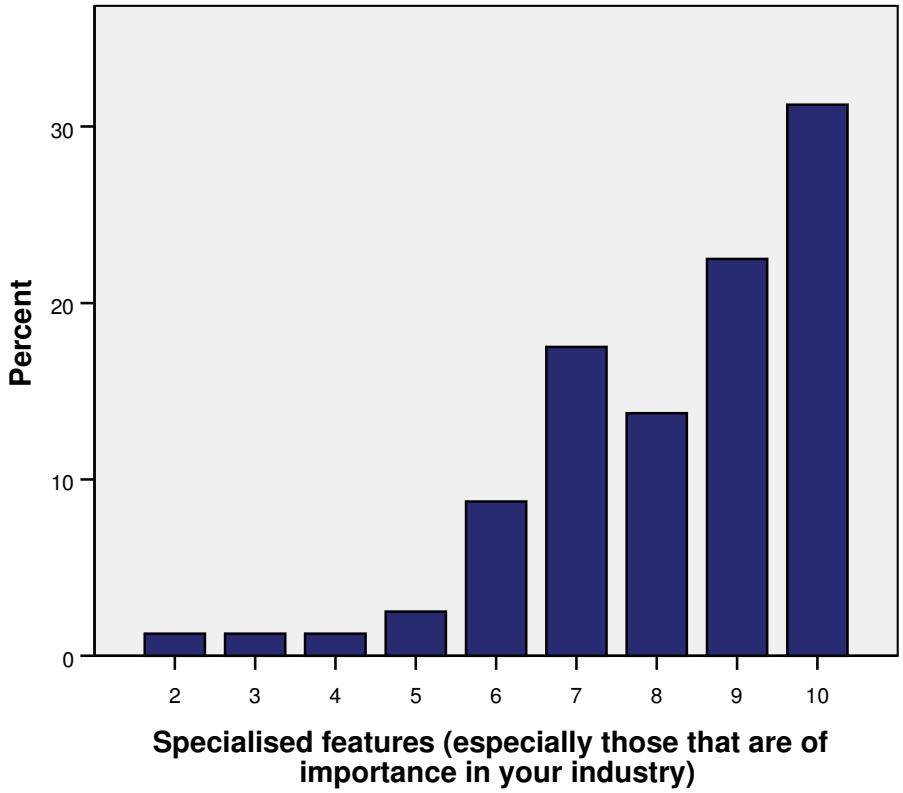
| | | |
|---|---|---|
| N | Valid | 80 |
| | Missing | 0 |
| Mean | | 8.24 |
| Median | | 9.00 |
| Mode | | 10 |

**Specialised features (especially those that are of importance in your industry)**

| | | Frequency | Percent | Valid Percent | Cumulative Percent |
|---|---|---|---|---|---|
| Valid | 2 | 1 | 1.3 | 1.3 | 1.3 |
| | 3 | 1 | 1.3 | 1.3 | 2.5 |
| | 4 | 1 | 1.3 | 1.3 | 3.8 |

| | | | | | |
|---|---|---|---|---|---|
| | 5 | 2 | 2.5 | 2.5 | 6.3 |
| | 6 | 7 | 8.8 | 8.8 | 15.0 |
| | 7 | 14 | 17.5 | 17.5 | 32.5 |
| | 8 | 11 | 13.8 | 13.8 | 46.3 |
| | 9 | 18 | 22.5 | 22.5 | 68.8 |
| | 10 | 25 | 31.3 | 31.3 | 100.0 |
| | Total | 80 | 100.0 | 100.0 | |

**Specialised features (especially those that are of importance in your industry)**




## Technical criteria such as support for multiple operating systems, databases, languages, currencies, character sets (e.g. Chinese or Arabic) etc. (This can also include other technical considerations like deployment options and scalability)

**Statistics**

Technical criteria such as support for multiple operating systems, databases, languages, currencies, character sets (e.g. Chinese or Arabic) etc. (This can also include other technical considerations like deployment options and scalability)

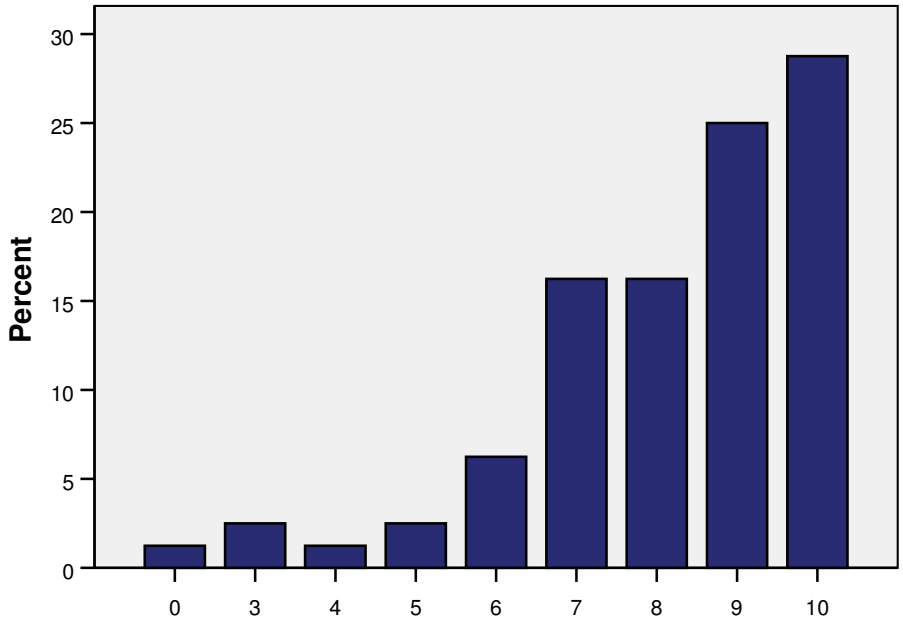
| | | |
|---|---|---|
| N | Valid | 80 |

| | | |
|---|---|---|
| | Missing | 0 |
| Mean | | 8.19 |
| Median | | 9.00 |
| Mode | | 10 |

**Technical criteria such as support for multiple operating systems, databases, languages, currencies, character sets (e.g. Chinese or Arabic) etc. (This can also include other technical considerations like deployment options and scalability)**

| | | Frequency | Percent | Valid Percent | Cumulative Percent |
|---|---|---|---|---|---|
| Valid | 0 | 1 | 1.3 | 1.3 | 1.3 |
| | 3 | 2 | 2.5 | 2.5 | 3.8 |
| | 4 | 1 | 1.3 | 1.3 | 5.0 |
| | 5 | 2 | 2.5 | 2.5 | 7.5 |
| | 6 | 5 | 6.3 | 6.3 | 13.8 |
| | 7 | 13 | 16.3 | 16.3 | 30.0 |
| | 8 | 13 | 16.3 | 16.3 | 46.3 |
| | 9 | 20 | 25.0 | 25.0 | 71.3 |
| | 10 | 23 | 28.8 | 28.8 | 100.0 |
| | Total | 80 | 100.0 | 100.0 | |

**Technical criteria such as support for multiple operating systems, databases, languages, currencies, character sets (e.g. Chinese or Arabic) etc. (This can also include other technical considerations like deployment options and scalability)**




**Technical criteria such as support for multiple operating systems, databases, languages, currencies, character sets (e.g. Chinese or Arabic) etc. (This can also include other technical considerations like deployment options and scalability)**

## Flexibility - specifically around the ease of customisation modify and extend existing functionality to support your unique business situation

**Statistics**

Flexibility - specifically around the ease of customisation modify and extend existing functionality to support your unique business situation

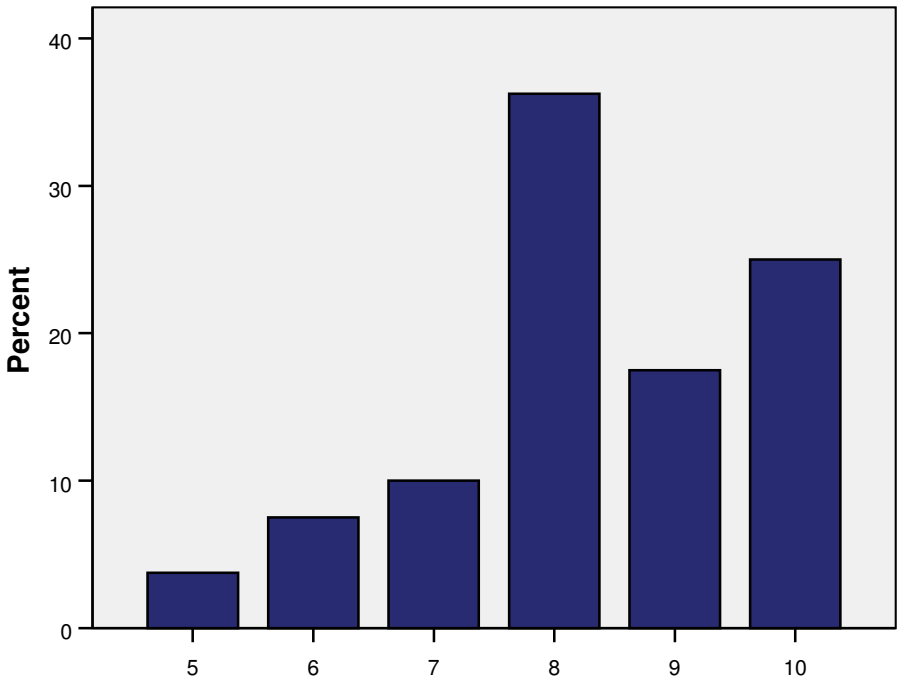
| | | |
|---|---|---|
| N | Valid | 80 |
| | Missing | 0 |
| Mean | | 8.31 |
| Median | | 8.00 |
| Mode | | 8 |

**Flexibility - specifically around the ease of customisation modify and extend existing functionality to support your unique business situation**

| | | Frequency | Percent | Valid Percent | Cumulative Percent |
|---|---|---|---|---|---|
| Valid | 5 | 3 | 3.8 | 3.8 | 3.8 |

| | | | | | |
|---|---|---|---|---|---|
| | 6 | 6 | 7.5 | 7.5 | 11.3 |
| | 7 | 8 | 10.0 | 10.0 | 21.3 |
| | 8 | 29 | 36.3 | 36.3 | 57.5 |
| | 9 | 14 | 17.5 | 17.5 | 75.0 |
| | 10 | 20 | 25.0 | 25.0 | 100.0 |
| | Total | 80 | 100.0 | 100.0 | |

**Flexibility - specifically around the ease of customisation modify and extend existing functionality to support your unique business situation**




**Flexibility - specifically around the ease of customisation modify and extend existing functionality to support your unique business situation**

## After sales support

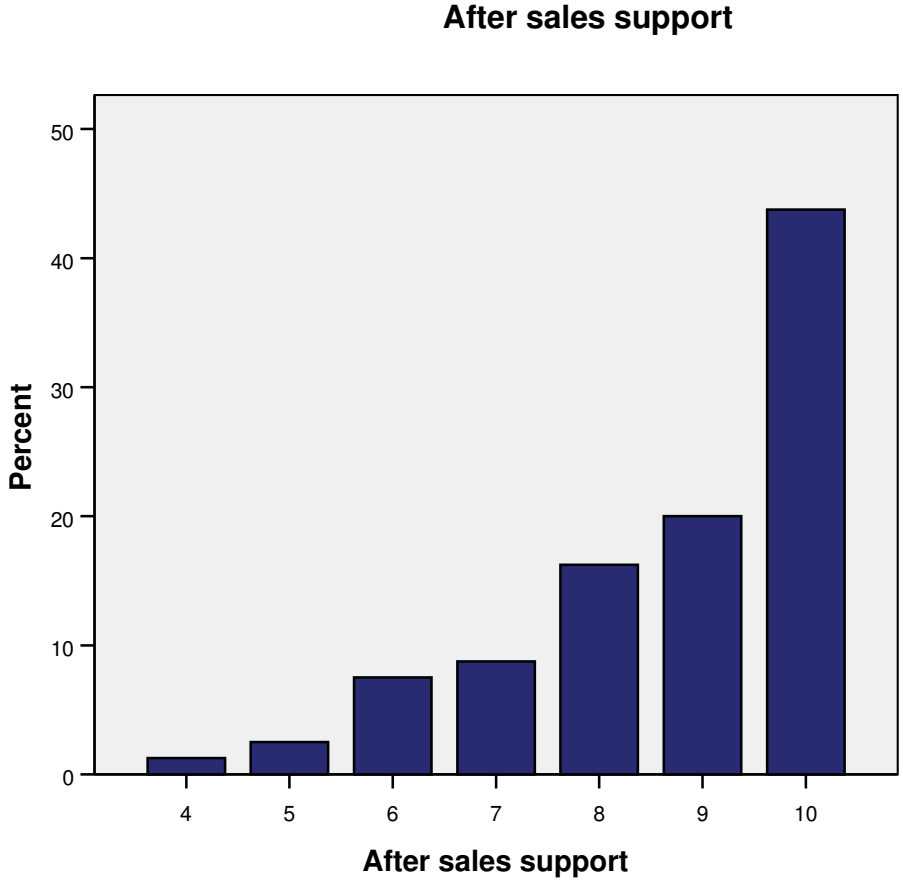
**Statistics**

After sales support

| | | |
|---|---|---|
| N | Valid | 80 |
| | Missing | 0 |
| Mean | | 8.71 |
| Median | | 9.00 |
| Mode | | 10 |

**After sales support**

| | | Frequency | Percent | Valid Percent | Cumulative Percent |
|---|---|---|---|---|---|
| Valid | 4 | 1 | 1.3 | 1.3 | 1.3 |
| | 5 | 2 | 2.5 | 2.5 | 3.8 |
| | 6 | 6 | 7.5 | 7.5 | 11.3 |
| | 7 | 7 | 8.8 | 8.8 | 20.0 |
| | 8 | 13 | 16.3 | 16.3 | 36.3 |
| | 9 | 16 | 20.0 | 20.0 | 56.3 |
| | 10 | 35 | 43.8 | 43.8 | 100.0 |
| | Total | 80 | 100.0 | 100.0 | |




## The future direction in which the product will be developed (AKA the product road map, or the vision of the vendor)

**Statistics**

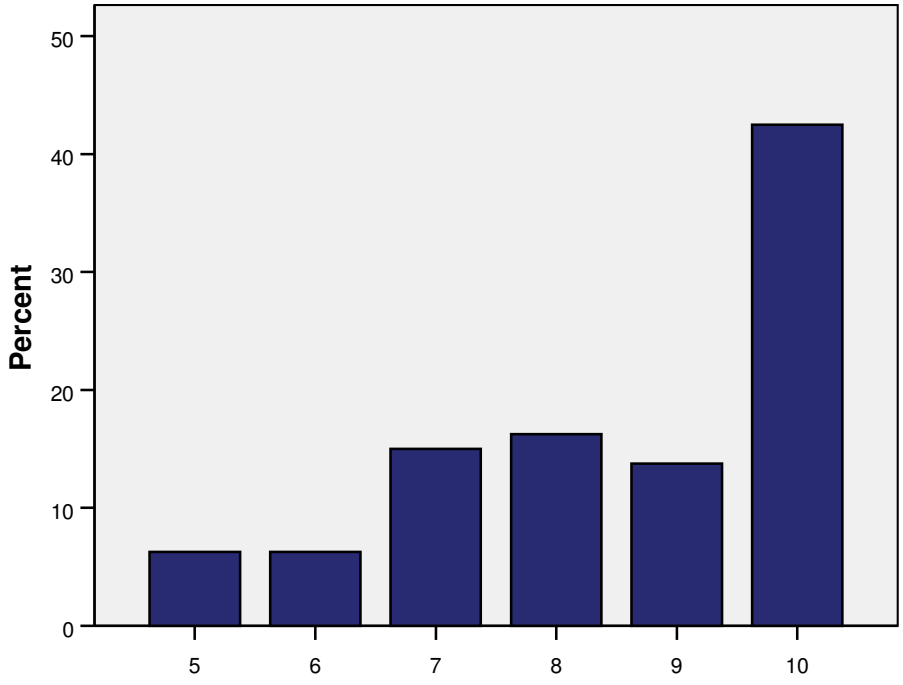
The future direction in which the product will be developed (AKA the product road map, or the vision of the vendor)

| | | |
|---|---|---|
| N | Valid | 80 |
| | Missing | 0 |
| Mean | | 8.53 |
| Median | | 9.00 |
| Mode | | 10 |

**The future direction in which the product will be developed (AKA the product road map, or the vision of the vendor)**

| | | Frequency | Percent | Valid Percent | Cumulative Percent |
|---|---|---|---|---|---|
| Valid | 5 | 5 | 6.3 | 6.3 | 6.3 |
| | 6 | 5 | 6.3 | 6.3 | 12.5 |
| | 7 | 12 | 15.0 | 15.0 | 27.5 |
| | 8 | 13 | 16.3 | 16.3 | 43.8 |
| | 9 | 11 | 13.8 | 13.8 | 57.5 |
| | 10 | 34 | 42.5 | 42.5 | 100.0 |
| | Total | 80 | 100.0 | 100.0 | |

**The future direction in which the product will be developed (AKA the product road map, or the vision of the vendor)**



# Size and economic strength of the vendor

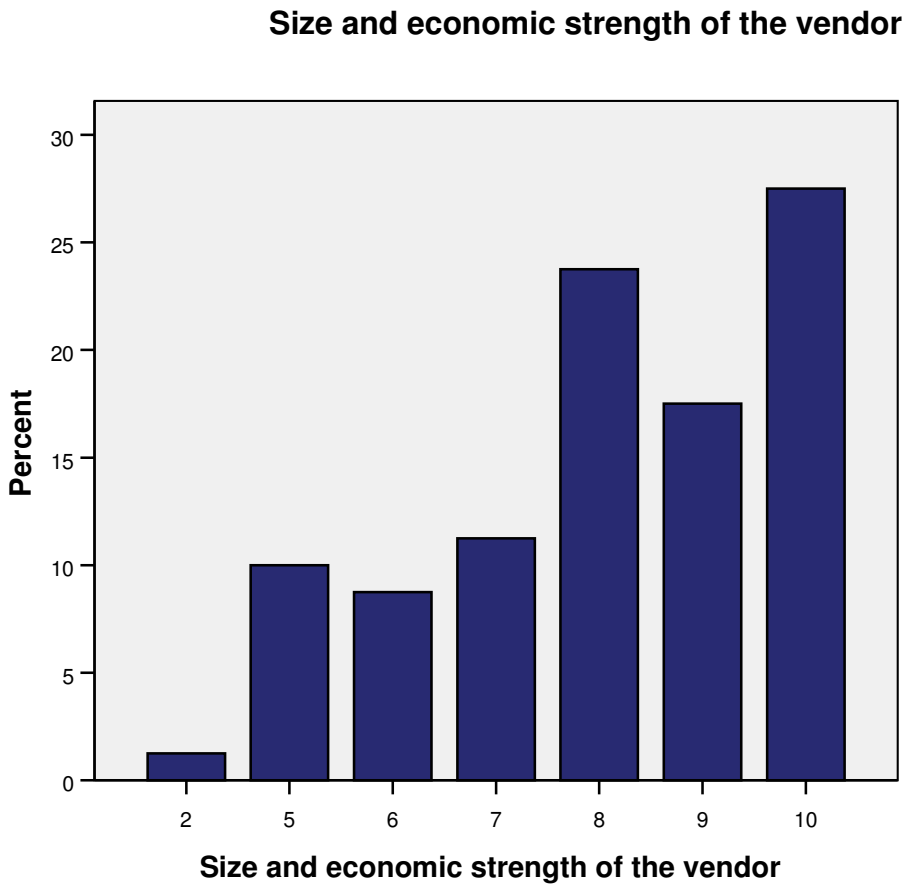
**Statistics**

Size and economic strength of the vendor

| | | |
|---|---|---|
| N | Valid | 80 |
| | Missing | 0 |
| Mean | | 8.06 |
| Median | | 8.00 |
| Mode | | 10 |

**Size and economic strength of the vendor**

| | | Frequency | Percent | Valid Percent | Cumulative Percent |
|---|---|---|---|---|---|
| Valid | 2 | 1 | 1.3 | 1.3 | 1.3 |
| | 5 | 8 | 10.0 | 10.0 | 11.3 |
| | 6 | 7 | 8.8 | 8.8 | 20.0 |
| | 7 | 9 | 11.3 | 11.3 | 31.3 |
| | 8 | 19 | 23.8 | 23.8 | 55.0 |
| | 9 | 14 | 17.5 | 17.5 | 72.5 |
| | 10 | 22 | 27.5 | 27.5 | 100.0 |
| | Total | 80 | 100.0 | 100.0 | |




## The level of knowledge that the vendor has about your industry.

**Statistics**

The level of knowledge that the vendor has about your industry.

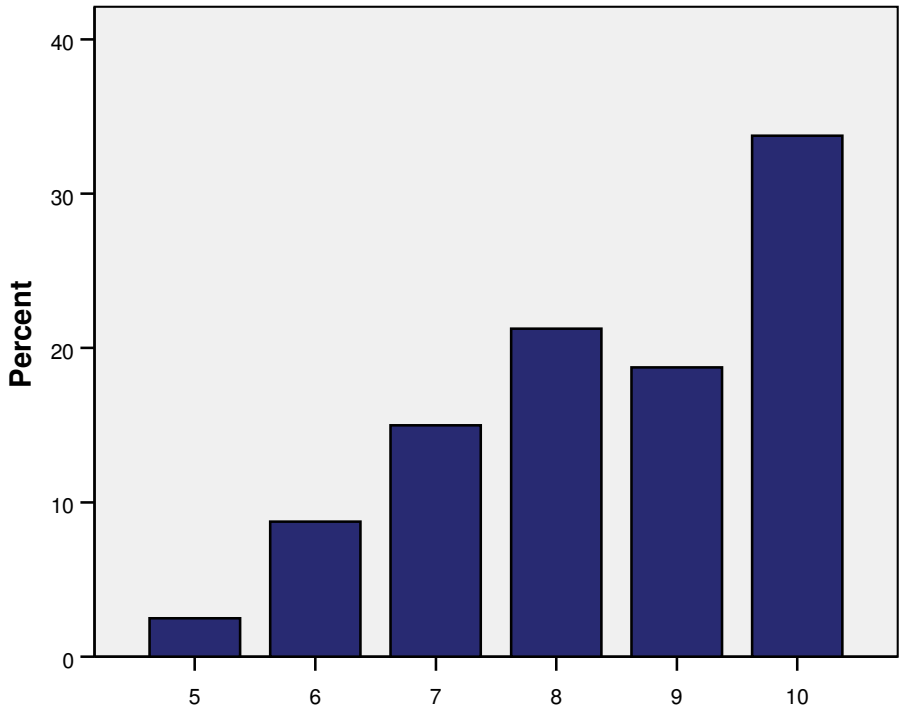
| | | |
|---|---|---|
| N | Valid | 80 |
| | Missing | 0 |
| Mean | | 8.46 |
| Median | | 9.00 |
| Mode | | 10 |

**The level of knowledge that the vendor has about your industry.**

| | | Frequency | Percent | Valid Percent | Cumulative Percent |
|---|---|---|---|---|---|
| Valid | 5 | 2 | 2.5 | 2.5 | 2.5 |
| | 6 | 7 | 8.8 | 8.8 | 11.3 |
| | 7 | 12 | 15.0 | 15.0 | 26.3 |
| | 8 | 17 | 21.3 | 21.3 | 47.5 |
| | 9 | 15 | 18.8 | 18.8 | 66.3 |

| | | | | | |
|---|---|---|---|---|---|
| | 10 | 27 | 33.8 | 33.8 | 100.0 |
| | Total | 80 | 100.0 | 100.0 | |

**The level of knowledge that the vendor has about your industry.**




**The level of knowledge that the vendor has about your industry.**

## References of the vendor (i.e. what other customers have to say about the vendor's product, service, pricing etc.)

**Statistics**

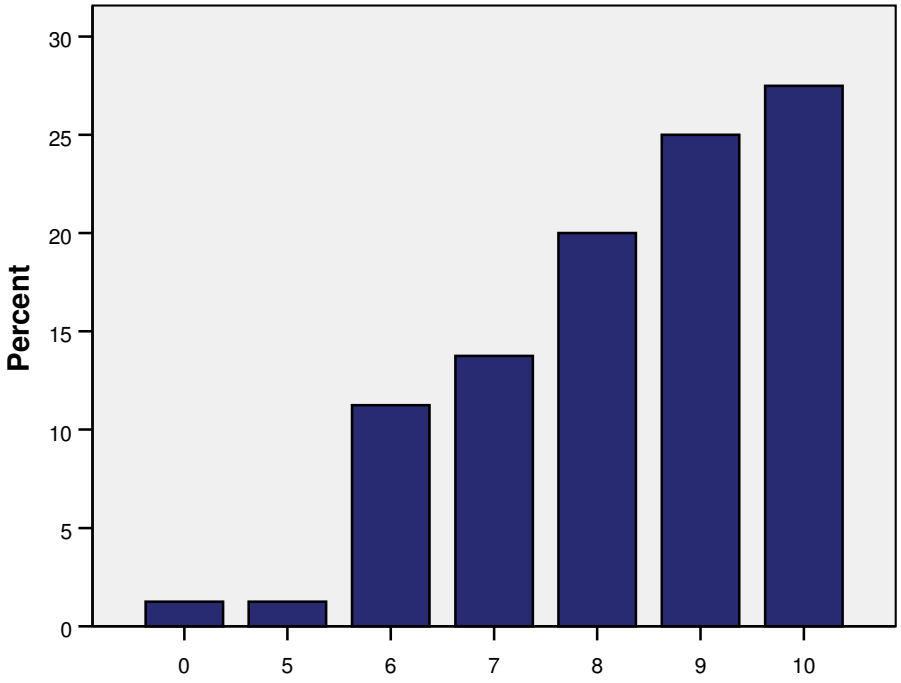
References of the vendor (i.e. what other customers have to say about the vendor's product, service, pricing etc.)

| | | |
|---|---|---|
| N | Valid | 80 |
| | Missing | 0 |
| Mean | | 8.30 |
| Median | | 9.00 |
| Mode | | 10 |

**References of the vendor (i.e. what other customers have to say about the vendor's product, service, pricing etc.)**

| | | Frequency | Percent | Valid Percent | Cumulative Percent |
|---|---|---|---|---|---|
| Valid | 0 | 1 | 1.3 | 1.3 | 1.3 |
| | 5 | 1 | 1.3 | 1.3 | 2.5 |
| | 6 | 9 | 11.3 | 11.3 | 13.8 |
| | 7 | 11 | 13.8 | 13.8 | 27.5 |
| | 8 | 16 | 20.0 | 20.0 | 47.5 |
| | 9 | 20 | 25.0 | 25.0 | 72.5 |
| | 10 | 22 | 27.5 | 27.5 | 100.0 |
| | Total | 80 | 100.0 | 100.0 | |

**References of the vendor (i.e. what other customers have to say about the vendor's product, service, pricing etc.)**



# Appendix 8: Open-source software in the ERP stack

The computer industry has shifted from vertically integrated solutions where a single vendor provided the hardware and all the software needed to operate a solution, to an environment where the hardware, operating system, database and application software are purchased separately as part of a stack of products that make up a complete solution (hence the term solution stack).

A typical ERP solution stack is made up of:

<table>
<tr><td colspan="2">Client Layer</td></tr>
<tr><td>Application Layer</td><td>Reporting Layer</td></tr>
<tr><td colspan="2">Infrastructure Layer</td></tr>
<tr><td colspan="2">Database Layer</td></tr>
<tr><td colspan="2">Operating System Layer</td></tr>
</table>

Client Layer: Mozilla Firefox
Application Layer: Compiere, ERP5, TinyERP, OpenMFG
Reporting Layer: JasperSoft, Pentaho, Bizgres
Infrastructure Layer: JBOSS, Enhydra, ZOPE
Database Layer: MySQL, PostgreSQL, Firebird, Ingres
Operating System Layer: Linux, FreeBSD, Xen*

*Xen is not an operating system, but a hypervisor –: software that allows multiple instances of any operating system to run on the same hardware infrastructure. This technology enables consolidation of hardware infrastructure, which can lead to major savings in ERP adoption.

The advance of open source alternatives into every layer of the ERP solution stack has not gone unnoticed by major ERP vendors. Consider the following:

1. SAP R3, Lawson and Oracle are compatible with the Linux operating system
2. SAP R3 is compatible with MySQL database software, and SAP has contributed its own database software to MySQL AB (the makers of MySQL)
3. SAP's Netweaver application server and Oracle's application server are compliant with the Java 2 Enterprise Edition (J2EE) standard – a standard against which several open source application servers are also built (e.g. JBOSS and Enhydra)

4. Microsoft and Oracle now host Open Source web sites (http://port25.technet.com/, www.gotdotnet.com , http://oss.oracle.com/, http://www.oracleopensource.com/)
5. It has been reported in various publications, that Oracle has considered acquiring several companies that make and distribute open source software. Oracle's CEO, Larry Ellison has clearly stated Oracle's commitment to open source software:

   *"We are moving aggressively into open source. We are embracing it. We are not going to fight this trend. We think if we're clever, we can make it work to our advantage." (Larry Ellison, CEO-Oracle available from:* ***http://www.businessweek.com/technology/content/feb2006/tc20060209_810527.htm*** *)*