Make, buy or rent decision for information systems in the heavy engineering industry

by

Thomas Francois Matthee

21919968

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Study Leader: Mr. JC Coetzee
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ABSTRACT

The study focuses on the use of information systems in the Heavy Engineering industry in South Africa and the decision to make, buy or rent information systems. Special focus was placed on the factors that influence the decision to make, buy or rent information systems. It is undeniable that changes in the competitive environment, such as technological advances and globalisation, are driving organisations toward new ways of operating. In striving to become flexible, lean, and more competitive, organisations have been increasingly swift to externalise support service functions.

Every organisation must adapt to the current economic environment, the technology available in its industry and consider the risk and rewards within the industry framework. Organisations should carefully analyse the impact of their decisions, especially in consideration of the extent to which organisational competencies and competitive advantage could be affected.

An extensive literature study was conducted on the factors that influence the decision to make, buy or rent. The literature study portrays the ideal state or methodologies for acquiring information systems and the best practices used in evaluating the best option for the organisation. The literature indicated the criteria for evaluating the decision to make, buy or rent information systems are the business need, in-house experience, project skills, project management and the time frame. These criteria can be broken down into the factors that have an influence on the decision, competitive advantage, security, skills, expertise, available resources, cost, time, implementation, support, maintenance, performance, quality, documentation, vendor issues, size of organisation, expected annual transactions, software control, functionality, productivity and increased turnover.

Calculating the benefit that can be achieved from information systems must also include measures to incorporate the total benefit, not only the financial benefit. The balance scorecard approach measures the total return accompanying an investment in information systems, broken down into four sections, the financial perspective that measures the tangible outcomes, the customer perspective that measures customer value (quality, delivery and skill), the internal process perspective that measures the internal processes that add value and have the greatest impact on strategy and finally the learning and growth perspective that measures the intangible assets which focuses on human capital. Information systems form part of the corporate strategy, competitive positioning and must be aligned with the overall strategy of the organisation.

A survey was done to determine the opinions about the different options managers/organisations have to consider when seeking to fulfil organisational requirements for information systems. Methodological issues as well as considerations with regard to gathering the data were discussed. A questionnaire was designed to collect data to obtain the information needed to solve the research problem. The internal consistency of the questionnaire was tested and it was found that a moderate to high level of consistency exists. The survey results were then presented in frequency tables and were analysed using descriptive statistics as well as inferring possible trends or conclusions based on relationships between certain responses on specific related questions and referring to the literature study.

A framework was compiled from the literature study and empirical study that can be used for the purpose of decision-making in the make, buy or renting of information systems in the heavy engineering environment in South Africa. Benefits from purchasing software from a vendor include competitive advantage, available resources, implementation of the system, support to the system, system performance, documentation and training, and business functionality. Benefits from open source offerings include the size of the organisation and the number of expected annual transactions by the organisation. Benefits from SaaS (Software as a service) include competitive advantage, expertise, system performance and business functionality. Benefits from the outsourcing of development and other IT functions include competitive advantage, security, skills, available resources, implementation of the system, support to the system, system performance, documentation and training, business functionality and technical functionality. Benefits from developing in-house all or part of the effort include competitive advantage, security, skills, expertise, available resources, time, implementation of the system, support to the system, maintenance and upgrades, system performance, quality, documentation and training, business functionality, technical functionality, productivity improvements and increased turnover.

Overall the linkage between the literature study and the empirical study concludes that a good fit between the literature study results and that of the empirical results transpired.

List of key terms: Competitive advantage, productivity improvements, in-sourcing, outsourcing, make, buy, rent, strategy alignment, business functionality, information systems, technology evolution.

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List of abbreviations

ASP	–	Application Service Provider
ERM	–	Enterprise-wide Risk Management
ESPs	–	External Service Providers
EVA	–	Economic Value Added
IS	–	Information Systems
IT	–	Information Technology
NPV	–	Net Present Value
OSS	–	Open Source Software
ROI	–	Return on Investment
RTCI	–	Resistance to Change Index
SaaS	–	Software as a Service
SDLC	–	System Development Life Cycle
SLA	–	Service Level Agreement
SOA	–	Service Oriented Architecture
TCO	–	Total Cost of Ownership
TPI	–	Third Party Intervention

1. CHAPTER 1:

2. ORIENTATION AND PROBLEM STATEMENT

1.1. INTRODUCTION

Evolution in today's Information Technology (IT) environments requires a great deal of investment towards Information Systems (IS). The make, buy or rent system gives managers options to consider when seeking fulfilling organisational requirements for IS. An organisation can purchase packaged software from a vendor, use open source offerings, outsource development or other IT functions to another organisation either domestically or abroad. Alternatively an organisation can develop all or part of the effort in-house. When presented with all of these options, making decisions about technologies and systems can seem a pretty daunting task (Kurbel, 2008:44).

IS is a business function much the same as marketing, finance, operations and human resources. In business, IS supports business processes and operations, decision-making and competitive strategies (Baltzan, Phillips & Haag, 2009:290).

The development and implementation of integrated information systems requires significant capital investment and therefore needs to be done in a structured and well-planned manner (Perrons, Richards & Platts, 2004:432). The success of the development and implementation of information systems largely determines the benefit that will be gained by the use (or lost by resistance to use) of the information systems. Organisations are always looking for competitive advantage and it is important to show whether investing in information technology provides a greater return on investment (ROI).

It is important to realize that for most organisations, technology decisions are not binary options for the whole organisation in all situations. Not all organisations will opt for an IT configuration that is one hundred percent in-house developed, or will use open source (OSS) offerings available, or would be completely outsourced or alternatively will use

SaaS (Software as a service). Being aware of the parameters to consider can help an organisation make better and more informed decisions. Markets and business are continuously changing and it is important to keep in mind that these decisions need to be continuously re-evaluated (Kurbel, 2008:44; Gallauger, 2010:1). IS in business today must support business processes and operations, decision-making and competitive strategies of the organisation (Baltzan *et al.,* 2009:290; Gallauger, 2010:1).

Business increasingly relies on more powerful computer systems and as software becomes embedded in more industrial and consumer products, the need to effectively manage larger and more critical software development projects becomes more intensive (Arya, Mittendorf & Sappington, 2008:1749).

Information systems play an increasingly important role in the success of businesses throughout the world. The benefits that can be derived from the effective utilisation of information technologies include cost reduction, performance improvement, quality enhancement, and the creation of new products and services (Arya *et al.,* 2008:1749).

In the current service-oriented economy, make-or-buy decisions are now often do-or-buy decisions that reflect the strategic question of whether outside entities should be hired to perform significant support service activities. Companies frequently point to the cost savings for labour and training, but also cite the benefits of releasing corporate resources for alternative uses and allowing the business to focus on its core competencies. The return on investment calculated for the outsourcing versus the cost saving for labour and training will have an effect on the process. Outsourcing support functions is not simple though, and companies must manage the related strategic, quantitative, and qualitative risk factors (Raiborn, Butler & Massoud, 2009:351).

Effective planning and utilization of IT resources involve analysis of available IT sourcing options to effectively respond to environmental changes and exploit IT for gaining competitive advantage. This includes choosing the optimal software sourcing option when implementing new IS. Organisations need to weigh their options relative to their capabilities. Sourcing strategies involve a range of options. One side of the sourcing-option spectrum is total in-sourcing which involves production, operation, and

maintenance of software completely by the organisation's staff within the boundary of the enterprise. The other side is total outsourcing which is an allocation of over 80 percent of the IT budget to external vendors. Between these two options, there exists a large variety of sourcing strategies involving some combination of in-sourcing and outsourcing (Sledgianowski, Tafti & Kierstead, 2007:423). There are generally three options available:

1) Purchased or leased packaged software system on-site.
2) An application service provider (ASP) model offering a packaged system delivered and supported by a remote data centre – "Cloud Computing".
3) Outsourcing development of a custom system which is then implemented on-site.

The make, buy, or rent decision may apply on a case-by-case basis that might be evaluated by the organisation, division, project or project component. Organisation and industry dynamics may change in a way that causes organisations to re-assess earlier decisions, or to alter the direction of new initiatives (Bocij, Greasly & Hickie, 2008:112).

This study will focus on the primary objective to establish the use of IS in the Heavy Engineering industry with focus on the decision to make, buy or rent IS. The primary objective will be supported by the secondary objectives that will give insight into decisions and factors influencing the decision to make, buy or rent IS.

1.2. IMPORTANCE OF THE STUDY

Managers have numerous options available when determining how to satisfy the software requirements of their organisations: purchase packaged software from a vendor, use Open Sourced Software (OSS), use Software as a Service (SaaS) or utility computing, or outsourcing development, or developing all or part of the effort themselves. Evaluating all of the options available will have an effect on how the organisation runs its business.

The importance of the study is to identify factors that need to be taken into account when each of these options (Make, buy or rent) is evaluated and also the implications to

and for the organisation. Identifying at which point is it feasible for the organisation to use either of these options (Make, buy or rent), as part of the IS strategy that will give the organisation the competitive advantage in all aspects of business.

1.3. CASUAL FACTORS

The casual factors for this study were the following:

- Continuous enhancement/evolution of technology and software available.
- Skills available and the capability to adopt/learn new technology.
- Cost associated with make, buy or rent and the Return on Investment (ROI) for the organisation and investors.
- Risk associated with make, buy or rent. There will be risk involved for any organisation that will need to be carefully managed.
- Security, privacy and protection of information.
- Current economic environment and market conditions.
- Government legislation.
- Best practice for the organisation and software available.

Factors that managers should consider when making a make, buy or rent decision include the following: competitive advantage, security, legal and compliance issues, the organisation's skill and available labour, cost, time, and vendor issues. These factors must be evaluated over the lifetime of a project, not at a single point in time (Arya *et al.,* 2008:1754).

1.4. OBJECTIVES OF THE STUDY

The objectives of this study are split into primary and secondary objectives.

1.4.1. Primary objective

The primary objective of the study was to establish the use of information systems in the Heavy Engineering industry in South Africa and the decision to make, buy or rent information systems.

1.4.2. Secondary objectives

The secondary objective of the study was to identify factors that play a role in the decision to make, buy or rent IS.

To achieve the primary objective of the study, the secondary objectives that had to be realised were as follows:

- Theory evaluation:
    - Perform a literature study to research the decision to make, buy or rent information systems.
    - To research the factors that have an influence on the decision to make, buy or rent IS.
    - Research the competitive advantages for make, buy or renting IS.
    - Research the effective utilisation of information technologies including cost reduction, performance improvement, quality enhancement, and the creation of new products and services for IS.
    - To research the need and application of IS in the Heavy Engineering industry in South Africa.

The purpose of the literature study was to gain theoretical knowledge of all factors influencing the decision to make, buy or rent. The knowledge gained from the literature was used to develop a questionnaire for the empirical investigation.

- Empirical research:
    - Research the expected outcomes of an IS.
    - Research expected outcomes from the Heavy Engineering industry.
    - Research the IT configuration used in the Heavy Engineering industry. (make, buy or rent).

To establish the abovementioned aspects, the empirical study was aimed at managers directly involved in striving to fulfil organisational requirements for IS, and end users of the IS.

1.5. SCOPE AND DEMARCATION OF STUDY

This study focused on the Heavy Engineering industry within South Africa that includes:

- Heavy equipment for the Mining industry.
- The Ship Building industry.
- Mine detection vehicles, armoured vehicles and new locomotives and wagons.

The focus of the study was limited to the empirical study within the Heavy Engineering environment within South Africa. Other organisations/industries will benefit from the recommendations made in this study.

1.6. RESEARCH METHODOLOGY

The methodology followed in this study consists of two parts, namely an extensive literature study and an empirical study.

Establishing a sound theoretical background to the problem formulated above requires an in-depth analysis, evaluation and integration of the different aspects relating to the make, buy or rent options available to managers. This was conducted by doing an in-depth theoretical study of factors influencing such a decision.

The aim of the literature study was to gain theoretical knowledge of what factors play a role in the decision. The knowledge gained from the literature was further used to identify best practices before and during IS development and implementation. The knowledge gained from the literature study was also used to develop a questionnaire for the empirical investigation.

Where possible, only recent literature in the field of IS decisions was utilised. The literature consisted of relevant textbooks, technical journals, magazine articles, publications on the internet, and IS documentation and programs.

The empirical study was aimed at the Heavy Engineering industry. Questionnaires were used to determine the shortcomings between the actual processes followed during the decision to incorporate a new IS system and the ideal process, as identified during the literature study with regard to the decision-making and implementation of IS. The questionnaires were distributed to study the relative importance of each factor identified in the preceding literature study. The responses obtained in the questionnaires were captured in a database/spreadsheet. Conclusions were drawn from these responses in order to identify the factors influencing an IS. The information gathered during the literature study was used for the development of the questionnaire.

The questionnaires were distributed via e-mail and through personal contact sessions. The responses to the questionnaires were followed up using e-mail, telephone calls, and personal contact sessions to ensure a high return rate. All questionnaires were treated as confidential to maintain the integrity of the questionnaire.

The results were statistically analysed using an appropriate statistical methodology. The analysed results were used to draw conclusions, and recommendations were made regarding the decision to invest in Information Systems.

1.7. DIVISION OF CHAPTERS

In order to achieve the objectives of this study, the study was split into four phases. The four chapters of the applied dissertation coincide with the phases of the study.

- **Chapter 1**

  Chapter one provides an overview of the study. The chapter includes an introduction into the study, the problem definition, the study objectives, the scope of the study, and the methodology to be followed in the study.

- **Chapter 2**

Chapter two consists of a literature study on the make, buy or rent options available when seeking to fulfil organisational requirements for IS. The literature focuses on factors influencing the decision to Make, buy or rent IS. The literature study portrays the ideal state or methodologies for acquiring IS and the best practices used in evaluating the best option for the organisation.

- **Chapter 3**

  Chapter three outlines the methodology used during the empirical study. A questionnaire is used in the empirical investigation. A detailed analysis of the feedback obtained from the questionnaire is conducted in this chapter and the elements / components of IS are evaluated using statistical analysis of the results. The results are presented and interpreted in relation to the literature study.

- **Chapter 4**

  Chapter four presents the conclusions from the study. Recommendations are made to address the shortcomings identified in the previous chapters. Final recommendations are made to assist with the decision to make, buy or rent IS.

1.8. CONCLUSION

The research objectives were confirmed as well as the research methods to be applied were discussed. Competitive advantage is the reward for organisations that are able to adopt new technologies, achieve economies of scale and scope, serve global markets, change product ranges regularly, and satisfy customers through high quality and timely delivery. Since few organisations have the resources and competencies to meet all of these diverse pursuits, there has been a widespread shift to alliances to meet the needs of this new economic environment. Making decisions about IS are a daunting task; managers have numerous options available when determining how to satisfy the software needs of their organisations through make, buy or rent (Arya *et al.,* 2008:1754).

Over the long term the only sustainable source for competitive advantage is the ability of the organisation to learn faster than its competitors and adopt IS to support the growth of the organisation. Managing the decision to make, buy or rent will add value to sustain competitiveness in an ever-changing environment.

1.9. CHAPTER SUMMARY

It is undeniable that changes in the competitive environment, such as technological advances and globalisation, are driving organisations toward new ways of operating. In striving to become flexible, lean, and more competitive, organisations have been increasingly quick to externalise support service functions. Organisations should carefully analyse the impacts of their decisions, especially in consideration of the extent to which organisational competencies and competitive advantage could be affected. Outsourcing support services may certainly help organisations become more efficient, have access to new skills and resources, and focus on the core business. This only holds true as long as the benefits accruing from the intangible assets are achieved and contribute to the organisation's goals, objectives, and competitive advantage (Sledgianowski *et al.,* 2007:423).

The sole option to avoid support service outsourcing risks entirely is to perform all service tasks in-house. This level of risk avoidance can come at an unacceptably high cost, given the compelling strategic and financial benefits that can be realised by outsourcing.

The aim of this study was to assess options available to managers for IS in the Heavy Engineering industry. Every organisation must adapt to the current economic environment, technology available and consider the risk and rewards within the framework. The importance of the study is to identify factors that need to be taken into account when each of these options (make, buy or rent) is evaluated and also the implications to and for the organisation. Identifying at which point is it feasible for the organisation to use either of these options (make, buy or rent), as part of the IS strategy that will give the organisation the competitive advantage in all aspects of business.

CHAPTER 2:

LITERATURE STUDY

2.1. INTRODUCTION

Throughout this chapter the focus will be on existing literature on the make, buy or rent options available when seeking to fulfil organisational requirements for Information Systems (IS). The literature focuses on factors influencing the decision to make, buy or rent IS. The literature study portrays the ideal state or methodologies for acquiring IS and the best practices used in evaluating the best option for the organisation.

A change in the way many organisations approach major software investments has been seen in the last decade. In a previous era of mainframe computing most major information systems were developed in-house or customised to suit the requirements of the organisation. With the rise/development of packaged software/enterprise systems and outsourced solutions, most organisations generally seek to purchase software rather than developing software in-house. There are still many organisations that remain committed to their customised software and find greater value in maintaining customised developed systems or developing systems to suit their specialised requirements that a packaged or outsourcing solution cannot offer (Sena & Sena, 2010:1).

Information systems forms part of the corporate strategy, competitive positioning and must be aligned with the overall organisational strategy. The investment and management of IS are recognised together with IT resource management. Organisations must prepare themselves for the future by studying emerging trends and technologies. Choice of technology should be coherent with the organisation's basic strategy and it is very important that an organisation has a technology strategy. It is also very important that IS must support business in the overall strategy of the organisation and its business process to ensure competitive advantage (Rahardjo, 2006:2).

Different types of outsourcing exist: Business Process Outsourcing where specific processes are contracted to a third party, and IT outsourcing where different information technologies are performed by a third party over a contract period (Chaffey & Wood, 2005:594).

In-sourcing offers a myriad number of direct benefits while presenting a host of potential opportunities. In-sourcing may be uniquely capable of challenging corporate thinking through its method of introducing new ideas, thoughts and processes.

Factors that need to be considered when evaluating the options to make, buy or rent software must be identified and evaluated. The objectives and investment drivers form an integrated part of an organisation's decision to invest in IS. Bocij *et al.* (2008:539) and Kaplan and Norton (2004:32) concur that the decision is not based on financial return only but must include both the intangible and tangible benefits.

The development and implementation of integrated information systems require significant capital investment and therefore needs to be done in a structured and well-planned manner (Perrons *et al.,* 2004:432). The success of the development and implementation of information systems largely determines the benefit that will be gained by IS.

2.2. TECHNOLOGY EVOLUTION: MARKET LEADER OR FOLLOWER

Evolution in today's IT environments requires a great deal of investment towards IS. It is very important for organisations to prepare themselves for the future by studying emerging trends and technologies. Having a broad view of emerging trends and new technologies as they relate to business can provide an organisation with a valuable strategic advantage. Organisations that can most effectively grasp the deep currents of technology evolution can use their knowledge to protect themselves against sudden and fatal technology obsolescence (Baltzan *et al.,* 2009:468).

The global economy is becoming more and more integrated and both economy and society are being dominated by technology. The pace of technological innovation is increasing at a phenomenal pace. This raises questions about where organisations

should position themselves with new technology. Should the organisation adopt the technology as a market leader or a follower? Do you like to be on the bleeding edge, the leading edge, in the middle of the pack or bringing up the rear (Baltzan *et al.,* 2009:17)?

Being a market leader or market follower depends on the technology strategy that the organisation follows. The choice of technology should be coherent with the organisation's basic strategy and it is important that an organisation has a technology strategy. At the core of the technology strategy there is the type of competitive advantage that an organisation is trying to achieve (Baltzan *et al.,* 2009:17). The purpose of a technology strategy is to identify, develop and nurture those technologies that will be critical for the organisation's long-term competitive positioning (Maheran, Muhammad, Jantan & Keong, 2008:98). The technology strategy must concentrate on seeking competitive advantage and must be consistent with the organisation's overall strategy. It must also focus on all areas within the organisation. The technology strategy must also recognise the risk and return tradeoffs that accompany any technology advantage.

Whether to be a technology leader or follower depends on the source and the application of the technology and the sustainability of the technology lead. The first mover has advantages and disadvantages. The first mover will sustain the investment cost earlier but can benefit with a higher market share with respect to the competitors (Stenbacka & Tomback, 1994:385).

Leveraging first mover advantage by leading and accepting technology as part of an organisation overall strategy can have its advantages and disadvantages. First mover advantage is never a guarantee of durable success. There are many advantages and disadvantages of being a technology leader. Some advantages include little or no competition, greater efficiency and lower cost, higher profits, reputation for innovation, entry barriers (patents), and knowledge (learning). Some disadvantages include risk, cost of development and marketing, and adverse impacts on existing products (Maheran *et al.,* 2008:105). Whenever the probability of successful implementation of a new technology is uncertain the risk associated with technology increases (Cortelezzi & Villani, 2007:1).

Analysis is needed on a case by case basis regarding the position of the organisation with regards to their technology strategy. Companies may be made or broken on the position they take. It is therefore very important for an organisation to assess its technology needs. Before developing strategies for developing or exploiting technological innovations an organisation must have a clear understanding of its own technology base, identifying key technologies upon which the organisation depends, and then, categorising the types of technologies used by the organisation and their level of importance to determine their competitive advantages (Liang, Czaplewski, Klein & Jiang, 2009:146). It is important to define the types of technologies used by an organisation.

Different types of technologies used within the organisation:

- Emerging and unproven but may be a breakthrough in the future?
- Pacing where they have yet to prove their full value?
- Key because they are proven effective and not everyone uses them?

Different techniques can be used to determine how technology is changing an industry and whether it has an influence on the organisation. Benchmarking is comparing the company with other company practices and technologies on a global scale. Scanning is another technique that focuses on what can be done and what is being developed. Benchmarking looks at key and pacing technologies where scanning looks at pacing and emerging technologies (Liang *et al.,* 2009:147; Baltzan *et al.,* 2009:36).

An organisation's decision to adopt a new technology depended on the economic environment in which the investment decision is made and on the type of technology involved. To be a market leader or follower of technology depends on the source and application of the technology. In some cases, it is better to be a follower than a market leader in technology applicability. If the technologies is unproven and has risk to the organisation it is better to be a close follower than a leader.

2.3. FUTURE TECHNOLOGY CAPABILITIES/PREDICTION

How far will technology advance into the future, how will it affect the organisation and the way they do business? In today's ever-changing environment and fast-paced world

of information technology it is important to keep up with technology. Equipment and/or technology today will most probably be obsolete by tomorrow. The rise of globalisation is shifting the way business works. There are some laws that identify the spread of technology. The laws are generally accepted as governing the spread of technology:

- **Moore's Law**

Gordon Moore, the co-founder of Intel, made a statement forty years ago that the transistors on a chip would roughly double every 18 months. The observation known as Moore's Law means that processing power, memory size and technology would roughly double every 18 months. Moore's law states that technology changes so fast it would almost be impossible to deliver an information system without reviewing technology on a regular basis (Moore, 2003:1).

- **Gilder's Law**

George Gilder proposed that the total bandwidth of communication systems triples every 12 months. Research has supported this theory that bandwidth availability will continue to expand at a rate that supports Gilder's Law (Pinto, 2001:1; Karlgaard, 2005:1).

- **Metcalfe's Law**

Metcalfe's Law proposed that the value of a network is proportional to the square of the number of nodes; so, as a network grows, the value of being connected to it grows exponentially, while the cost per user remains the same or even reduces (Pinto, 2001:1; Karlgaard, 2005:1). The exponential growth means that the effectiveness and value of the Internet is continuously increasing.

- **Less's Law**

Following Moore's Law that microprocessors have set a brisk pace by doubling in density every 18 months, hard disk storage density has been doubling every 12 months. It is also important to take note that the costs have been plummeting by 50 percent per year. It's through this inexorable decline, megabytes costing less and less, that gives

this technology its great disruptive power. This gave birth to a new law called Less's Law and states that the cost of disk storage falls by half every twelve months, while capacity doubles (Quon, 2004:1).

The effects of all of these laws on technology evolution have a multiple effect; this would require an in-depth study. This is not covered in this study; recommendations for further study on this effect are required.

Business increasingly relies on more powerful computer systems and as software becomes embedded in more industrial and consumer products, the need to effectively manage larger and more critical software development projects becomes more intensive (Arya *et al.,* 2008:1749). Emerging technologies combined with industry challenges offer companies new ways to operate. Business leaders need to anticipate how these changes will affect their ways of operating and look to new technological innovations to help them succeed in this new landscape (IBM, 2009:1). More and more emphasis will be placed on organisations to also be more eco friendly in the future (Clarke, 2009:1). Outsourcing would become less of a cost saving and more an overall context of business (Baltzan *et al.,* 2009:492).

A number of architectural changes are occurring which are expected to evolve into a new enterprise environment with new ways to deploy information technology. IBM (2009:2) has identified the following trends:

- Reinventing the way computer systems are built.
  Hardware and software will need to evolve to maintain peak computing performance and respond to the changing needs of today's and tomorrow's business environments. A significant evolution of systems and software across several market segments, cost and power optimized systems, high-end servers and specialized domains will have to occur to take full advantage of these new computer architectures.
- Answering business needs with a "cloud".
  The engine rooms of information (data centres) are widely distributed. New Internet Scale Data Centres are emerging to address this issue enabling these

cloud data centres to expand and grow rapidly. The data centres will be more efficient and more interconnected, inside and outside their companies because they will have the ability to access applications from common infrastructures, often referred to as cloud computing. This will provide a tremendous increase in flexibility for large companies because they now will be able to quickly and easily take advantage of IT tools like web delivery, business analytics, and business process services to help grow their business and better serve their customers.

- Social and data networking for the enterprise.

  Community Web Platforms have introduced new forms of content distribution, leading to more users because it is easier to share information through these new tools. Social networking enables people to ask questions to a general community that can be answered by people with expertise on a topic (EConcept, 2008:1). Users are finding more value in the collaborative nature of these platforms. As these new business models evolve, additional new capabilities will emerge to help sustain and grow the features and functionality that organisations need.

- Real time information processing and analysis.

  Real World Aware is all about a new class of applications that will move business beyond traditional analytics to a place where all data past and present from inside and outside an organisation can be streamed, processed and analysed in real time. New systems are emerging to support this trend, and business applications will need to be extended so organisations can use these new technologies.

- Doing business anywhere, anytime.

  Business requirements and technology advances are driving tremendous change across the Enterprise Mobile space. Mobile devices are becoming an increasingly viable alternative to PCs. With the rapid rise of mobile business, companies will be able to do more than just give their employees the option to access email remotely. They will be able to give them access to critical data and applications. This will allow for anywhere, anytime access because the infrastructure and security features will be there to support them.

These trends defined by IBM give us an indication of what to expect in the near future.

There are also other organisations that are exploring technology evolution. The Global Environment for Network Innovation (GENI) is a project sponsored by the National Science Foundation. It is open and broadly inclusive providing collaborative and exploratory environments for academic, industry and the public to catalyse groundbreaking discoveries and innovation in these emerging global networks. GENI is a virtual laboratory at the frontiers of network science and engineering for exploring future internets at scale. GENI creates major opportunities to understand, innovate and transform global networks and their interactions with society (GENI, 2009:1).

Without doubt, technology will continue to profoundly impact how people live, work, interact, and are entertained. Among the trends predicted by the panellists are the simplifications of the massive amounts of information, greater connection of consumers through social media, better use of technology by large organisations to create competitive advantage (Harvard business school, 2008:2).

Evolving technological and social networks, intertwined and worldwide in scope are rapidly transforming societies and economies. It is very important for organisations to invest in Research & Development to ensure a better tomorrow. Change is here and the challenges are who will be ready and taking full advantage of the technology available today and into the future that will allow for competitive advantage.

2.4. INFORMATION SYSTEMS SUPPORTING BUSINESS PROCESSES

Information systems have to support business in the overall strategy of the organisation and therefore must support the organisational business processes. IS is the backbone of any organisation today; all major business processes and business functions are supported by information systems (Kurbel, 2008:3). The purpose of a technology strategy is to identify, develop and nurture those technologies that will be critical for the organisation's long-term competitive positioning (Maheran *et al.,* 2008:98; Masaaki, Mol & Murray, 2008:37). Strategy must lead the way, and the business processes must support the objectives through effective use of organisations and supporting technology

solutions. A clear evolutionary path for transformation has to be defined and followed, driven directly by business requirements (Schlegelmann, 2008:2; King, William & Flor, 2008:1).

Business applications of IS perform three vital roles in organisations:

- Organisation's business processes and operations: involves dealing with information systems that support the business processes and operations in a business.
- Business decision-making: help decision makers to make better decisions and attempt to gain a competitive advantage.
- Strategic competitive advantage: help decision makers to gain a strategic advantage over competitors requires innovative use of information technology.

Major application categories of information systems include operations support systems, such as transaction processing systems, process control systems, enterprise collaboration systems, and management support systems, such as management information systems, decision support systems, and executive information systems. Most applications are combined into cross functional IS that provide information and support for decision-making and also perform operational information processing activities (Sachenko, 2009:2; Simkova & Basl, 2006:426).

An understanding of the effective and responsible use and management of information systems and technologies is very important for organisations. IS plays a vital role in the e-business and e-commerce operations, enterprise collaboration and management, and strategic success of businesses that must operate in an inter-networked global environment (Sachenko, 2009:1).

Technology strategy must concentrate on seeking competitive advantage and must be consistent with the organisation's overall strategy. It must also focus on all areas within the organisation. Technology strategy must also recognise the risk and return tradeoffs that accompany any technology advantage.

Business increasingly relies on more powerful computer systems and as software becomes embedded in more industrial and consumer products, the need to effectively manage larger and more critical software development projects becomes more intensive (Arya *et al.,* 2008:1749).

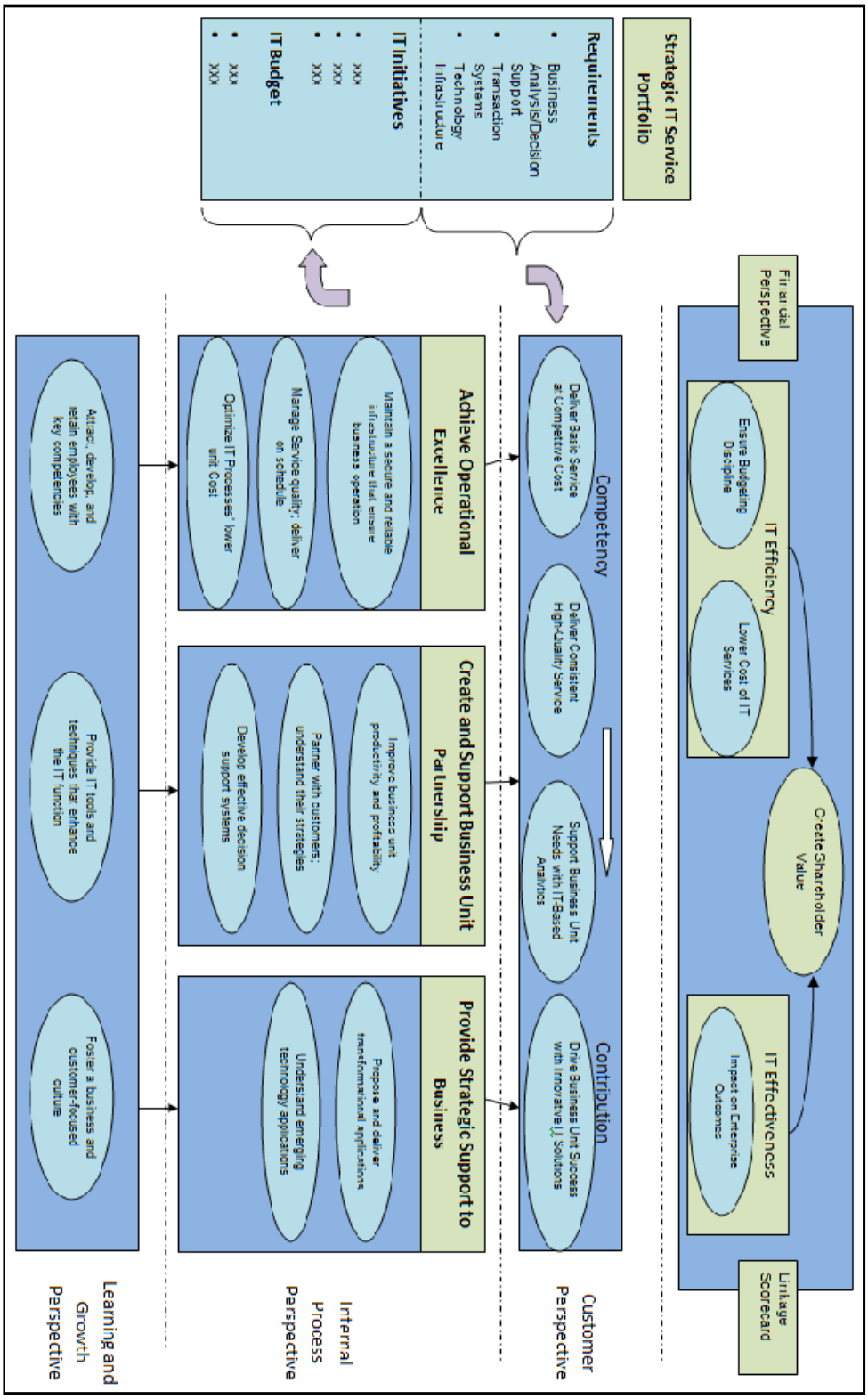
Markets and business are continuously changing and it is important to keep in mind that these decisions need to be continuously re-evaluated (Kurbel, 2008:44). IS plays an increasingly important role in the success of businesses throughout the world. The benefits that can be derived from the effective utilisation of information technologies include cost reduction, performance improvement, quality enhancement, and the creation of new products and services (Arya *et al.,* 2008:1749; Jukic & Jukic, 2010:62).

Conceptualisation of organisational processes and IS that support and facilitate them can provide significant value to the achievement of organisational strategy goals. The main goal of such conceptualisation it to reduce poor choices that lead to improper fit between the organisation's strategic goals, business processes and supporting systems (Jukic & Jukic, 2010:62; Bocij *et al.,* 2008:538).

The importance of alignment of information systems with the underlying support of the business processes defines the competitive advantage of an organisation. Increasingly with the evolution of technology the emphasis on business strategy to incorporate IS are increasing more and more every day.

Kaplan and Norton (2006:146) define a strategic organisational map template (Figure 2.1) that illustrates the balance that IT organisations must maintain to be competent at basic necessary services while devoting the capabilities to collaborate with business units thus offering them customised services, solutions and technologies that advance their strategies. **Figure 2.1** can be used to maintain a balance within the organisation between technology and business units.

Figure 2-1: Information Technology Organisation Strategy Map Template



(Source: Kaplan & Norton, 2006:147)

Figure 2.1 illustrates the strategic organisational map template; the following can be derived from this figure (Kaplan & Norton, 2006:146-149).

- The financial perspective reflects the objectives to lower unit cost while supplying basic IT services. The enterprise strategy is aligned with the IT unit's strategy through the portfolio of strategic IT services which is derived from the enterprise strategy and negotiated with the business units.
- Customer perspective: The success of delivering the portfolio of infrastructure and application is measured in two levels, at the basic competency level and the contribution level that adds value to the organisation.
- Internal process perspective: The internal process is organised through three strategic themes:
  - Achieve Operational Excellence;
  - Create and support Business Unit Partnership;
  - Provide Strategic Support to the Business.

  The first theme demonstrates the group's ability to supply IT capabilities at competitive cost, reliable service delivery and consistent quality. The second theme enables the group to develop solutions customised to the needs of each business unit, becoming a strategic partner of the business units and participating in the creating and executing of its strategy.
- Learning and Growth Perspective: this theme identifies the critical skills required for the IT unit's people to deliver on the three pronged strategies.

Effective planning and utilisation of IT resources involve analysis of available IT sourcing options to effectively respond to environmental changes and exploit IT for gaining competitive advantage. This includes choosing the optimal software sourcing option when implementing new IS. Organisations need to weigh their options relative to their capabilities. Sourcing strategies involve a range of options. One side of the sourcing-option spectrum is total in-sourcing which involves production, operation, and maintenance of software completely by the organisation's staff. The other side is total outsourcing which is an allocation of over 80 percent of the IT budget to external vendors. Between these two options, there exists a large variety of sourcing strategies

involving some combination of in-sourcing and outsourcing, open source (Sledgianowski *et al.,* 2007:423; Chaffey & Wood, 2005:78).

2.5. OPEN SOURCE SYSTEMS

A significant software selection issue for managers in many organisations is the open source software option. It can be applicable to system software or application software. Open source refers to an instruction or program code which the software is based on. It is freely available to everyone for use and programmers can use and redistribute source code, fix bugs, improve on it and adapt it to their environment. This allows the software to rapidly evolve and produce better software at a faster pace than the normal closed compiled source code (Chaffey & Wood, 2005:83; Kurbel, 2008:222; Baltzan *et al.,* 2009:347; OSI, 2011:1).

Advantages and benefits of open source software options (OSI, 2011:1; Cervone, 2003:1):

- Easing of licensing restrictions.
- Cross-platform simplicity.
- Possibility to run modules on any operating system.
- Low cost as no licensing fees are required.
- Modification of system is possible, as you have the source code.
- With the source available any bugs can be fixed.

Disadvantages of open source software options (OSI, 2011:1; Cervone, 2003:1):

- Certain open source systems are not fully developed as commercial software with similar functionality. This results in general lack of sophisticated tools for administrative purposes.
- Lack of necessary expertise to do modifications, or do installations.
- Open source systems can be less user-friendly than commercial software.
- Support to the system is not always available.
- Security might be a problem as source is available to everybody.

The Open Source Initiative (OSI, 2011:1) is a non-profit corporation with global scope formed to educate about and advocate for the benefits of open source and to build bridges among different constituencies in the open source community. The Open Source Initiative Approved License trademark and program create a nexus of trust around which developers, users, corporations and governments can organise open source cooperation.

2.6. SOFTWARE AS A SERVICE (SaaS)

Software as a Service (SaaS) is a software distribution model in which applications are hosted by a vendor or service provider and made available to customer over a network like a web browser on the Internet. Instead of installing the software locally, the program is used by hundreds of users distributed globally and is hosted in a central location by the vendor. The customer who is using this service pays the vendor or host of the software on a per-use basis. SaaS is becoming an increasingly prevalent delivery method as underlying technologies that support web services and service oriented architecture (SOA) mature and develop (Carraro, 2006:2).

SaaS is often divided into two major categories (Gruman, 2007:2):

- Line of Business Service. Refers to business solutions offered to, sold, or made available to organisations on a subscription basis.
- Customer oriented services. Services offered to the general public either on a subscription basis or for free supported by advertising.

SaaS applications take advantage of the benefits of centralisation through a single instance, multi-tenant architecture that provides a feature rich experience. A typical SaaS application is offered either directly by the vendor or by an intermediary party called an aggregator, which bundles SaaS offerings from different vendors and offers them as part of a unified application platform (Carraro, 2006:1). SaaS providers will host the application and data centrally and will deploy patches and upgrades to the application transparently, delivering access to end users over the Internet through a browser or smart-client application.

SaaS application access is frequently sold using a subscription model, with customers paying a fee to use the application. The structure of fees varies from application to application, where some service providers charge a flat rate for unlimited access to the applications while others charge varying rates that are based on usage (Simon, 2009:1; Carraro, 2006:1).

SaaS has the following characteristics (Exforsys, 2009:1):

- Network or Online Access: SaaS is an online application or a network based application.
- Centralised Management: Where the control, monitoring and update could be done in a single location.
- Powerful Communication Features: SaaS is not only based on providing functions for online processing but could take advantage of other powerful communication features like voice calls and instant messaging.

Advantages of SaaS (Carraro, 2006:1; Exforsys, 2009:1):

- No Infrastructure cost allowing for easier administration.
- Automatic updates and upgrades: You always get the latest version and security updates automatically and therefore there is no need to spend time updating each of your computers.
- Maintenance: The software deployment and maintenance are handled elsewhere, allowing customers to focus on their core competencies to run their business.
- Compatibility as all users will use the same and latest updated software. The data is all centralized.
- Global access/Ease of Use of software, anywhere any time.
- Recurring Revenue/Financial Benefit: Where the predictable monthly payments provide better stability. Software is subscribed to and not purchased, therefore expenses are not front loaded but are usually made up of predictable monthly fees.

- No Human Capital is needed to maintain software which contributes to additional cost savings.
- Data storage: As the data is stored online; the service provider must take care of data backups and availability of software and data.
- Uptime of software.
- Easier to do an incremental rollout.

Disadvantages of SaaS (Carraro, 2006:1; Exforsys, 2009:1):

- Less customisation: The customers using the service have less scope for customisations as they need to use the same code base as used by multiple other users. It may not meet the requirements of highly demanding users.
- Security: There are some apprehensions among customers in terms of security for their data and systems especially if their business-critical applications are hosted and maintained by external vendors/suppliers.
- Integration and scalability: It is found that these services are not easy to integrate with other applications in the enterprise, especially legacy systems.
- Connection: You need a permanent connection to the service. If you do not have a permanent connection you cannot use the software.
- The connection speed or lack of it.
- Vendor viability becomes an even greater concern since the vendor controls the software, security, and the data.

It is important that if one is considering SaaS as a solution, that one must set up an agreement/contract with the service/vender provider. This type of agreement is called a Service Level Agreement (SLA). Things to consider when setting up such an agreement are:

- System uptime; availability of the system and if there is any down-time a procedure to deal with it.
- Data Ownership: what happens to your data when the contract ends or in case of the vendor failing.

- Backup data policies: vendor must ensure that the data is properly backed up.
- Support: phone support and e-mail or call logging facility. Also the turnaround time from logging such a support call.

SaaS products are generally considered to be part of cloud computing where anything can be made into a service. Software as a service puts the control back into the hands of the business users if controlled properly. The benefits that the SaaS delivery model brings to the end user are the main driver for companies changing the way they think about software deployment.

2.7. OUTSOURCING

Outsourcing is an arrangement by which one organisation provides a service for another organisation that chooses not to perform that service in house (Chaffey & Wood, 2005:593). Different types of outsourcing exist: Business Process Outsourcing where specific processes are contracted to third party; Information technology (IT/IS) outsourcing is where different information technologies are performed by a third party over a contract period (Chaffey & Wood, 2005:594). The IT Outsourcing support function is not simple though, and companies must manage the related strategic, quantitative, and qualitative risk factors (Raiborn *et al.,* 2009:351). Different outsourcing options include onshore outsourcing, near shore outsourcing and offshore outsourcing (Sashikala, 2010:17).

Conditions for outsourcing and information systems outsourcing drivers are:

- It allows organisations to focus on their core competencies.
- It allows organisations to have a competitive advantage especially when an activity can be performed more quickly and at a lower cost than in-house.
- Increase the technical capability through “best-of-breed” especially where the IT department is a non core activity.
- Reduce or control operating costs where the Third Party Intervention (TPI) have a lean overhead structure, more expertise, less excess capacity and better control.

- Flexibility and reduced risk where investment of a sizable amount in a non core business can have tremendous risk.

Outsourcing is a very attractive option to take advantage of the global opportunities and to improve customer service (in-house and external) and to focus on core competencies (Sashikala, 2010:17; Kurbel, 2008:51).

Advantages that an organisation could gain through outsourcing can be seen both from an operational and strategic point of view. This can be achieved when an organisation looks at their long-term capital investments through strategic outsourcing (Sashikala, 2010:21; Kurbel, 2008:89).

Operational and strategic advantages of outsourcing include:

- Operational Impacts
  - Cost reduction can be experienced through lower IS cost due to increased efficiency if the TPI.
  - Improved IS service due to the increased levels of service consistency that can lead to higher customer satisfaction.
  - Capital investment reduction due to the fact that the assets investment belongs to and is the responsibility of the TPI.
  - Upgrade to state-of-the-art IS system and if the agreement stipulates, are free of charge as the TPI beard the cost.
  - Accelerate re-engineering benefits.

- Strategic Impacts
  - Access to IS expertise from the TPI due to it being his core business.
  - Allows the organisation to focus on their core competencies.
  - Economies of scale where small to medium organisations do not have the available capital to invest in IS.

Disadvantages of outsourcing include:

- Loss of critical skills when an organisations decides that the IS function in question is not a core activity for itself and the organisation then decides to outsource that activity, it will then lose the specific skill that constitutes part of its competence.
- Loss of cross functional skills where there is a close collaboration between departments and one of the activities is outsourced.
- Lack of Global IS Provider where the organisations make use of the global market and the organisation cannot trust a worldwide IS network.
- Human resource issues especially where the TPI is seen as interference.

There are also challenges that are faced by outsourcing (Baltzan *et al.,* 2009:491):

- Contract length: A contract is usually for long periods of time because of the high cost of transferring assets and employees as well as maintaining technological investment. These types of contracts are difficult to get out of and because of its length if the focus of the organisation changes you are stuck with this lengthy contract.
- Competitive edge, where you would have achieved this with an internal department that understands the organisation and is committed to its goals.
- Confidentiality, where the information stored by an organisation is essential to the organisation's success or survival.

The overall reasons for outsourcing should focus on adding value to the final consumer of the product or on service through achieving lower logistic costs and a higher level of quality and expertise resulting in adding value to the consumer (Chaffey & Wood, 2005:593; Sashikala, 2010:15).

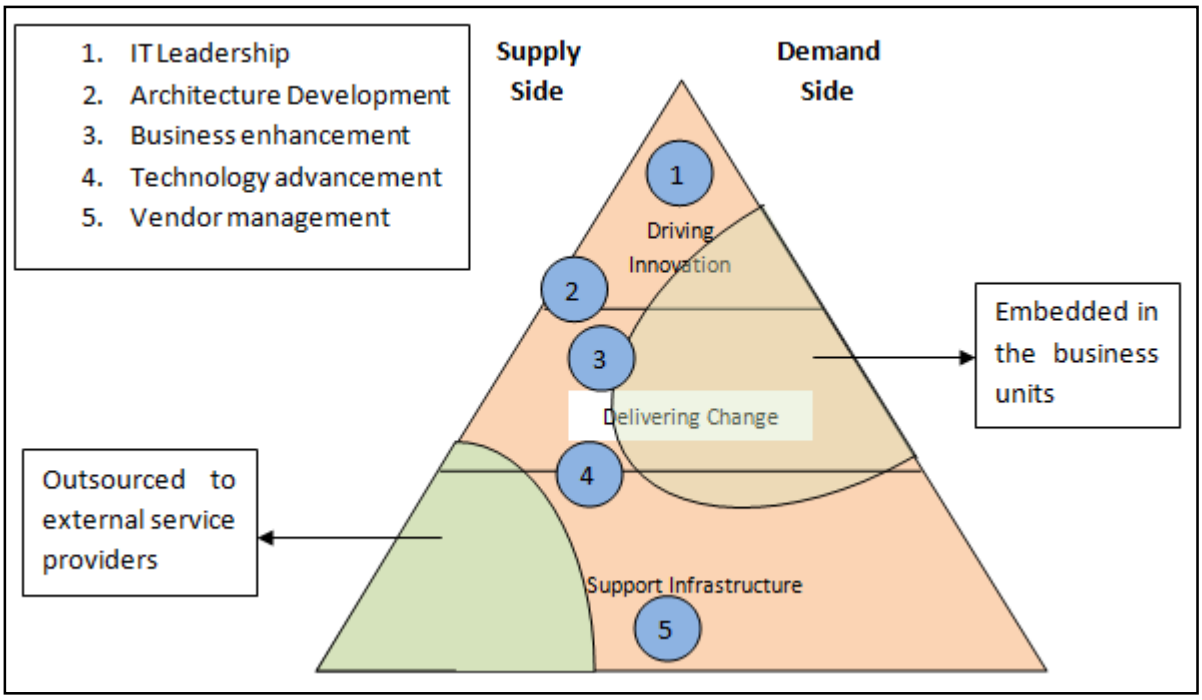
What can be outsourced and what must be retained in an organisation should remain a key set of roles and skills within the organisation to assure a competitive advantage and also to ensure the sustainability of the organisation. Do not outsource what you do not understand, these are rules required in an organisation.

Broadbent and Kitzis (2005:181) define the following roles as necessary within an organisation:

- IT Leadership
- Architecture development
- Business enhancements
- Technology advancement
- Vendor management

Figure 2.2 (Five Roles to Retain IS) gives a picture of the integration of the roles needed within an organisation structure (Broadbent & Kitzis, 2005:181-183). For the implementation of the organisation vision it is crucial to have IT leadership, as it defines the shift from functional silos to processes. It also drives innovation for business value as well as the creation of excellence. Architecture development is needed to ensure system links with outsourcers to establish process-based work and control standards used in the competency centres. This does not imply that the architecture itself is not outsourced but that the planning and decision-making capability must be retained within an organisation. Business enhancement deals with the IS business integration which is important in shifting the process based work and moving the IT work to business units – shifting the technical orientation from a cost centric to a value centric approach. Technology advancement deals with the introduction of emerging technologies that will directly support business goals and it increases the focus of innovation. Vendor management plays an important role in outsourcing as it deals with contract management and vendor management. It is key to extract maximum value from external service providers (ESPs).

Figure 2-2: Five Key Roles to Retain IS



(Source: Broadbent & Kitzis, 2005:183)

2.8. IN-SOURCING

In-sourcing deals with the decision to make or customise-develop a system. The organisation uses its internal capabilities to develop an Information System in-house. Organisations have complete control over how the system looks and functions. Developing a system in-house allows developers to be flexible and creative in the way they solve business problems through information systems that support the business strategy (Kurbel, 2008:44; Baltzan *et al.,* 2009:252). Successful in-sourcing requires ongoing proactive management to deliver. Organisations that choose to in source must shape internal IT skills and exploit their strengths including those that align with the business and the ability to match IT and business risk (Reynolds & Seddon, 2010:1988).

A custom application would be easier to change to include components that take advantage of current technologies that can support strategic efforts. Building a system in-house also helps to builds technical skills and functional knowledge within the

organisation. Developers working with business users also increase their understanding of the business and therefore allows for better alignment of information systems with organisational strategy. These same developers climb the technology learning curve so that future projects applying similar technology become much less effortful (Chaffey & Wood, 2005:591).

Drivers that favour the make decision are:

- Keep core competencies in-house.
- IS service or product that requires considerable security or confidentiality.

A variety of technical and functional skills all have to be in place for any development project to move ahead smoothly. Highly skilled individuals are quite often quite difficult to hire and retain if the skills are not available in house. The risk associated with building a system from the ground up can be quite high, and there is no guarantee that the project will succeed (Lanz, 2010:11).

There are three major ways to develop the system in-house (Rahardjo, 2006:15):

- Building the application from scratch to match the specific application with the requirements.
- Building the application by using the standard components or features that have been included in some commercial packages like Java, Visual Basic and C++.
- Building the application using available packaged software that can be customised.
- Building the application using available packaged software that can be customised offers greater flexibility, cost and time saving.

The approach of developing in-house may be time consuming and somehow costly but the organisation may have a system that meets all the organisation requirements. Developing a system in-house has the overriding advantage of the freedom to create a system that would closely fit the organisation's business processes. Viewed in contrast

to other solutions it would be relatively inexpensive but it would take more time to test and implement (Rahardjo, 2006:15).

2.9. RENT, MAKE OR BUY DECISION FACTORS

It is important to identify the factors that influence the decision when seeking to upgrade or replace legacy systems with new information systems. Once the decision has been made the next step that an organisation needs to take involves the classic "make, buy or rent" question: Is the organisation going to build its own system from scratch or purchase a "mature" system that tens, hundreds, or even thousands of organisations currently use, or rent a system (Gallauger, 2010:1; Lanz, 2010:11).

Packaged software can range from small single function tools such as the shopping cart program to huge systems, such as enterprise resource planning (ERP) applications (Bocij *et al.,* 2008:112).

Factors that managers should consider when making a make, buy, or rent decision include the following (Gallauger, 2010:1; Simon, 2009:1):

- Competitive Advantage: Does the organisation rely on unique processes, procedures or technologies that are vital for the organisation to create and differentiate their competitive advantage?
- Security: Are there unacceptable risks associated with using the packaged software, OSS, cloud solution, or an outsourcing vendor? Is the organisation satisfied that there are sufficient policies in place to secure their privacy? Are there sufficient policies in place for on-site auditing? If there is unacceptable risk associated with using packaged software then the outsourced option is not viable.
- Legal and Compliance: Are there specific legal and compliance requirements related to deploying the organisation's products or services*?* Is the organisation prohibited outright from using technologies? In certain cases organisations are required by law to reproduce the electronic equivalent of a paper trail.
- Skills, expertise and available labour: Do you have the internal skills available to develop a technology solution? If you do have the skill you must consider the

cost associated with taking the available skill out of the organisation to allocate them to the development project.

- Cost: What is the best cost effective solution available for the organisation? There are a huge number of factors that organisations must consider. The cost to build, host, maintain and support an ongoing effort of sustaining the solution. Cost is one of the main drivers in the decision to make, rent or buy an information system.
- Time: Do you have the time to build, test and deploy an internally devolved system?
- Vendor issues: Is the supplier reputable and in a sound financial position? Can the supplier guarantee the service levels and reliability the organisation requires? What alternatives must be put into place if the supplier cannot deliver? Is the supplier certified and/or belongs to a professional and regulatory body that conveys quality, trust and reliability?
- Size of the organisation: If the organisation is small to medium the cost associated with large information systems does not always justify the means. Larger organisations find it easier to justify the expense of large systems that have been thoroughly tested.
- Number of Expected Annual transactions: This is especially applicable where a SaaS agreement is being considered. These types of solutions are usually transactions based. The organisations should consider the amount of transactions and the cost per transaction. This should be measured against the cost of a buy, rent or make decision. These types of solutions can usually be very expensive for huge organisations.
- Control: If an organisation develops (makes) the system in-house it is very accessible to make desired changes to the system. An organisation with the desire, knowledge, and resources to customize its system probably will not want any part of renting. Renting or purchasing software from a vendor may restrict a client's ability to make changes with the software.
- Business and technical functionality: Business and technical functionality must be major considerations when considering making, buying or renting information

systems. If the purchase software does not fit the business and technical aspects of the business it is not an option for consideration.

To make a decision an organisation must compare the advantages and disadvantages of the buy, rent or make options available for the specific information system (World Bank, 2008:1; Kurbel, 2008:44).

- Custom-developed solutions

Advantages:

- Can be customised to organisation's specific requirements.
- Can exploit any established skill sets in custom software development.
- Can incorporate niche domain needs.
- Can transfer specialised domain knowledge already built into any existing systems.
- Build technical and functional knowledge with the organisation.
- Alignment of information system with organisation strategy.

Disadvantages:

- Time taken for developing software in-house is typically long.
- Retention of the IT personnel is crucial and difficult.
- Industry best practices may not be fully incorporated.
- Dependency on technology evolution, developing a solution to find at the end there is better technology already available.
- Investment in IT resources is very high.
- The organisation must have experience in developing application packages.

- Package-based solutions

Advantages:

- Time saved in developments.
- Software is field-tested and robust.
- Incorporates best global processes.
- No need to re-invent the wheel.

- Easier migration to integrated solution.
- Uniform users interfaces and ease of use.

Disadvantages:

- Business and functionality not always a one hundred percent fit for organisation.
- Customisation of software to suit organisation requirements.

Software as a Service (SaaS) applications take advantage of the benefits of centralisation through a single-instance, multi-tenant architecture that provides a feature-rich experience. SaaS application access is frequently sold using a subscription model, with customers paying an ongoing fee to use the application. The structure of fees vary from application to application, where some service providers charge a flat rate for unlimited access to the applications while others charge varying rates that are based on usage (Simon, 2009:1; Carraro, 2006:1).

By using the factors influencing the make, buy, or rent decision (Gallauger, 2010:1; Simon, 2009:1) we can begin to evaluate the make, buy or rent decision. The following criteria for analysis and the purpose of decision-making are listed in **Table 2.1** (SDU, 2010:8; Simon, 2009:1).

Table 2-1: Make, Buy or Rent Criteria

	When to Use Custom Development	**When to use a packaged system**	**When to outsource**
Business Need	The need is unique	The need is common	The need is not a core competency
In house experience	In-house functional and technical expertise exist	In-house functional and technical expertise exist	In-house functional and technical expertise does not exist
Project skills	There is a desire to	The skills are not	The decision to outsource is a strategic

	build in-house skills	strategic	decision
Project management	Project has a highly skilled project manager and a proven methodology	The project has a project manager who can coordinate the vendor's efforts	The project has a highly skilled project manager at the level of the organisation that matches the scope of the outsourcing deal
Timeframe	Flexible	Short	Flexible or short

(Source: Adapted from SDU, 2010:8; Simon, 2009:1)

- The Business Need

  If the business need for the system is common and technical solutions already exist in a common application it makes little sense to build a custom application. Packaged systems are good alternatives for common business needs. If there is a unique business need then customised solutions must be considered. Usually if the business need is not critical to the company, then outsourcing is the best choice. Another factor to consider is the level of functionality fit. Purchase software will not always have one hundred percent functionality fit to an organisation, whereas with a customised application the organisation will be able to build to functional fit.
- In-house experience

  Required experience in developing customised solution. Purchase software does not require that the organisation have the skill set for development. Organisations must assess their ability to develop and maintain the skill levels required to develop in-house systems and to keep pace with the technology shifts.
- Project skills

  The skills that are applied during projects are either technical (e.g., Java, Structured Query Language [SQL]) or functional (e.g., electronic commerce), and different design alternatives are more viable depending on how important the skills are to the company's strategy. Skills such as network security may be either beyond the technical expertise of employees or not of interest to the organisation's strategy.

Packaged systems or outsourcing should be considered where some skills are just an operational issue that needs to be addressed.

- Project Management

  Any of the options for consideration requires project management. Customised applications require excellent project management as there are things that can push a project off track. The project team should only choose to develop a custom application if it is certain that underlying coordination and control mechanisms are in place. With packaged and outsourcing alternatives there are also obstacles but it is more shielded from internal obstacles because the external parties have their own objectives and priorities. Packaged and outsourcing alternatives typically have their own methodologies, which can benefit companies that do not have an appropriate methodology to use.

- Time Frame

  When time is a factor, the project team should look for a system that is already built and tested and that has the applicable business and technical functionality required. The time frame for custom applications is very unpredictable especially when you consider testing and deployment.

Other factors to consider with the abovementioned criteria for analysis and the purpose of decision-making are (Gallauger, 2010:1; Simon, 2009:1):

- Legacy system with organisation:

  The presence of a legacy system with most organisations makes the need to integrate with these types of systems difficult from a purchase software approach.

- Global best practices:

  Customised developed solutions do not always include the best practices.

- Implementation of system:

  If the systems have to be implemented across a wide spectrum of and over several organisational levels, a robust and proven package solution would mitigate the risk associated with large scale implementations.

- Maintenance and upgrades:
  With packaged or rented software the maintenance and upgrades of software are usually incorporated in a contract.
- Performance and quality:
  Development of systems are subject to rigorous testing, even after full deployment it needs to be continually trouble shouted and debugged in order to solve problems and errors. Packaged and rented software are stable as it has been installed previously and subjected to testing both in simulated and actual production environments.
- Documentation and training:
  With packaged and rented software training and documentation are available before commencing. With a customised solution, the organisation usually only has the documentation and training material available at the end.

The make, buy, or rent decision may apply on a case-by-case basis that might be evaluated by the organisation, division, project or project component (Bocij *et al.,* 2008:112).

2.10. MANAGING RISK ASSOCIATED WITH INFORMATION SYSTEMS

In striving to become flexible, lean, and more competitive organisations have opted towards more externalised support service functions. Organisations must carefully analyse the impacts of their outsourcing decisions. Outsourcing information systems will help organisations become more efficient, have access to new skills and resources and will allow organisations to focus on the core business. This however is only as long as the benefits accruing from the intangible assets are achieved and contribute to the organisational goals, objectives and ensuring a competitive advantage. The only way to avoid risk associated with outsourcing is to perform all service tasks in-house. Again, this also has risk associated with it and this level of risk avoidance can come at an unacceptably high cost given the compelling strategic and financial benefits that can be realised by outsourcing (Raiborn *et al.,* 2009:349). It is also important to ensure that you

do not outsource functions that 'interrupt the flow of product or service' between the organisation and its customers.

Each outsourcing agreement is unique but risk associated with outsourcing can be divided into four general categories (Raiborn *et al.,* 2009:349; Kurbel, 2008:56).

- loss of control;
- loss of innovation;
- loss of organisational trust;
- Higher-than-expected transaction costs.

Loss of control due to an inadequate Service Level Agreement (SLA) that incorrectly details the work specifications required. The monitoring of performance and productivity can be challenging as well as the coordination and communication especially with offshore vendors. The inability to engage in face-to-face discussions, brainstorm, or explore nuances of obstacles could cripple a project's flow. Organisations using innovations or an innovation strategy must place focus on human resources. Such organisations must be able to recognise the need to recruit and hire highly qualified individuals and providing them with a long-term focus. Employee retention is very important especially in innovative organisations. It is also very important to create the desired working environment. Employees who feel that the organisations are not loyal to them could exploit new opportunities. Care must be taken to ensure that a complete and thorough cost benefit analysis has been done to ensure that there are no unforeseen costs. Unforeseen costs like vendor identification and selection, legal fees for contracting and composition, vendor communications, performance measurement development, quality assurance and security audit must be incorporated in the decision to outsource (Raiborn *et al.,* 2009:349).

Outsourcing risk can be managed through two processes:

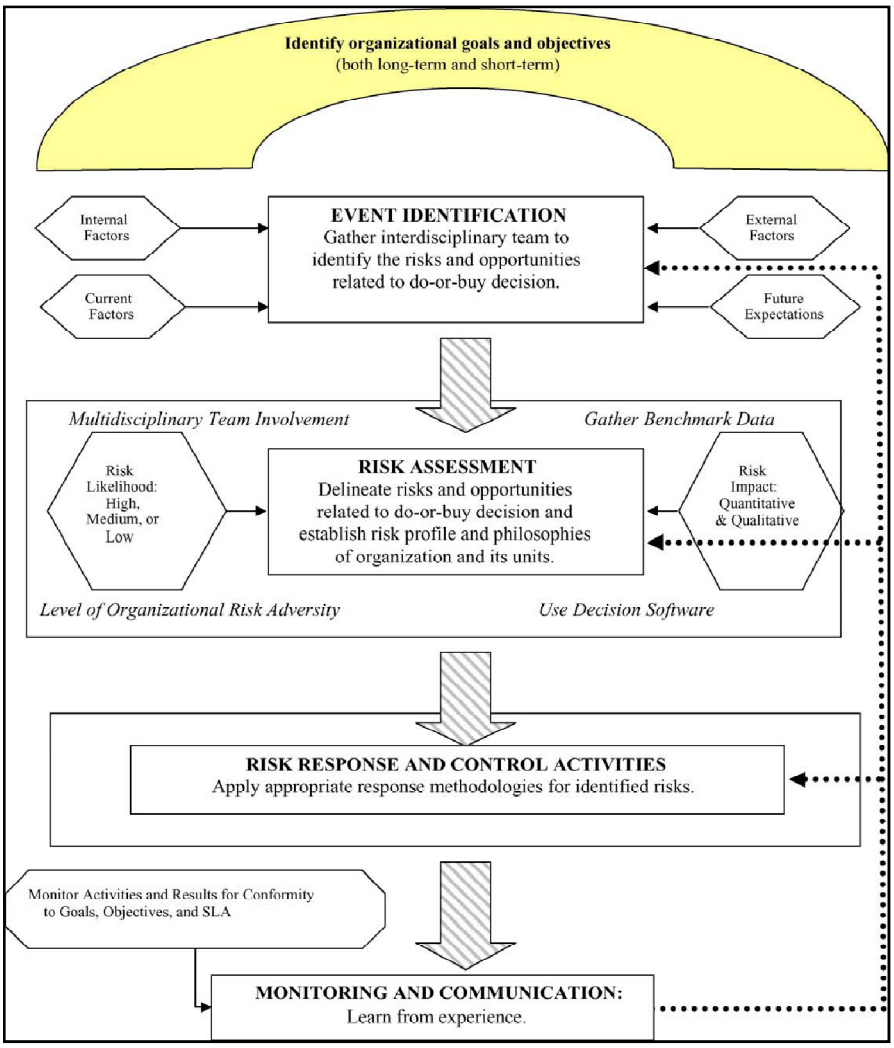
- Viewing outsourcing risk separate from other risk management issues using logic and reasoning.

- Using an enterprise wide risk management approach (ERM) such as the one developed by the Committee of Sponsoring Organisations of the Treadway Commission (COSO, 2004:1).

Risk management for each outsourcing activity is viewed as part of an integrated whole rather than as a separate consideration for each organisation using the COSO (2004:1) ERM model.

The impact of outsourcing risks and their related control activities are assessed at each level of the organisation. The ERM approach is preferred to the general approach because ERM is a three-dimensional enterprise wide, top-down means of anticipating, assessing, and addressing business risks, including those generated from outsourcing activities. This allows for an optimal balance between growth and return goals. The ERM approach allows managers to be more proactive in anticipating and responding to the preponderance of business threats, and allows an organisation to develop a comprehensive, future focused approach to risks engendered by different organisational strategies (Raiborn *et al.,* 2009:349). The ERM approach as shown in **Figure 2.3** means that service outsourcing risk can be addressed more efficiently and effectively.

Figure 2-3: The ERM Approach



(Source: Raiborn *et al.,* 2009:352)

As shown in Figure 2.3, ERM begins with:

- An analysis of the organisation's long-term and short-term goals and objectives. This phase is essential to identifying the multiple internal and external, current and future factors that can affect risk and opportunities in a make/buy or rent decision.
- The event identification phase determines the factors that allow management to delineate the overall risk profile. The event identification phase focuses on recognising the risks and opportunities both internal and external to the organisation.

- The risk assessment is where managers perform risk assessment to determine how to cope with the risk acknowledgement during the identification phase.
- In the risk response phase managers develop and evaluate a way to respond to the identification process. Organisations must also consider the organisation's attitude towards risk, and incorporate the response of management into policies and procedures.
- Finally after the decision has been taken the organisation must monitor the results and activities to evaluate their conformity to the organisation's goals and objectives.

Most risks can be mitigated if the organisation decides to outsource but there are some rules that an organisation must take into consideration. Never outsource what you do not understand and choose a vendor very carefully. If the planning phase is completed you should have to conduct a proper analysis. At this stage it is important to be very aware of the organisational needs. Choose a vendor/developer or service provider with a proven track record in the type of system and technology that your system needs (Raiborn *et al.,* 2009:349; Kurbel, 2008:62).

2.11. RESISTANCE TO CHANGE IN INFORMATION SYSTEMS AND THE CHANGE MANAGEMENT PROCESS

Resistance to change can be defined as an emotional response to real or imagined threats to an established work routine. The main reasons for resistance to change are an individual's predisposition towards change, surprise and fear of the unknown, climate of mistrust, fear of failure, loss of status or job security, peer pressure, disruption of cultural traditions or group relationships, personality conflicts, lack of tact or poor timing, non re-enforcing reward system and past success (Kreitner & Kinicki, 2008:546-547). Additional personal characteristics to change include the resilience to change (high self esteem, optimism and internal locus of control), commitment to change, positive self concept, tolerance to risk and high levels of self-efficacy (Cummings & Worley, 2009:321).

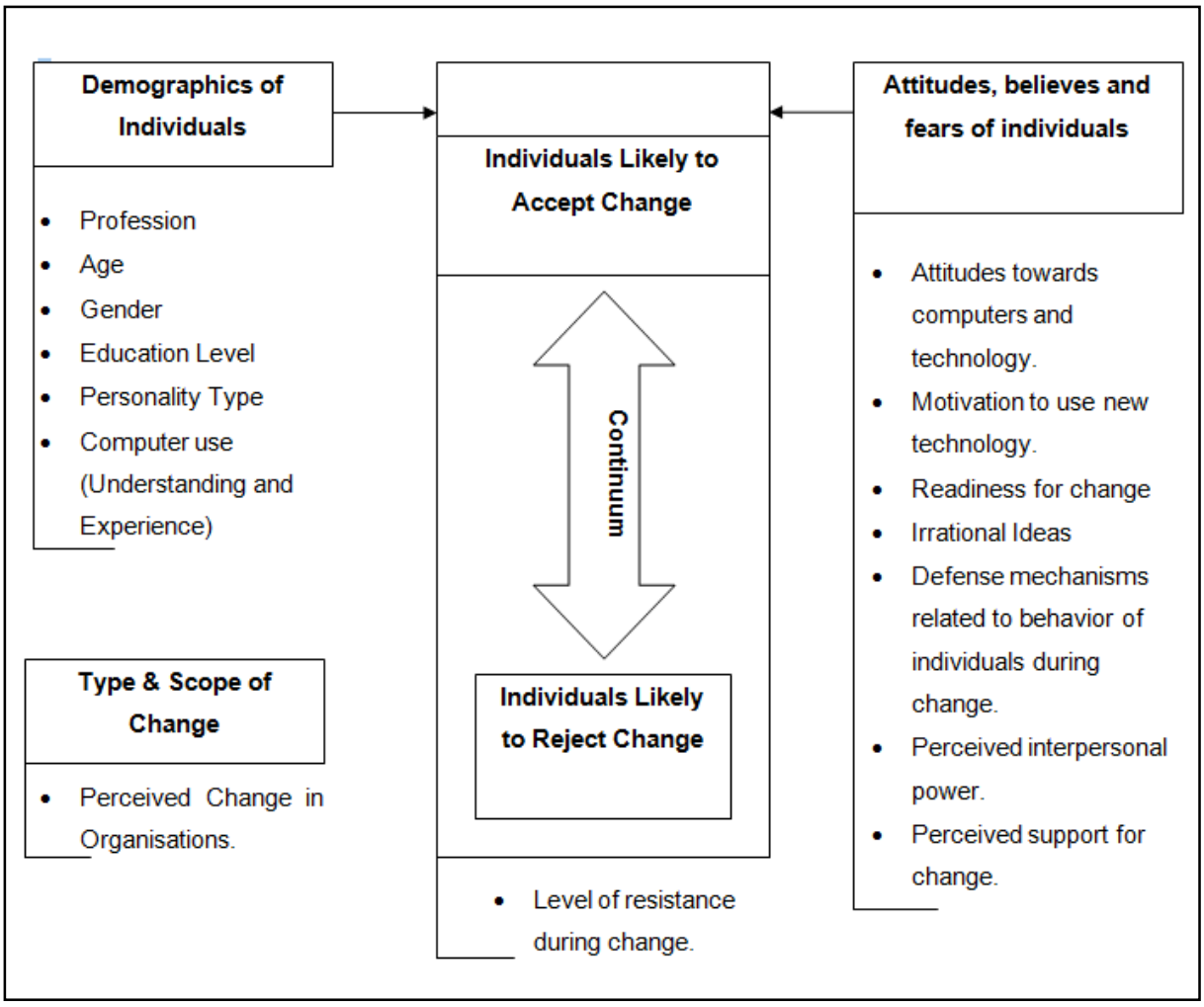
Murray (2007:1) defined that by shifting the weight of resistance and turning it into positive momentum it will focus the energy where it will do the most good. Marry (2007:1) stated that to manage change one could use any one of the following basic approaches.

- Focused concentrated;
- Relentless repetition;
- Living embodiment.

Change cannot occur if energy is misdirected. By focusing energy on the target, the vision, the mission, the strategy and objectives, the performance drivers, the key people, the processes and the technologies must be closely aligned and in balance. The lack of organisational alignment means that energy is being wasted in places not critical to the mission. A complete transformation can only occur when the desired change in behaviour becomes habitual. By doing something out of habit it will increase the success of the change process. It is also important that organisations must be the leading change agent and must have a clear theme, with a clear result, communicated many times over to increase the success of the change initiative (Murray, 2007:1).

Davis and Songer (2009:1324) developed a resistance to change index (RTCI) to investigate the intensity of resistance an individual is likely to exhibit towards information technology (IT) implementation initiatives. David and Songer focused their study on the relationship between the demographical variables and the RTCI. The demographical variables include: profession, gender, age, personality type, education level, computer understanding and experience, and perceived past and future IT changes. **Figure 2.4** shows a model depicting the focus of the research done by Davis and Songer (2009:1325). Combining the demographics of individuals on the right hand side creates the RTCI that represents the likelihood of an individual to accept or reject IT change.

Figure 2-4: Model depicting level of resistance to IT change



(Source: Davis & Songer, 2009:1325)

This study done by Davis and Songer (2009:1331) has identified the need for organisations to quickly identify the individuals who are more likely to resist the change. Identifying individuals that exhibit different intensities of resistance to change efforts and their attendant demographics provide benchmarking data to organisations. By quickly identifying the individual's behaviour organisations can begin to alter their change process to reflect the concerns of those individuals. It was found that the demographics that indicated high likelihood of resistance to change were gender (female), computer understanding and experience, past IT changes, future IT changes and profession, has the higher resistance to change factors.

This study also incorporates the Ten Principles of Successful Change Management by Coetsee (2002:207). Change in information systems should create a motivating climate to be successful. The ten principles: clarify the need for change; involve and obtain the commitment of all stakeholders in planning and execution of the change process; top management involvement and commitment; diagnose present functioning; establishing what the results of the change process should be; the change intervention must be directed by line managers-leaders and assisted by a change agent; develop a result-orientated strategy for change; align all enabling structures; diagnose and manage resistance to change; build in reliable feedback mechanisms to monitor, manage and eventually evaluate the change process.

Any change must be planned, monitored and evaluated during and after the change have been initiated. Organisations can learn from previous experience/best practices on how to best manage the change process and identify the individuals who will most likely resist the change process.

2.12. MEASURING CAPITAL INVESTMENT IN INFORMATION SYTEMS

Companies often invest in information technology to gain competitive advantage over their competitors. Previously, research was focused on the tangible value of new technologies like productivity improvements and efficiency. In a study done by Laine (2009:13) it was found that the focus shifted towards the intangible value and to the strategic value gained from altering the market equilibrium. The missing linkage to strategy is likely to cause investment in IS to fail, because the management of IS should be in accordance to corporate strategy (Kaplan & Norton, 2004:30; Weill & Ross, 2004:198).

The competitive and demanding business environment of today's world has forced players in the marketplace to be more efficient, to emphasise on a leaner organisation and continuously innovate new procedures to stay ahead of competitors (Sashikala, 2010:15). This raised questions about how to measure the investment towards information systems. Managers are increasingly searching for methods to measuring the investment in information systems, this is very important in today's competitive

business environment. There is no single method for measuring the investment towards IS, organisations have very different goals and the environments in which organisations strive are different (Simkova & Basl, 2006:424; Kurbel, 2008:89). Controlling the total cost of ownership (TCO) is important in reducing the cost of information systems. TCO refers to all costs associated with hardware and software (Chaffey & Wood, 2005:603).

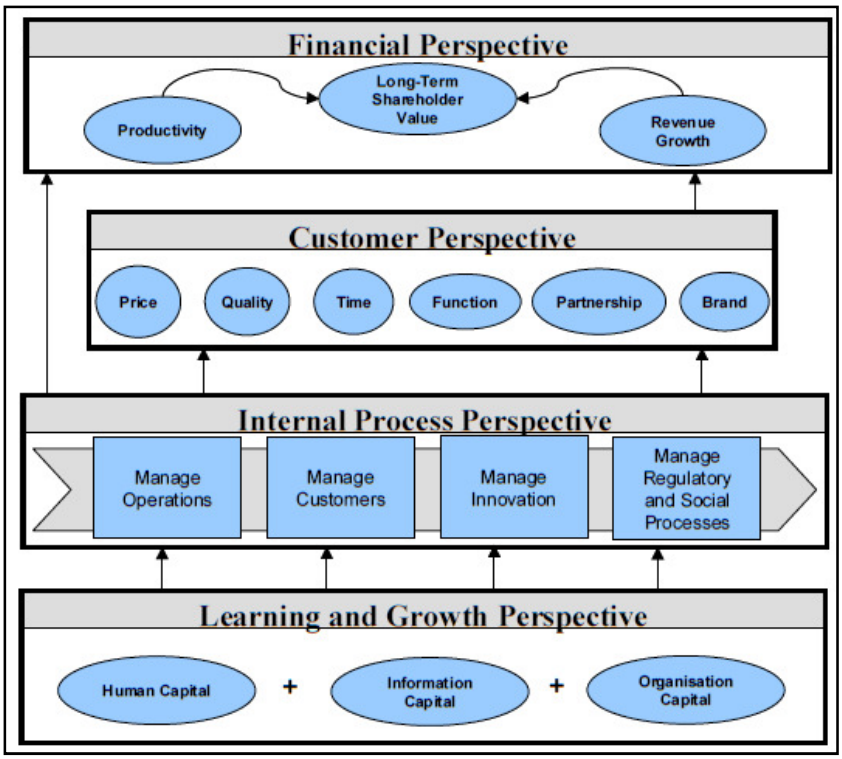
Simkova and Basil (2006:424) defined the following approaches to calculate the benefit of IS. These findings are also supported by Grant, Hackney and Edgar (2010:279):

- Comparative
    - Cost of A versus the cost of B
    - EVA of A versus the EVA of B

- Cost Benefit
    - NPV (Net Present Value) – Net value of future discounted cash flows,
    - ROI (Return on Investment) – A figure of merit used to help make capital investment decisions,
    - Breakeven – The breakeven point in economics is the point at which cost or expenses and income are equal,
    - EVA (Economic Value Added) – A way to determine the value created above the required return for the shareholders of a company,
    - TCO (Total Cost of Ownership) – A method of cost analysis.

Information system investment must be managed just like other capital investments. It is not always easy to measure the direct result of investment in information systems. The benefit of information systems must be calculated not only from a financial position but we must include alternative measures to incorporate the total benefit (Grant *et al.,* 2010:277). The Balanced Scorecard as defined by Kaplan and Norton (2004:30) in **Figure 2.5** defines an alternative measure of measuring the total return accompanying an investment in information systems.

Figure 2-5: Balanced Scorecard Strategy Map



(Source: Kaplan & Norton, 2004:31)

The Balanced Scorecard strategic map by Kaplan and Norton (2004:30) provides a framework to illustrate how strategy links intangible assets to the value creating process. It is split into four sections:

- Financial perspective – Measures the tangible outcomes of the strategy in financial terms and includes financial measures such as ROI, shareholders value, profitability, revenue growth and cost per unit (Jukic & Jukic, 2010:63).
- Customer perspective – Defines the value proposition for targeted customers, and provides the content for the intangible assets to create value. Where customers value consistent quality and timely delivery then the skills, systems and processes that produce and deliver quality products and services are highly valuable to the organisations.
- Internal process perspective – Identifies the few critical processes that are expected to have the greatest impact on the strategy.

- Learning and growth perspective – Identifies the intangible asset that are the most important to the strategy by identifying which jobs (human capital), which systems (information capital) and what kind of climate are required to support the value creating process.

Building a strategic map forces an organisation to clarify the logic of how it will create value and from whom (Kaplan & Norton, 2004:32; Laine, 2009:17). The strategic map **Figure 2.1** illustrated the balance that IT organisations must maintain to be competent at basic necessary services while devoting the capabilities to collaborate with business units (Kaplan & Norton, 2006:146). The two modules interlink offering an organisation solutions and technologies that advance their overall strategies.

There is a difference in determining information system value and evaluating information system investments (Bocij *et al.,* 2008:539; Laine, 2009:17).

- IS Value – relates closely with a productivity paradox.
- Evaluating IS investment – relates to how organisations can identify and evaluate IS investments and their associated benefits.

Bocij *et al.* (2008:539) in their analysis of the management of IS, identified objectives that provide a stimulus to organisational IS investment.

- Productivity;
- New opportunities;
- Change;
- Competitive advantage;
- Contribution to organisation;
- Increased turnover;
- Reduced risk.

With these objectives Bocij *et al.* (2008:539) identified investment drivers that will assist in determining the organisational response to IS investment opportunity.

- Organisational strategy;

- Management decisions;
- Interfacing of systems;
- Quality of service;
- Evaluating of IS by looking at both the intangible and tangible benefits;
- Business modelling to improve business processes;
- Budgets.

The objectives and investment drivers form an integrated part of an organisation's decision to invest in IS. Bocij *et al.* (2008:539) and Kaplan and Norton (2004:32) concur that the decision is not based on financial return only but must include both the intangible and tangible benefits.

2.13. MANAGING THE INFORMATION SYSTEMS PROCESS IN MAKE, BUY OR RENT

The managing of the information system process from the initial request can take on different elements in compiling the decision whether to make, buy or rent. The implementation element along with other management strategies is one of the most challenging phases.

To convert the theory/ideas into effective practices demands co-operation and synchronisation of all efforts as there are numerous factors that may prevent the successful implementation of IS (Sashikala, 2010:23). Sashikala (2010:23) presents a model and framework for practical actions needed by organisations to achieve the organisation's overall goal.

The model consists of six phases:

- Phase 1: Diagnose and conceptualise model. The organisation must, during this phase, define its need for outsourcing IS functions. Factors that have an influence on the decision to outsource must be carefully re-evaluated. Some of these factors have been identified in section 2.9.

- Phase 2: Internal commitment and team-building. The commitment and a clear understanding of the issues involved with outsourcing are critical factors for the development of the relationship process. The expertise and commitment of management are essential prerequisites for the successful implementation. It is essential to build a cross functional implementation team as outsourcing requires a coordinated effort for all parties involved. The implementation team will be responsible for the development of collaborative relationships and for managing the relationship change program. The team should also have the following characteristics:

    - Stakeholder representation;
    - Technical expertise;
    - Organisational expertise;
    - High level managers;
    - Strong leadership.

- Phase 3: Identify alternatives. In this stage, it is important to have selection criteria for the third party suppliers. The needs, as defined in the first phase, should act as the basis for defining the factors required for the relationship between the organisation and the third party supplier. This phase should also include the request for proposals from interested third party suppliers.

- Phase 4: Selecting partners. Selecting the right third party supplier is very important and it is also very important to take care that the emphasis should not be on the lowest price offered by suppliers but on the total acquisition cost. Selecting the right third party supplier is critical to the success of the IS.

- Phase 5: Supplier commitment and team-building. Once the right supplier has been identified it is important for the organisation to get the supplier to buy into a continuous relationship improvement process. It is important that both the organisation and the supplier must develop the ability of understanding the forthcoming changes and provide improvements in the supplier management process (Haried & Ramamurty, 2009:57).

- Phase 6: Implementation and continuous improvement. This phase entails that both the organisation and supplier must be committed to the overall objective. Both parties must work together to achieve mutual benefits and to achieve a competitive advantage. In order to achieve the overall goal it is important to identify critical targets and time scales in order to establish performance measures to better manage the process (Haried & Ramamurty, 2009:63). The system implementation covers a broad spectrum of activities from the detail workflow analysis to the formal go live of the new system.

For the successful implementation of IS it is important that there is a commitment from top to lower management and a wide understanding of all factors and stages of the implementation process. Selecting the right supplier is one of the most important factors that an organisation can make in an outsourcing or rent situation (World Bank, 2008:1). The organisation must recognise that the relationship between themselves and the third party supplier must be continuously measured and enhanced in order to achieve the overall goal (Kurbel, 2008:56; Haried & Ramamurty, 2009:67 & Sashikala, 2010:27).

Oversight is required to ensure that projects support strategic business objectives and resources are effectively implemented into an organisation's enterprise architecture. Factors that organisations must also consider are (Kurbel, 2008:32-44; Rahardjo, 2006:18):

- Business considerations:
    - Strategic business and technology goals and objectives;
    - Expected benefits measured against the value of current technology;
    - Potential organisational changes regarding facilities or the addition/reduction of end users, technicians, or managers;
    - Budget, scheduling, or personnel constraints.
- Functional requirements:
    - End-user functional requirements;
    - Internal control and information security requirements;

- Operating, database, and backup system requirements (type, capacity, performance);
- Connectivity requirements (Local Area Network, Wide Area Network, external);
- Network support requirements (type, volume, and frequency of data transfers);
- Interface requirements (internal or external applications)

- Project factors:

  - Project management methodology;
  - Risk management methodology;
  - Estimated completion dates of projects and major project phases;
  - Estimated costs of projects and major project phases.

- Cost/Benefit analysis:

  - Expected useful life of the proposed product;
  - Alternative solutions (buy vs. build);
  - Nonrecurring project costs (personnel, hardware, software, and overheads);
  - Tangible benefits (increased revenues, decreased costs, return-on-investments);
  - Intangible benefits (improved public opinions or more useful information).

Make/in-house/customised development of information systems (IS) incorporates some of the functions defined above. There are a number of methodologies that could be used for the process of system development: waterfall, prototyping, rapid application development, extreme programming and agile. These methodologies are all based on the systems development life cycle (SDLC) approach (Baltzan *et al.,* 2009:498-509; Kurbel, 2008:156-420).

This approach has seven different phases:

- Phase 1: Planning that involves the establishment of a high level plan of the project and also the determining factors for the project goal (critical success factors). The major activities involved in this phase are (Baltzan *et al.,* 2009:499; Kurbel, 2008:156):

- Identifying and selecting the system for development;
- Assess project feasibility;
- Developing the project plan.

- Phase 2: Analysis phase involves the analysis of end user business requirements and refining the project goals into defined functions. The major activities involved in this phase are (Baltzan *et al.,* 2009:501; Kurbel, 2008:237):
  - Compiling business requirements;
  - Compiling process flows/diagrams;
  - Perform a buy versus build analysis.

- Phase 3: Design phase builds the desired features and functions of the system. This includes the business rules, screen layouts, process diagrams and documentation. The major activities involved in this phase are (Baltzan *et al.,* 2009:504; Kurbel, 2008:278):
  - Infrastructure design;
  - System Design models.

- Phase 4: Development is physically taking the design and transforming it into a system through programming. The major activities involved in this phase are (Baltzan *et al.,* 2009:506; Kurbel, 2008:355):
  - Developing the infrastructure;
  - Developing the database;
  - Developing the fiscal programs;
  - Developing the help files.

- Phase 5: Testing phase involves putting the project section together and to perform the necessary testing, debugging of errors and verifying system requirements (does it fulfill the design?). The major activities involved in this phase are (Baltzan *et al.,* 2009:506; Kurbel, 2008:387):
  - Testing conditions;
  - System testing;
  - Design verification.

- Phase 6: Implementation phase involves deploying the system to the production/live environment. The major activities involved in this phase are (Baltzan *et al.,* 2009:507; Kurbel, 2008:445):
    - Developing user documentation (training);
    - The implementation method to be used;
    - Training of users and management.

- Phase 7: Maintenance phase includes the continuing update of the system to ensure alignment with business goals and performing corrections and upgrades to enhance the software (Baltzan *et al.,* 2009:508):
    - Creating a help desk to support the system and users;
    - Performing system maintenance;
    - Creation of environment to support system changes/enhancements.

The systems development life cycle (SDLC) is a project management technique that divides complex projects into smaller, easily managed segments or phases. Segmenting projects allows managers to verify the successful completion of project phases before allocating resources and energy to subsequent phases.

2.14. CONCLUSION

In the current service oriented economy the make-or-buy decisions are often do or buy decisions that reflect the strategic question of whether outside entities should be hired to perform significant support service activities. IT support functions such as information technology and customer service can be outsourced to provide many organisational benefits. Outsourcing support functions is not simple and organisations must manage the related strategic, quantitative, and qualitative risk factors (Raiborn *et al.,* 2009:347).

There are a host of success factors for organisations pursuing an outsourcing strategy; the top three as defined by Gottchalk and Solli-Saether (2005:690) are:

- Carefully defining IT needs and managing IT services provided by the vendor;

- Creating effective communication with and between stakeholders to secure continued support while balancing their interests and making the IT outsourcing arrangement so that all stakeholders achieve their goals; and
- Integrating and exploiting IT services from the vendor in a cost-effective way to produce competitive goods and services.

Information system investment must be managed just like other capital investments. It is not always easy to measure the direct result of investment in IS. The benefit of IS must be calculated not only from a financial position but must include alternative measures to incorporate the total benefit (Grant *et al.,* 2010:277). The Balanced Scorecard as defined by Kaplan and Norton (2004:30) in **Figure 2.5** defines an alternative measure of measuring the total return accompanying an investment in IS. The Balanced Scorecard is a multivariate approach taking an internal and external view, and suggests a balanced set of measures in four categories: customer satisfaction, learning and growth, internal business process and financial measures to achieve alignment.

Strategic information technology alignment can be defined as the linking of information systems to organisational strategy. This allows organisations the achievement of greater business success through increased efficiency, effectiveness and competitiveness.

IS business alignment is widely acknowledged as an important driver for effectively applying IS in a business context and for increasing the performance of the supported business process. The successful adoption of information systems requires that the organisation evaluates candidates to ensure that they satisfy intended goals and consider the backgrounds and capabilities of the users.

The competitive and demanding business environment of today's world has forced players in the marketplace to be more efficient, to emphasise a leaner organisation and continuously innovate new procedures to stay ahead of competitors (Sashikala, 2010:15). This raised questions about how to measure the investment towards IS. Managers are increasingly searching for methods to measure the investment in IS. This is very important in today's competitive business environment. There is no single

method for measuring the investment towards IS, organisations have very different goals and the environments in which organisations strive are different (Simkova & Basl, 2006:424; Kurbel, 2008:89). Controlling the total cost of ownership (TCO) is important in reducing the cost of information systems. TCO refers to all cost associated with hardware and software (Chaffey & Wood, 2005:603).

Building a strategic map forces an organisation to clarify the logic of how the organisation will add/create value through the investment in IS (Kaplan & Norton, 2004:32; Laine, 2009:17). It is also important to include objectives and investment drivers that form an integrated part of an organisation's decision to invest in IS. Bocij *et al.* (2008:539), and Kaplan and Norton (2004:32) concur that the decision is not based on financial return only but must include both the intangible and tangible benefits.

Therefore, there must be a selective view when selecting which option to execute. Total outsourcing is a poor strategy for most organisations because it fails to capitalise on the inherent cost advantages posed by internal IS departments for certain IS functions. Total in-sourcing is also a poor strategy because it fails to capitalise the inherent cost advantages posed by vendors for certain IS functions. Selective outsourcing which capture the advantages of both is the key.

2.15. CHAPTER SUMMARY

There is no simple or easy answer to the question of whether organisations are best served by renting, buying, or building systems. In the absence of a compelling business need, organisations should purchase or rent a tested, proven solution rather than build one from scratch. From a business perspective, the amount of time, money, and effort required to build a system will dissuade all but the most naïve or stubborn senior managers. The case for building is perhaps strongest for organisations that have a specific need with no apparent software application providing the solution on the market, at least for a reasonable cost (Simon, 2009:1).

Implementing information systems in large organisations can cost millions and is much more difficult than installing small application packages because benefits can be harder

to realise and problems are much more serious. Organisations buying packaged systems must accept the functionality that is provided by the system and rarely is there a perfect fit. If the packaged system is large in scope, its implementation could mean a substantial change in the way the organisation does business. Thus there is going to be a re-engineering of the business. Letting technology drive the business can be very dangerous (Raiborn *et al.,* 2009:355).

The key to success will be the ability to implement the right technologies to support those strategies that will provide continuous competitive advantages in the market. In order to accomplish this, decision makers must constantly be presented with analysis of the factors that impact their business. Effective analysis applied to business decisions will reduce business risks in this dynamic environment. It is sometimes wise to leave new technology to others and concentrate on the core business while keeping the eyes open for tested technologies that truly add value to the operations (Laine, 2009:1).

Organisations should carefully analyse the impact of their outsourcing decisions, especially in consideration of the extent to which organisational competencies and competitive advantage could be affected. There are many factors that should be considered prior to acquire information systems functions. Managers should consider alignment between a company's business and IT strategy; core competencies and critical success factors, feasibility studies, and a wide range of specific information system functions that can be acquired, as well as understanding of the related and implementation methodologies. The work does not end with the implementation of the systems. Indeed, monitoring and evaluating the developed system on an ongoing basis is also crucial for the success of IS (Rahardjo, 2006:21).

It is evident that benefits from the use of information systems do not arise automatically; these benefits must be actively managed and controlled. Evaluation is the mechanism by which organisations choose which information systems to invest in. The Balanced Scorecard as defined by Kaplan and Norton (2004:30) in **Figure 2.5** defines an alternative measure of measuring the total return accompanying an investment in IS. The Balanced Scorecard model is a tool enabling organisations the alignment of

measures and strategies in a dynamic manner in order to monitor and control the essential characteristics for future success of an organisation.

It is very important to retain skills and roles that an organisation must retain and keep in-house to control information systems. **Figure 2.2** (Five Roles to Retain IS) gives a picture of the integration of the roles needed within an organisation structure (Broadbent & Kitzis, 2005:181-183).

Kaplan and Norton (2006:146) define a strategic organisational map template (**Figure 2.1**) that illustrates the balance that IT organisations must maintain to be competent at basic necessary services while devoting the capabilities to collaborate with business units. This offers customised services, and solutions and technologies that advance their strategies.

To manage the risk the enterprise risk management (ERM) model is used. Risk management for each sourcing activity is viewed as part of an integrated whole rather than as a separate consideration for each organisational using the COSO (2004:1) ERM model.

The ERM approach is a three-dimensional enterprise wide, top-down means of anticipating, assessing, and addressing business risks, including those generated from outsourcing activities. The ERM approach allows managers to be more proactive in anticipating and responding to the preponderance of business threats, and allows an organisation to develop a comprehensive, future focused approach to risks engendered by different organisational strategies (Raiborn *et al.,* 2009:349). The ERM approach means that service sourcing risk can be addressed more efficiently and effectively.

The literature focuses on factors influencing the decision to make, buy or rent IS. The literature study portrays the ideal state or methodologies for acquiring information systems and the best practices used in evaluating the best option for the organisation. Throughout the literature study it was found that information systems forms part of the corporate strategy, competitive positioning and must be aligned with the overall organisational strategy.

CHAPTER 3:

RESEARCH METHODOLOGY AND FINDINGS

3.1 INTRODUCTION

The empirical research on the decision to make, buy or rent information systems in the Heavy Engineering industry in South Africa was done by means of a field study using a structured questionnaire. The questionnaire (Appendix A) was structured in such a way that the statements and conclusions within the literature study of chapter 2 were verified for validity, correctness and to see if the literature portraits the actual sentiments in practice. Questionnaires were used to determine the shortcomings between the actual processes followed during the decision to incorporate a new information system and the ideal process, as identified during the literature study with regard to the decision and implementation of an information system. The information gathered during the literature study was used for the development of the questionnaires.

The objective of this chapter was to set out the background to the design of the questionnaire, the processing of the data and the results of the field study. This chapter begins with a discussion on the literature of paradigm and methods used for research. The chapter also includes the development, the goal and selection method of the questionnaire. It also includes literature to enforce the method of empirical research as well as on the statistical review method used to analyse the data that will be presented following the questionnaire completion. The second part of this chapter is devoted to the analysis of the data gathered and the results obtained.

4.2 THE RESEARCH PROBLEM

The research problem identifies the research destination and what will be researched. The nature of the research will determine whether the research type will be:

- Exploratory: Initial research conducted to clarify and define the nature of a problem.

- Descriptive: This type of research is designed to describe the characteristics of a population or phenomenon which can be qualitative or quantitative in nature.
- Casual: This type of research is defined as a cause and effect relationship among variables when the research problem has already been narrowly identified.

The purpose of this study is to answer the research problem or question “The decision to make, buy or rent information systems in the Heavy Engineering industry in South Africa”.

The answer will be achieved through answering the following research objectives.

- Information systems configuration used in the Heavy Engineering industry (make, buy or rent).
- Factors that have an influence on the decision to make, buy or rent information systems.
- Measuring the capital benefit of investment in information systems.
- Factors that identify when to make, buy or rent information systems.

To establish the abovementioned aspects, the empirical study was aimed at managers directly involved in striving to fulfil organisational requirements for information systems, and end users of the information systems. This was done using a descriptive research method which can be measured qualitatively and/or quantitatively.

This study presents a research process where the aim and objectives were well framed and defined around the research problem and motivation, whereas, the research questions and methods were determined by the nature of the specific research question that emerged during the process.

4.2 RESEARCH PARADIGM AND METHODS

Research is a structured enquiry that utilises acceptable scientific methodology to solve problems and create new knowledge that is generally applicable. Research not only involves systematic, controlled, valid and rigorous associations but also identifies gaps

in knowledge, verifies what is already known and identifies past errors and limitations. Research is a process that involves obtaining scientific knowledge by means of various objective methods and procedures (Welman, Kruger & Mitchell, 2005:2).

The Association for Information Systems (2009:1) describes that research can be generally defined as an activity that contributes to the understanding of a phenomenon. Research design can be defined as all or part of the phenomenon that may be *created* as opposed to naturally occurring. The phenomenon is typically a set of behaviours of some entities that is found interesting by the researcher or by a group.

Literature use words such as paradigm, methodology, method, technique with different interpretations. The Association for Information Systems (2009:1) explains that a **paradigm** is a construct that specifies a general set of philosophical assumptions which include aspects such as ontology (the study that describes the nature of reality, what is real and what is not, what is fundamental and what is derivative), epistemology (the study that explores the nature of knowledge, on what does knowledge depend and how can we be certain of what we know), axiology (the study of values: what values an individual or group hold and why) and methodology (set of guidelines to assist in generating valid and reliable research results).

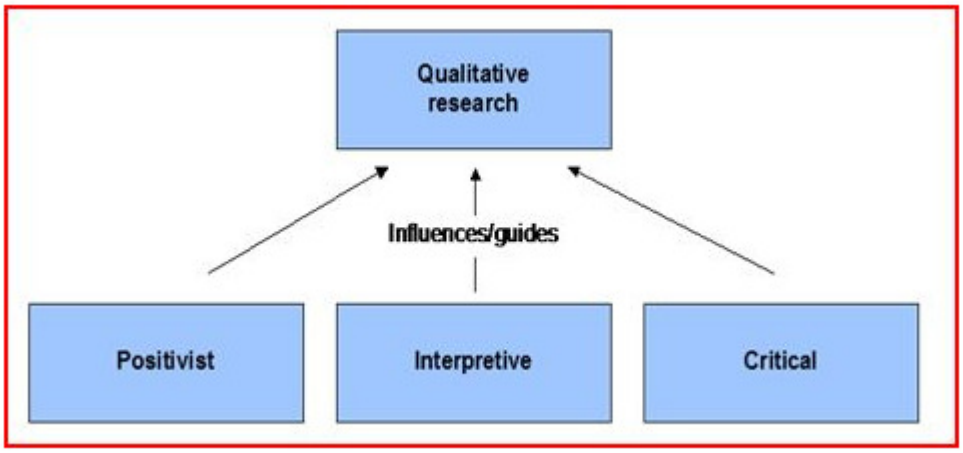
Methodology is more general and less prescriptive than a method and can be defined as a set of guidelines to assist in generating valid and reliable research results under a specific paradigm (Welman *et al.,* 2005:2). A **method** then is a set of procedures and techniques for gathering and analysing data (Welman *et al.,* 2005:2), which is usually associated with methodologies but includes a wider scope than research techniques.

Different approaches to research include **qualitative** and **quantitative** methods. Quantitative research is a form of conclusive research involving large representative samples and fairly structured data collection procedures. The quantitative approach is also known as the positivist approach which is based on a philosophical approach known as logical positivism. Qualitative research employs research methods such as

participating observations, archival source analysis, interviews, focus groups and content analysis (Welman *et al.,* 2005:6). Qualitative research can be theoretically described as an approach rather than a set of techniques that is fundamentally a descriptive form of research. The qualitative research approach is also known as the anti-positivist approach. Anti-positivists share a resistance to uphold the natural-science method as the norm in human behavioural research (Welman *et al.,* 2005:188). Qualitative research methods were developed in the social sciences to enable researchers to study social and cultural phenomena (Myers, 2009:5; Welman *et al.,* 2005:188).

Qualitative research can be positivist, interpretive, or critical (**Figure 3.1**). It follows from this that the choice of a specific qualitative research method is independent of the underlying philosophical position adopted (Digital learning Africa, 2011:1; Association for Information Systems, 2009:3).

Figure 3-1: Qualitative Research "Underlying Philosophical Assumptions"



(Source: Association for Information Systems, 2009:3)

- A positivist assumes that reality is objectively given and can be described by measurable properties which are independent of the researcher and his or her instruments. Positivist studies attempt to test theory in an attempt to increase the predictive understanding of phenomena.

- Interpretive researchers start out with the assumption that access to reality is only through social constructions such as language, consciousness and shared meanings. An interpretive study attempts to understand phenomena through the meanings that people assign to them and interpretive methods of research in information systems and are aimed at producing an understanding of the context of the information system. It also includes the process whereby the information system influences and is influenced by the context. It does not predefine dependent and independent variables but focuses on the full complexity of human sensemaking as the situation emerges.
- A critical researcher assumes that social reality is historically constituted and that it is produced and reproduced by people. People can consciously act to change their social and economic circumstances and it is therefore important to recognize that their ability to do so is constrained by various forms of social, cultural and political domination. Critical research focuses on the oppositions, conflicts and contradictions in contemporary society.

With the different philosophical perspectives which can inform qualitative research it is possible to define various qualitative research methods. A research method is a strategy of inquiry which moves from the underlying philosophical assumptions to research design and data collection. Different research methods influence the way in which the researcher collects data (Myers, 2009:5). The Association for Information Systems (2009:3), Myers (2009:5) and Welman *et al.* (2005:192-205) define four research methods:

- Action research.

  "Action research aims to contribute both to the practical concerns of people in an immediate problematic situation and to the goals of social science by joint collaboration within a mutually acceptable ethical framework".
- Case study research.

  "A case study is an empirical inquiry that investigates a contemporary phenomenon within its real-life context, especially when the boundaries between phenomenon and context are not clearly evident".

- Ethnography.

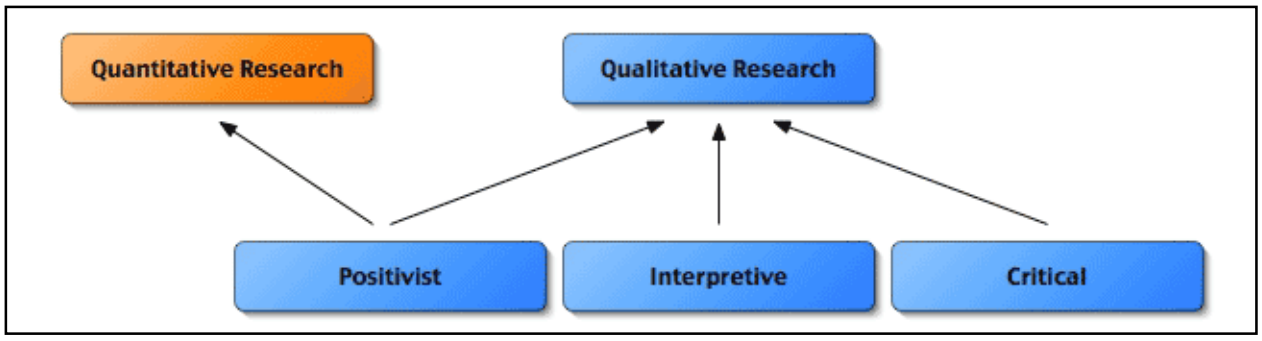
  “Ethnographic research comes from the discipline of social and cultural anthropology where an ethnographer is required to spend a significant amount of time in the field. Ethnographers immerse themselves in the lives of the people they study and seek to place the phenomena studied in their social and cultural context”.
- Grounded theory.

  “Grounded theory is a research method that seeks to develop theory that is grounded in data systematically gathered and analysed. Grounded theory suggests that there should be a continuous interplay between data collection and analysis”.

Qualitative research is not concerned with the methods and techniques to obtain appropriate data for investigating the research hypothesis; qualitative data are based on meanings expressed through words and other symbols or metaphors (Welman *et al.,* 2005:207). Each of the research methods discussed above uses one or more techniques for collecting empirical materials (data). These techniques range from interviews, observational techniques such as participant observation and fieldwork, through to archival research. Written data sources can include published and unpublished documents, company reports, memos, letters, reports, email messages, faxes, newspaper articles (The Association for Information Systems, 2009:5; Welman *et al.,* 2005:192-207).

Quantitative research is a form of conclusive research involving large representative samples and fairly structured data collection procedures. In the case of quantitative research as shown in **Figure 3.2** the interpretive and critical positions are not meaningful and only the positivist one is. The positivist epistemology relies on a host of scientific methods that produce numerical and alphanumeric data (The Association for Information Systems, 2009:5; Welman *et al.,* 2005:78).

Figure 3-2: Quantitative Research "Underlying Philosophical Assumptions"



(Source: Association for Information Systems, 2009:5)

In quantitative research the aim is to determine the relationship between one independent variable and another (a dependent or outcome variable) in a population. Quantitative research designs are either descriptive or experimental. A descriptive study establishes only associations between variables, and an experiment establishes causality. For an accurate estimate of the relationship between variables, a descriptive study usually needs a sample of hundreds or even thousands of subjects. An experiment especially a crossover may need only tens of subjects. The estimate of the relationship is less likely to be biased if you have a high participation rate in a sample selected randomly from a population (Welman *et al.,* 2005:78-79).

A quantitative approach was chosen by the author in order to be able to provide an objective base to meet the research objectives. Reasons for this decision was based on the amount of time and cost involved conducting a qualitative research study compared to a quantitative study.

The aim of this study is to better understand the dynamic interrelationships between the factors affecting the decision to make, buy or rent information systems. This has an effect on the decision across strategic tactical and operational levels. The essence of these relationships is based on the meaning that participants at different levels assign to the factors in the organisational context to comprehend the impact and interrelationships between these factors. Based on the characteristics of the different

research paradigms an interpretative approach is adopted as the most appropriate to address the aim of this study.

4.2 QUESTIONNAIRE DESIGN

Instrument or questionnaire design can be defined as the formal construction of a data collection device to obtain the information needed to solve the research problem (Welman *et al.,* 2005:174). A questionnaire is only relevant if no unnecessary information is collected and if the information needed solves the research problem. Different techniques like surveys, interviews, questionnaires and experiments are available to collect data and information. For this study the questionnaire were sent out by e-mail. During the design of the questionnaire it was decided to make use of open-ended questions as well as scaled-response questions (predominantly fixed-alternative questions which required less interviewing skills, took less time and were easier for the respondents to answer). The use of open ended questions was due to the interest in new ideas that could not be foreseen or where it was not anticipated what the likely answer would be. It is for this reason that it was chosen to make use of open ended questions in order to establish the different techniques used (Welman *et al.,* 2005:174).

The aim of the questionnaire was to determine the demographics of the sample (Section A); determine the organisational adoption of technology (Section B); determine the importance of alignment with the overall organisational strategy (Section C); get a better understanding of the existence and perceptions of what options is available to the make, buy or rent of information systems (Section D) and to determine the factors that have an influence on the decision to make, buy or rent (Section E).

A number of studies were perused in Chapter 2 on the field of information systems and all the relevant factors of the decision to make, buy or rent information systems. The questions were formulated according to the established literature study. The researcher used these studies as a guide to formulate the appropriate and relevant questions for this study.

The questionnaire designed for the study was developed by the researcher after taking all the factors into account as identified in Appendix A.

Two experts from the information management field were asked to determine the simplicity of the questionnaire and whether additional items needed to be included. They were asked to indicate whether they understood the questionnaire's instructions, the meaning of the questions, and the meaning of any words in the questionnaire.

3.5. POPULATION AND SAMPLING

The population is the study object and consists of individuals, groups, organisations, human products and events or conditions to which they are exposed. It is difficult with research to question every member of the population involved. The total population in question is termed the sampling frame and the individuals within the population are called the sampling units (Welman *et al.,* 2005:52-56). There are two different types of sampling: probability (random) and non-probability (non- random). A sample is a subset from a larger population, and this enables the researcher to estimate some of the unknown characteristics of the population.

The questionnaire was e-mailed to managers and end users within the Heavy Engineering industry.. A list of these organisations can be found attached as Appendix C.

The decision about the size of the sample can be very complex and can be influenced by the population characteristics, research objectives, time, statistical precision and judgement (Welman *et al.,* 2005:70). In order to meet the research objectives, the sample size were selected based on a required accuracy of 6 percent at a 90 percent confidence level, taking into consideration the size of the population, the variance of the variable and the units of analysis.

The sample size calculation is indicated in **Equation 3.1** and can be described as follows:

Equation 3-1: Sample Size

$$S = \frac{P(1-P)}{\frac{A^2}{Z^2} + \frac{P(1-P)}{N}}$$

Where:

S = Sample size required

N = Number of people in population (950)

P = Estimate of people who possess attribute of interest (80 percent)

A = Accuracy desired (6 percent)

Z = The number of standard deviations of the sampling distribution that correspond to the desired confidence level. A factor of 1.64 was used for a 90 percent confidence level.

The exact numbers of managers and end users within the sampling frame is not known. It is estimated that between nine hundred to a thousand users are using information systems within the Heavy Engineering industry.

From **Equation 3.1**, the calculated sample size for this population yielded a number of hundred and seven questionnaires that needed to be analysed. A total of five hundred and sixty survey questionnaires were sent out by electronic mail to various heavy engineering organisations within the industry. The response rate from the survey was 17 percent and yielded 94 returned questionnaires. The amount of returned questionnaires is close to the calculated sample size number. It can thus be concluded that the results from analysing the questionnaires is expected to have a 6 percent accuracy coupled to a 90 percent confidence interval level.

3.6. DESCRIPTIVE STATISTICS

In order to analyse the data collected from participants in the survey elements of descriptive statistics are used such as:

- Measure of an average value;
- Effect size;

- Measure of variability around this average;
- Coefficient of variance;
- Normal probability distribution;
- Confidence interval;
- Chi-squared test;
- Cronbach's alpha.

It is important to understand each of the above elements for the measuring and analysis of the data received from participants in the survey.

The measure of an average value can be defined as the mean and is the most common measure of central tendency (Levine, Stephan, Krehbiel & Berenson, 2008:97).
Mean: If we denote x as the individual numbers the items of data and n as the number of data items, then the arithmetic mean calculation becomes **Equation 3.2**:

Equation 3-2: Mean calculation

$$Mean = \frac{\sum x}{n}$$

where $\sum x$ is the sum of all the x values. The arithmetic mean is not necessarily a representative indication of an average for a set of data. There are other measures of average that can be calculated for the same set of data. One of these is the median (Levine *et al.,* 2008:99). The median is a measure of average representing the middle value of a set of data which has been ordered (ranked from lowest value through to highest). Frequently, the median will differ in value from the mean and this difference may tell us something about the variability within the data.

The measure of variability around this average can be defined as the standard deviation; this is a far more important and widely used measure of variability (Levine *et al.,* 2008:107). There are two versions of this calculation, one measures the sample standard deviation and the other measures the population standard deviation.

Effect Size: The effect size is independent of the sample size and is a measure of practical significance. It can be understood as a large enough effect to be important in

practice and is described for differences in means, for the relationship in two-way frequency tables and also for a multiple regression fit (Ellis & Steyn, 2003:51-53). The formula for calculating the effect size used in this study for the purpose of comparing the means of two groups is:

Equation 3-3: Effect Size

$$d = \frac{|(x_1 - x_2)|}{s_{max}}$$

Where $|(x_1 - x_2)|$ is the absolute difference between two means divided by the maximum estimate for standard deviation. Correlation coefficients (r) can also be view as effect sizes and will be used in this study to determine the practical significance of linear relationships/associations between variables.

Standard Deviation (population) is the square root of the sum of the squared differences around the mean divided by the sample size. The formula for calculating the standard deviation is:

Equation 3-4: Standard deviation calculation for population

$$SD = \sqrt{\frac{\sum(x - \bar{x})^2}{n}}$$

Where x refers to the individual data items, $\bar{x}$ is the mean and n the number of data items in the data set. The formula is simply the square root of the sum of the squared deviations divided by the number of items in the data set.

Standard Deviation (sample): is the square root of the sum of the squared differences around the mean divided by the sample size minus one. In the context of the sample standard deviation it is also important to note that the formula for its calculation is slightly different from that of the population standard deviation. The formula for calculating the standard deviation is:

Equation 3-5: Standard deviation calculation for sample

$$S = \sqrt{\frac{\sum(x - \bar{x})^2}{n - 1}}$$

The difference is in the divisor in the equation being n -1, not n.
The standard deviation measures the average scatter around the mean; how large values fluctuate above it and how smaller values distribute below it (Levine *et al.,* 2008:106).

Coefficient of variance: When comparing different sets of data it can be helpful to assess their comparative relative variability rather than the absolute variability measured by standard deviation. This can be done through the statistic known as the coefficient of variation. The coefficient of variation is a relative measure of variance that is always expressed as a percentage rather than in terms of units of the particular data. The coefficient of variance measures the scatter in the data relative to the mean (Levine *et al.,* 2008:110). The formula for calculating the coefficient of variance is:

Equation 3-6: Coefficient of variance

$$CV = \frac{Standard\ Deviation}{Mean} \times 100$$

Normal probability distribution: If it is taken that all possible samples from the population and for each sample calculated its mean the distribution of all these means will be normal. This distribution is known as sampling distribution. If we take random sample of size η from a population, the distribution of sample means will approach that of the normal probability distribution. This approximation will become closer the larger η (Levine *et al.,* 2008:264). The larger the sample size we use the closer approximation will become. The sampling distribution will approximate to the normal distribution as long as we take sufficiently large samples. The standard deviation of the sampling distribution is given by:

Equation 3-7: Normal probability distribution

$$\delta\bar{x} = \frac{\delta}{\sqrt{n}}$$

Where δ is the population standard deviation and η the sample size. The value of the standard deviation of all possible sample means, called the standard error of the mean, expresses how the sample means vary from sample to sample (Levine *et al.,* 2008:264).

Confidence interval: The confidence interval represents the probability that a sample mean will fall within the central part of the sampling distribution. The 95 percent confidence interval calculation is given by Levine (2008:285):

Equation 3-8: Confidence interval for the mean (δ is known)

$$95\%CI = \pm 1.96\ \frac{s}{\sqrt{n}}$$

Chi-squared test: The test we shall use in evaluating data for the pilot study is known as the x^2 test also known as Chi-squared test. This is an example of something known as a nonparametric test. The chi-squared statistics plays an important role when we obtain information by counting, rather than measuring, that is, when we want to compare two categorical variables to determine whether there exists an association among said variables. There are frequently times when we are interested not in a specific parameter of a data set, such as the mean but on the whole set of data. To perform such a test we use something known as the x^2distribution (Levine *et al.,* 2008:465):

Equation 3-9: Chi-squared test

$$x^2 = \sum \frac{(O-E)^2}{E}$$

Where O is observed frequency and E the expected frequencies. The chi-squared distribution is different from the normal distribution and has the following characteristics (Levine *et al.,* 2008:465):

- It can only take on non-negative values;
- It is not symmetrical – it is distribution that is skew to the right;

- It has a different shape depending on the size of sample; and
- The larger the sample size the more symmetric and less skew is the distribution.

As with the other tests, there is a simple decision rule. If the calculated x^2 obtained from the sample data using the above formula is greater than the critical x^2 (obtained from the table) we must reject the null hypothesis. One good thing about a x^2 test is that the null hypothesis is always the same: that there is no significant difference between the observed frequencies and the expected (Levine *et al.,* 2008:468).

Cronbach's alpha coefficient: The Cronbach's alpha test assesses how reliably survey questions are answered (Field, 2009:667-678). Cronbach's alpha is a popular method to measure reliability in quantifying the reliability of a score to summarise the information of several items in questionnaires. Cronbach's alpha estimates the consistency between items in a test, which is the internal consistency of the test. Cronbach's alpha values range between one and zero where values above 0.7 suggest higher internal consistency. A benchmark value of 0.7 is commonly used to suggest that at least some of the items measure the same construct (Field, 2009:667-678). The Cronbach's alpha value for internal consistency is given by:

Equation 3-10: Cronbach's alpha

$$a = \frac{k}{k-1}\left[1 - \frac{\sum_1^k S_i^2}{S_T^2}\right]$$

Where

a = Cronbach's alpha value

k = the number of items in analysis

S_i^2 = sample variance of the ith item

S_T^2 = sample variance of the total

3.7. DATA ANALYSIS

The data analysis was performed by the Statistical Consultation Services of the North-West University using Statistical Package for the Social Sciences Incorporated (SPSS Inc) version 18 of 2009 to analyse the collected data. The data was analysed using

descriptive statistics as well as inferring possible trends or conclusions based on relationships between certain responses on specific related questions and referring to the literature study of Chapter 2. The responses that were received were populated into an Excel Spreadsheet to make data analysis easier. The Excel Spread sheet were then used with the statistical package SPSS to analyse the data. The results of the descriptive statistical tests (Valid %, # Missing, Mean and StdDev) can be found in Appendix B.

The aim of this study is to better understand the dynamic interrelationships between the factors affecting the decision to make, buy or rent information systems in the Heavy Engineering industry in South Africa. This has an effect on the decision across strategic tactical and operational levels. The essence of these relationships is based on the meaning that participants at different levels assign to the factors in the organisational context to comprehend the impact and interrelationships between these factors.

3.7.1. Understanding the Results

Understanding the results obtained from the statistical analysis the following guidelines will be used when analysing the data. Statistical significance (p-value) has a tendency to yield small p-values as the size of data increase ($p \leq 0.05$). The sample is not random and it cannot be generalised to the larger population, that is the entire South African Heavy Engineering industry. The statistical significance will be reported on for the sake of being complete.

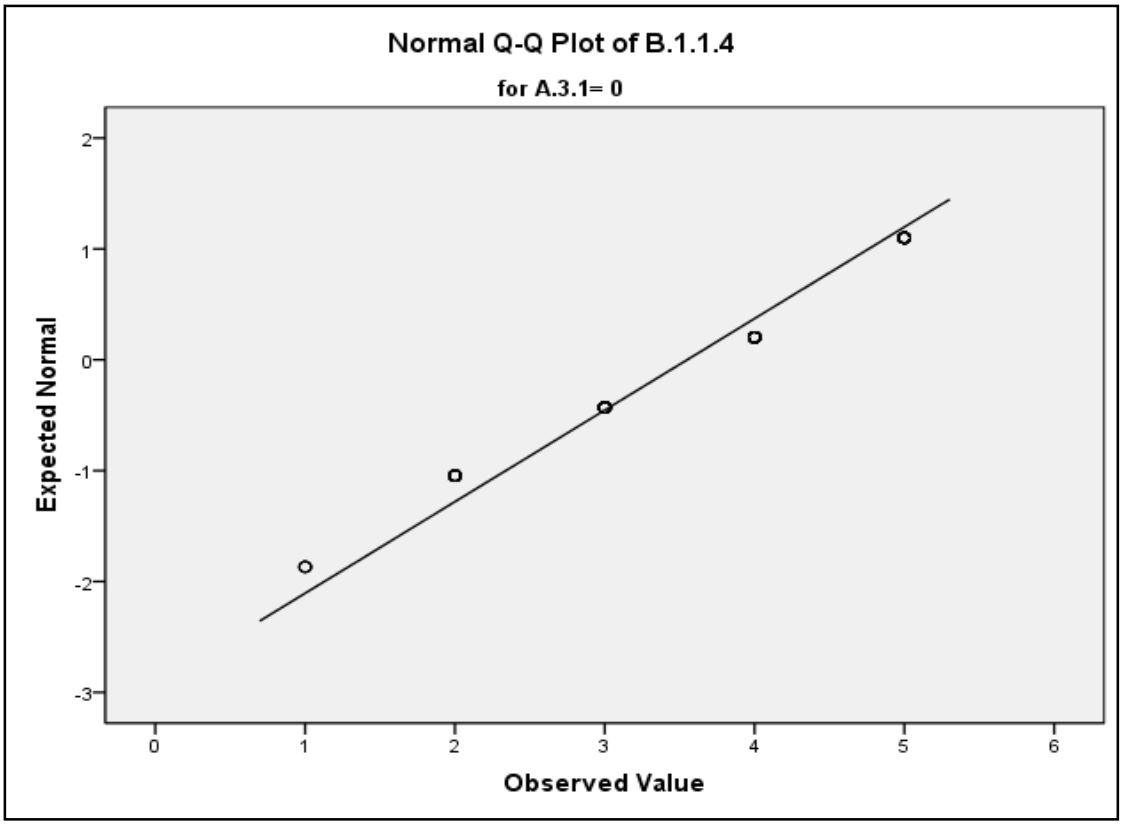
Practical significance (r / d value) is not sensitive to the sample size as the effect size is independent of the sample size. When interpreting the effect size it can be taken that when d = 0.2 it has a small effect, when d = 0.5 it has a medium effect or practical visible effect and if d = 0.8 it has a large effect (Field, 2009:667-678). When $d \geq 0.8$ it is considered as being practically significant since it is the result of a difference having a large effect. When interpreting the r (correlation coefficient) it can be generalized that when r = 0.1 it has a small effect, when r = 0.3 it has a medium effect or practically visible effect and if r = 0.5 it has a large effect (Field, 2009:667-678). When $r \geq 0.5$ it is considered as being practically significant.

Cronbach's alpha values range between one and zero where values above 0.7 suggest sufficient internal consistency to allow for dimension reduction, reduction in the number of variables used, through the formation of factor scores.

Parametric versus Non Parametric tests

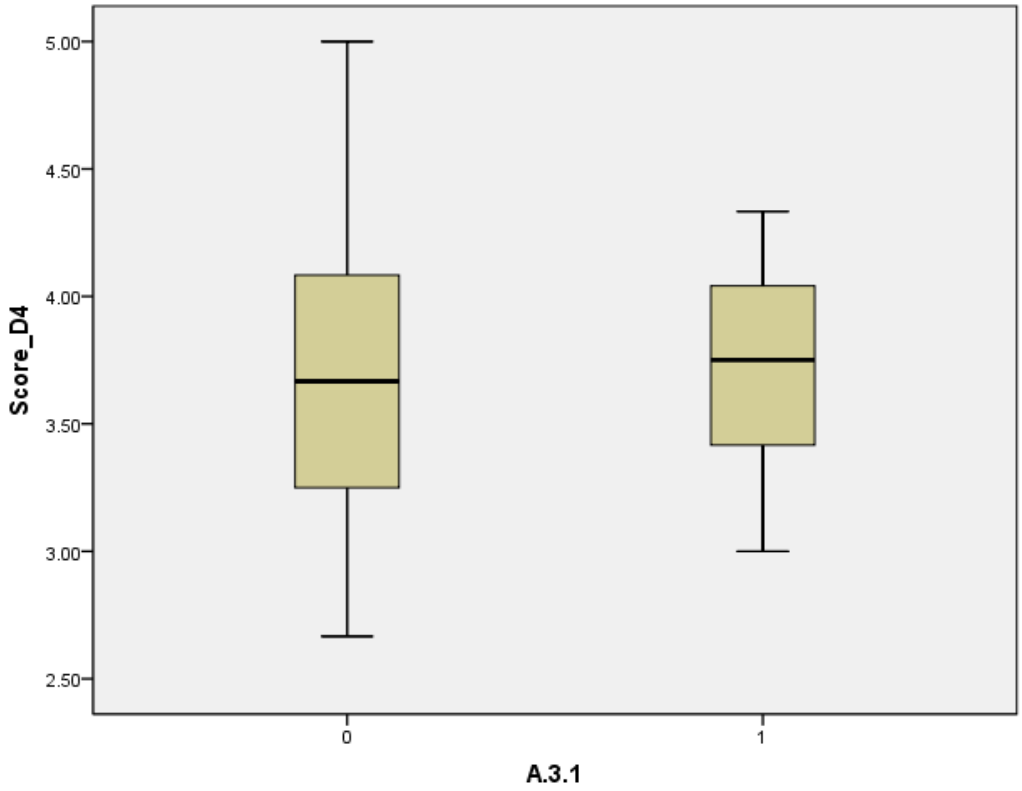
Parametric tests investigating the statistical significance of differences between group means are only valid under the assumptions of independence of observations, normality and constant variance (homoscedasticity) whereas non parametric tests are less sensitive to deviations from normality and homoscedasticity. Non parametric test protects against some violations of assumption and not others. The two sample t-test, a parametric test, requires four assumptions, interval data, normality, equal variance and independence for data. More precise information can be obtained by performing one of the tests of normality to determine the probability that the sample came from a normally distributed population of observations. We will use the Kolmogorov-Smirnov test and the Shapiro-Wilk test. However, these tests become sensitive to small deviations from normality as the sample size gets larger (p-value), as such QQ-plots were used to evaluate the severity of deviation and potentially overrule the Kolmogorov-Smirnov and Shapiro-Wilk tests. The Kolmogorov-Smirnov and Shapiro-Wilk tests rejected normality for the data collected with p-values of less than 0.05. However, the QQ-plots as shown in **Graph 3.1** show no severe deviations.

Graph 3-1: QQ plot



To test for constant variance the Levene test is used. The data collected rejects in some instances with p-values of less than 0.05 which shows that the variance is not constant. However, the test can also be overly sensitive as the sample size becomes large, as such box plots were used to assess the severity of heteroscedasticity (non-constant variances). The data collected shows relative differences in variance as shown in the Box-and-Whiskers Plot in **Graph 3.2**.

Graph 3-2: Box-and-Whiskers Plot



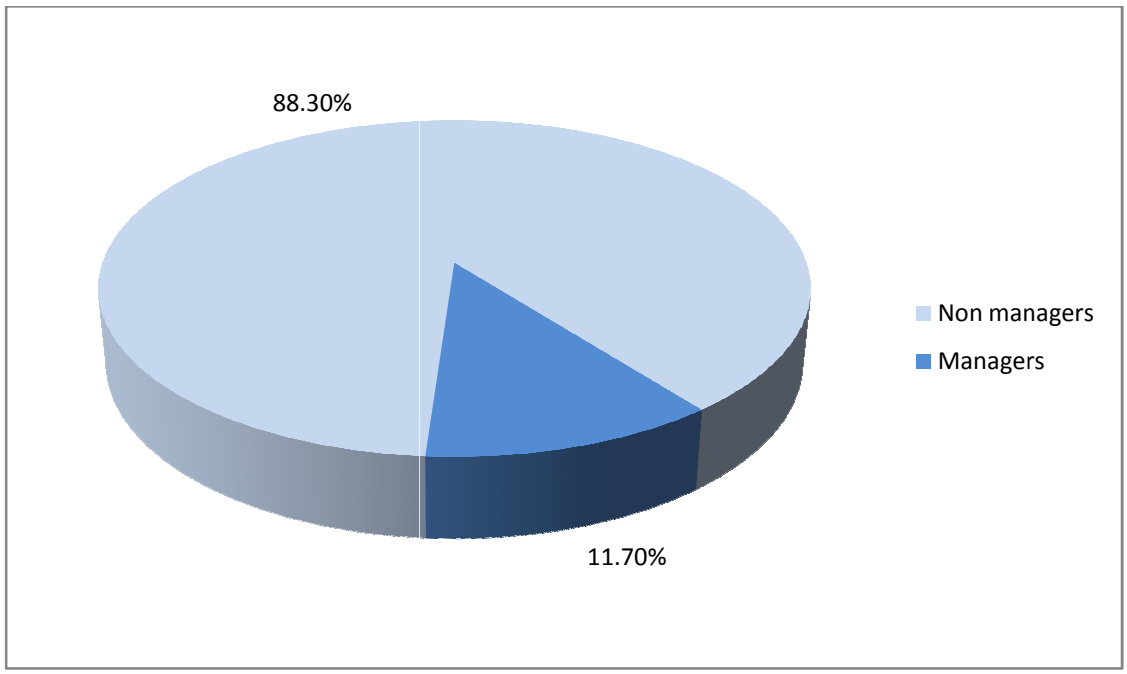
As some tests are more and less sensitive to deviations from normality and homoscedasticity, both parametric and non parametric tests were done on all data collected.

3.7.2. Biographical information of the respondents

- **Manager versus non manager distribution**

The purpose of this question A3, in Section A of the questionnaire (refer to Appendix A) was to determine the split between manager and non manager. The distribution of manager to non manager is shown in **Graph 3.3**.

Graph 3-3: Manager versus non manager distribution

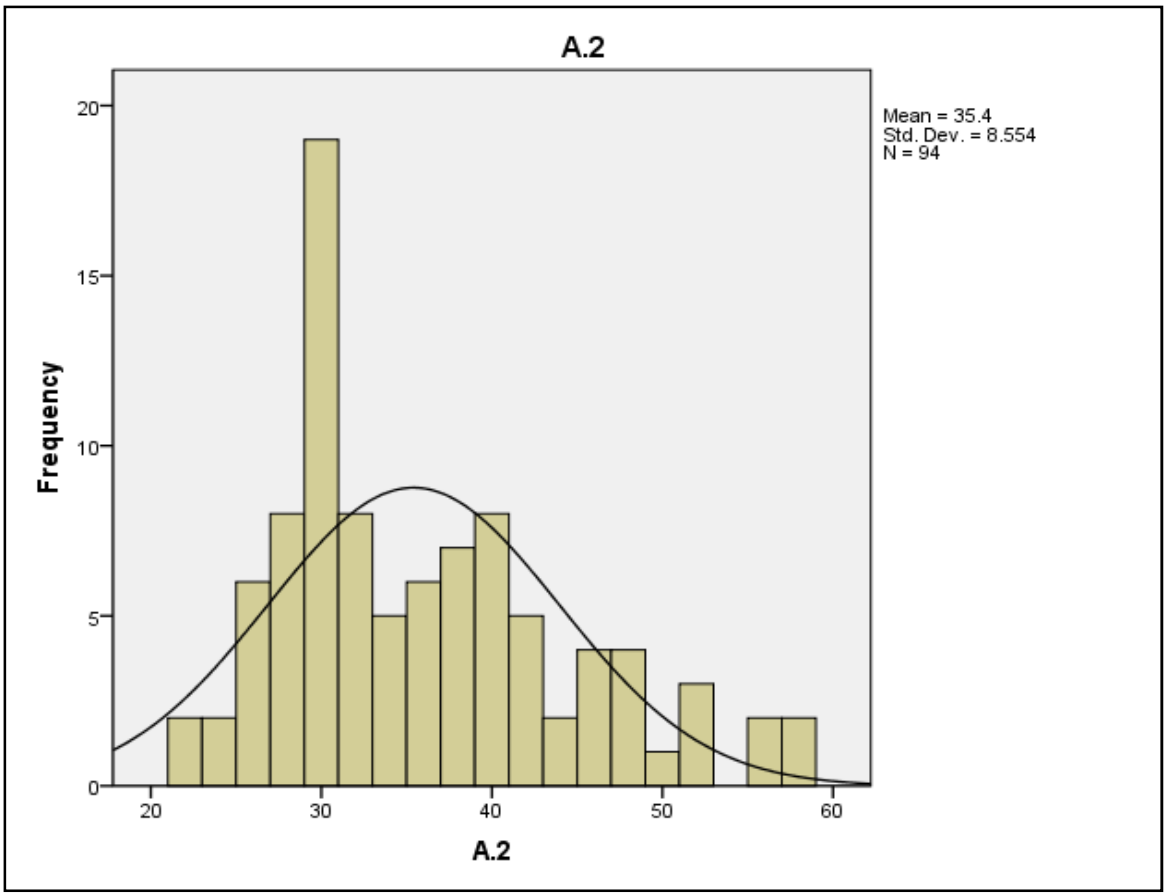


The respondents were divided into two groups namely managers and non managers; this was intentional as managers should be capable to give direct insight into the interrelationship between factors that affect the decision to make, buy or rent information systems. Managers should also have the biggest influence on the decision whether to make, buy or rent information systems. Ninety four returned questionnaires yielded that 11.7 percent were managers versus the 88.3 percent non managers. It is also important to take into account the manager versus non manager perspective of what is important in the decision to make, buy or rent. The non manager (end user) is at the end the respondent who will give feedback that will also have an influence on the technology investment of the future. The perspective of both managers and non managers were measured and a detailed discussion will follow in the dimension reduction section of this chapter.

- **Age group classification of respondents**

The purpose of this question A2, in Section A of the questionnaire (refer to Appendix A) was to determine the age group category of respondents. The age group of the respondents that responded to the survey is presented in the histogram **Graph 3.4**.

Graph 3-4: Age group of respondents

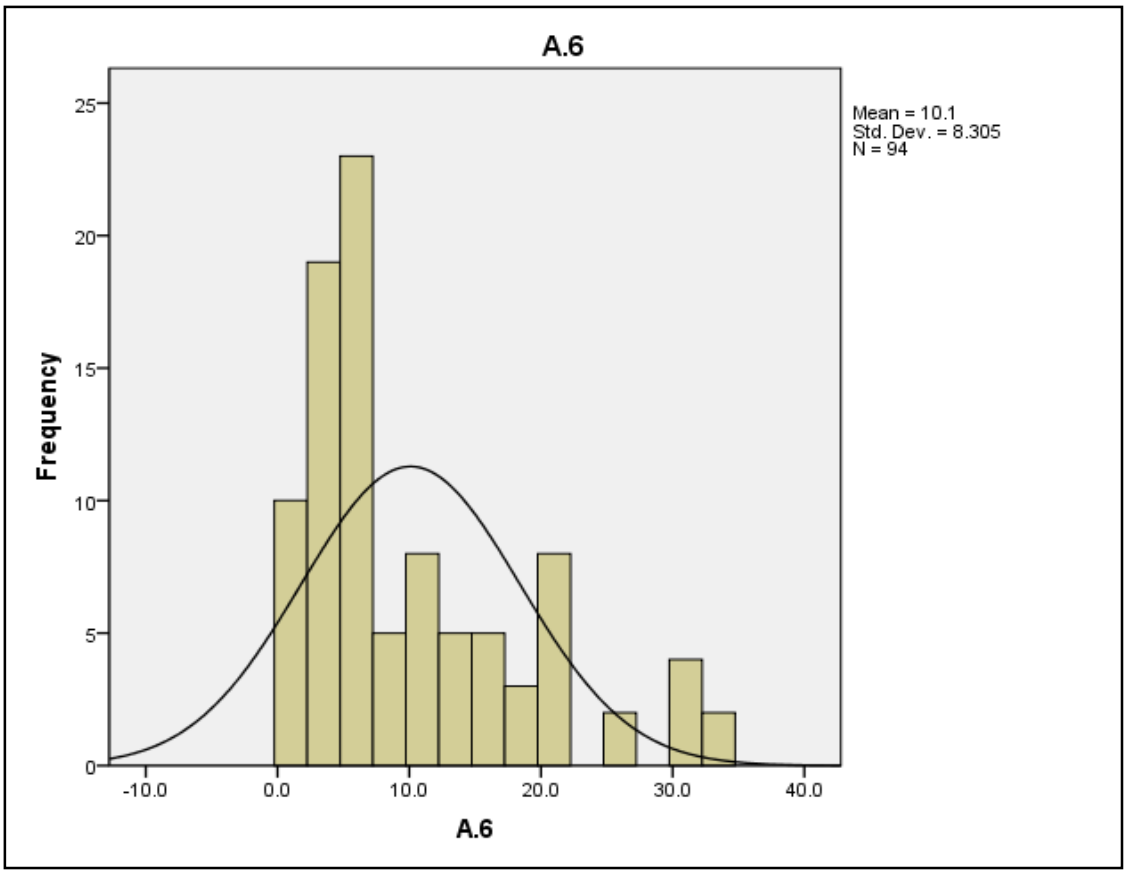


The biggest category in this age review is around the 30 year age group with the mean being 35.4 years.

- **Number of years in industry**

The purpose of this question A6, in Section A of the questionnaire (refer to Appendix A) was to determine the years in industry of the respondents. The years in industry of the respondents that responded to the survey are presented in the histogram **Graph 3.5**.

Graph 3-5: Years in Heavy Engineering industry



The biggest category in the years in industry review is presented by the 0 to 10 years category. The mean is 10.1 years in the industry.

3.7.3. Dimension reduction

Certain variables were grouped into a single variable to measure the overall attractiveness of the option to make, buy or rent information systems. This was done by the means of the mean scores and have been tested for the reliability of scale with Cronbach's alpha (α). This were applied to Section D of the questionnaire (refer to Appendix A) where we tested for the perception of what options are available to the make, buy and rent of information systems. All the questions grouped were measured on a scale of 1 (not relevant) to 5 (very relevant).

Factor 1: Benefits from purchasing software from a vendor. Question 4.1 to question 4.12 formed the basis of this grouping. Question 4.13 was excluded from this grouping as none of the respondents have completed it since the question was optional. The

mean score of this grouping is 3.644 with a Std Deviation of 0.527. The Cronbach's alpha for this grouping is 0.744 which shows that there is a high internal consistency with the grouping of questions.

Factor 2: Benefits from open source offerings. Question 5.1 to question 5.12 formed the basis of this grouping. Question 5.13 was excluded from this grouping as none of the respondents have completed it since the question was optional. The mean score of this grouping is 2.9 with Std. Deviation of 0.826. The Cronbach's alpha for this grouping is 0.899 which shows that there is a high internal consistency with the grouping of questions.

Factor 3: Benefits from SaaS (Software as a service). Question 6.1 to question 6.12 formed the basis of this grouping. Question 6.13 was excluded from this grouping as none of the respondents have completed it since the question was optional. The mean score of this grouping is 3.594 with Std. Deviation of 0.502. The Cronbach's alpha for this grouping is 0.771 which shows that there is a high internal consistency within the grouping of questions.

Factor 4: Benefits from the outsourcing of development and other IT functions. Question 7.1 to question 7.10 formed the basis of this grouping. Question 7.11 was excluded from this grouping as none of the respondents have completed it since the question was optional. The mean score of this grouping is 3.461 with Std. Deviation of 0.605. The Cronbach's alpha for this grouping is 0.814 which shows that there is a high internal consistency within the grouping of questions.

Factor 5: Benefits from developing in-house all or part of the effort. Question 8.1 to question 8.10 formed the basis of this grouping. Question 8.11 was excluded from this grouping as none of the respondents have completed it since the question was optional. The mean score of this grouping is 3.823 with Std. Deviation of 0.612. The Cronbach's alpha for this grouping is 0.768 which shows that there is a high internal consistency within the grouping of questions.

Table 3.1 shows the reliability for benefit scores summary. The table shows the number of items in each grouping, the number of respondents who responded to the grouping,

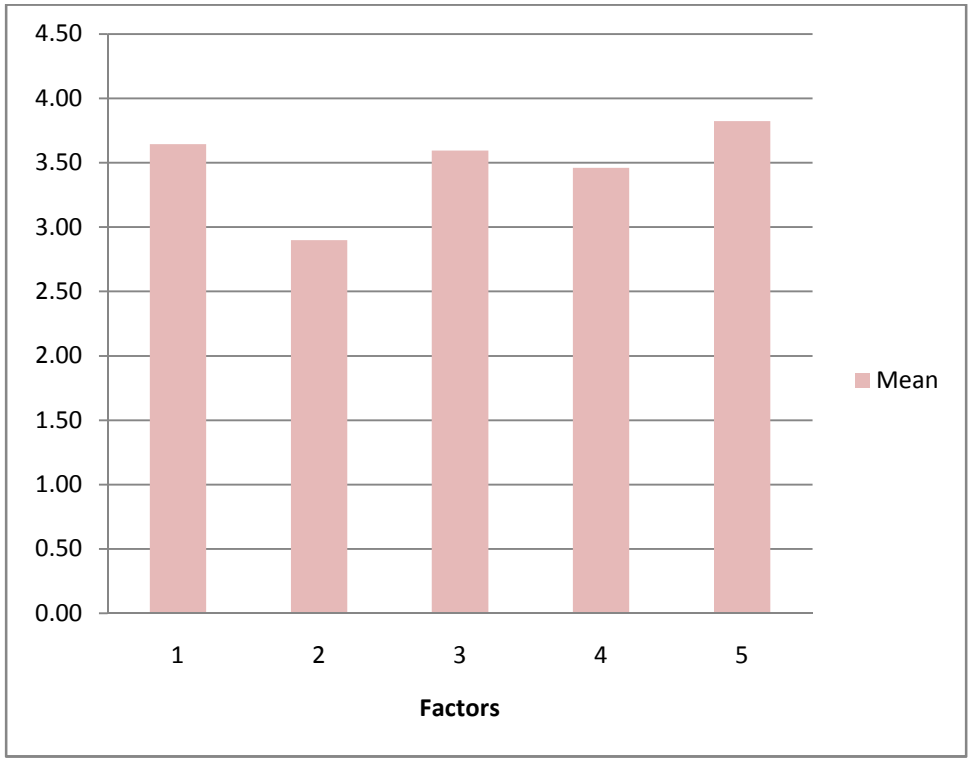
the mean scores for the grouping, the Std. Deviation and the Cronbach's alpha value calculated for each grouping.

Table 3-1: Reliability of benefit scores summary

Factor	No of Items	N		Mean	Std. Deviation	Cronbach's Alpha
		Valid	Excluded			
1	12	93	1	3.6440	0.527	0.744
2	12	91	3	2.9000	0.826	0.899
3	12	91	3	3.5940	0.502	0.771
4	10	92	2	3.4610	0.605	0.814
5	10	94	0	3.8230	0.613	0.768

Graph 3.6 shows the mean scores by grouping. Factor 2 (open source offerings) scored the lowest overall on the mean at 2.9. Factor 5 (developing in-house all or part of the effort) scored the highest on the mean at 3.82.

Graph 3-6: Mean scores of dimension reduction groupings



All the different options (make, buy or rent) have advantages and disadvantages. There is no simple or easy answer to the question of whether organisations are best served by

renting, buying, or building systems. In the absence of a compelling business need, organisations should purchase or rent a tested, proven solution rather than build one from scratch. From a business perspective, the amount of time, money, and effort required to build a system will dissuade all but the most naïve or stubborn senior managers. The case for building is perhaps strongest for organisations that have a specific need with no apparent software application providing the solution on the market, at least for a reasonable cost (Simon, 2009:1).

3.7.4. Data correlation

The Spearman's rho correlation method was used to verify if there are correlations between different questions and factors, and also if these were practically significant.

The following analysis were obtained from the data analysis in Section D and Section E of the questionnaire (refer to Appendix A). The researcher would like to inform the reader that question D.9.1 to D.11.11 were excluded from the analysis as there were no responses received from the respondents as these were optional questions. These questions were optional and only to be completed where the respondent in their option could add any additional configurations of types of information systems used.

- **Purchase software**

The correlation between question D.1.1 (purchased software to be considered as an option) and question E1.13 (The relevance of documentation and training) was statistically significant, though the result cannot be generalised, as well as practically visible (r = 0.303, p = 0.003). Respondents who felt strongly about considering to purchase software as an IS solution also felt that documentation and training is relevant. Purchase software usually included training manuals and documentation. Training courses are also available for most purchased software packages.

The correlation between question D.1.1 (purchased software to be considered as an option) and question E1.15 (The relevance of size of organisation) was significant (r = -0.372, p = 0.000). Respondents who felt that it is relevant to consider purchasing

software as an IS solution did not necessarily feel that the size of the organisation is taken into account when the decision is made to buy/make/rent IS.

The correlation between question D.1.1 (purchased software to be considered as an option) and question E1.16 (The relevance of number of expected annual transactions) was significant (r = -0.279, p = 0.007). Respondents who felt that the number of expected transactions is taken into account when the decision is made to buy/make/rent IS did not always feel that purchasing from a vendor is a relevant consideration.

The correlation between question D.1.1 (purchased software to be considered as an option) and question E1.18 (The relevance of business functionality) was significant (r = 0.333, p = 0.001). Respondents who felt strongly about considering to purchase software as an IS solution also felt that business functionality is relevant. Business functionality would be perceived to be an important consideration when purchasing software.

- **Open source offerings**

The correlation between question D.1.2 (open source systems) and question E1.2 (The relevance of security) was small but still significant (r = -0.271, p = 0.008). Respondents who felt that security is taken into account when the decision is made to buy/make/rent IS did not always feel that open source systems are a relevant consideration. Open source systems do not always include all the security requirements from an organisation.

The correlation between question D.1.2 (open source systems) and question E1.6 (The relevance of cost) was significant (r = -0.375, p = 0.000). Respondents who felt that cost is taken into account when the decision is made to buy/make/rent IS did not always feel that open source systems are a relevant consideration. Costs found with open source system are usually lower in comparison with other offerings.

The correlation between question D.1.2 (open source systems) and question E1.7 (The relevance of time) was significant (r = -0.339, p = 0.001). Respondents who felt that time is taken into account when the decision is made to buy/make/rent IS did not always

feel that open source systems are a relevant consideration. Open source systems are available and there are lower/less waiting times.

- **Software as a service offerings (SaaS)**

The correlation between question D.1.3 (software as a service) and question E1.1 (The relevance of competitive advantage) was small but still significant ($r = 0.298$, $p = 0.003$). Respondents who felt strongly about considering software as a service as an IS solution also felt that competitive advantage is relevant. As the percentage of SaaS increases so too would the competitive advantage of the offering.

The correlation between question D.1.3 (software as a service) and question E1.4 (The relevance of expertise) was small but still significant ($r = 0.294$, $p = 0.004$). Respondents who felt strongly about considering software as a service as a IS solution also felt that expertise is relevant. Expert support grows as the offerings from SaaS increase.

The correlation between question D.1.3 (software as a service) and question E1.11 (The relevance of system performance) was small but still significant ($r = 0.277$, $p = 0.007$). Respondents who felt strongly about considering software as a service as an IS solution also felt that system performance is relevant. System performance becomes increasingly relevant as the ideal % of software as a service increases.

The correlation between question D.1.3 (software as a service) and question E1.11 (The relevance of software control) was significant ($r = 0.327$, $p = 0.001$). Respondents who felt strongly about considering software as a service as an IS solution also felt that software control is relevant. Software control from the organisations plays an important role in SaaS, the licence, maintenance agreements and ownership of such a system.

The correlation between question D.1.3 (software as a service) and question E1.18 (The relevance of business functionality) was significant ($r = 0.38$, $p = 0.000$). Respondents who felt strongly about considering software as a service as an IS solution also felt that business functionality is relevant.

- **Outsourced all or part of the effort**

The correlation between question D.1.4 (outsourced all or part of the effort) and question E1.6 (The relevance of cost) was small but still significant (r = -0.279, p = 0.007). Respondents who felt that cost is taken into account when the decision is made to buy/make/rent IS did not always feel that outsourcing all or part of the effort is a relevant consideration. Cost can be a huge factor when deciding to outsource, there can be savings as well as unexpected (hidden) cost.

The correlation between question D.1.4 (outsourced all or part of the effort) and question E1.8 (The relevance of implementation of the system) was significant (r = -0.313, p = 0.002). Respondents who felt that implementation of the system is taken into account when the decision is made to buy/make/rent IS did not always feel that outsourcing all or part of the effort is a relevant consideration. Implementing a system and or development that have been outsourced can have an unexpected outcome on an organisation's performance, availability and resources.

The correlation between question D.1.4 (outsourced all or part of the effort) and question E1.12 (The relevance of quality) was small but significant (r = -0.278, p = 0.007). Respondents who felt that quality is taken into account when the decision is made to buy/make/rent IS did not always feel that outsourcing all or part of the effort is a relevant consideration. Quality is always an expected prerequisite when outsourcing is considered.

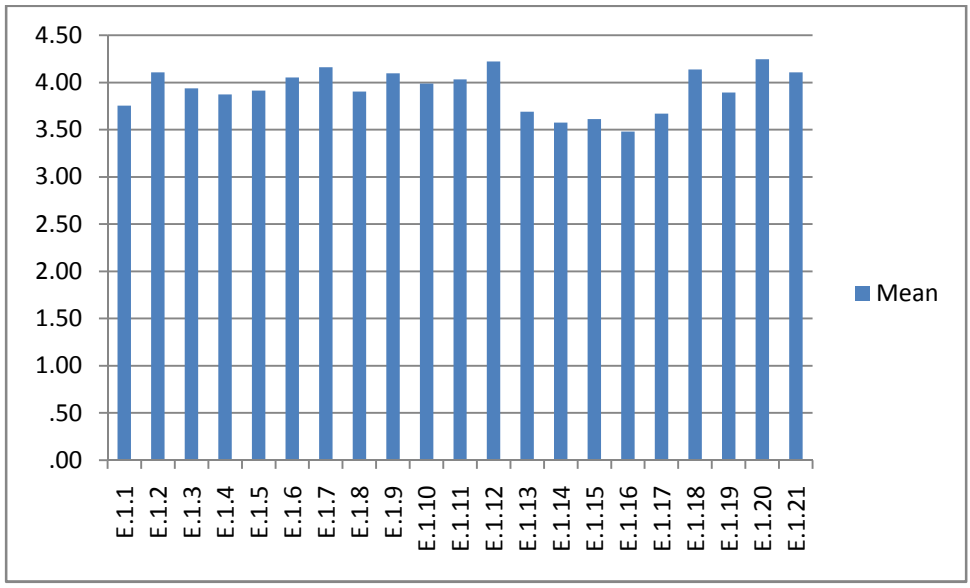
The correlation between question D.1.4 (outsourced all or part of the effort) and question E1.21 (The relevance of increased turnover) was significant (r = -0.347, p = 0.001). Respondents who felt that increased turnover is taken into account when the decision is made to buy/make/rent IS did not always feel that outsourcing all or part of the effort is a relevant consideration. It can be perceived that outsourcing all or part of the effort will not result in an increase of turnover.

A correlation coefficient would not be significant unless its p value is less than the corrected significance level. There is strong evidence of correlation and practical significance of medium to large relevance between the factors that have an influence on

the decision to make, buy or rent information systems within the heavy engineering environment in South Africa.

The correlation of data between Section D and Section E of the questionnaire (refer to Appendix A) confirms the literature study outcome in chapter two. The criteria as defined by SDU (2010:8) and Simon (2009:1) were used as a basis to set up the questions for Section D and Section E of the questionnaire. **Graph 3.7** shows the results obtained on the mean values from all the respondents. Since a score of 5 implies that the consideration is very relevant, it is evident that all the factors play a role when choosing which option to consider when seeking fulfilling of an organisation's need for an information system.

Graph 3-7: Mean values for decision factors on make, buy or rent



From the correlation of data between from Section D and Section E of the questionnaire (refer to Appendix A) with **Graph 3.7** it can be perceived that all these factors must be considered when seeking to fulfil the organisation's need for information systems. Further analysis will be done with dimension reduction and data correlation.

3.7.5. Dimension reduction and Data correlation

The same dimension reduction groups or factors were used as defined in section 3.7.3. The factors as defined in section 3.7.3 that were applied to Section D of the questionnaire (Refer to Appendix A):

- Factor 1: Benefits from purchasing software from a vendor;
- Factor 2: Benefits from open source offerings;
- Factor 3: Benefits from SaaS (Software as a service);
- Factor 4: Benefits from the outsourcing of development and other IT functions;
- Factor 5: Benefits from developing in-house all or part of the effort.

The Spearman's rho correlation method was used to verify if there are correlations between different questions and the factors (refer to section 3.7.1), and also if these were practically significant.

The following analysis was obtained from the data analysis in the factors section 3.7.3 and Section E of the questionnaire question E.1.1 to question E.1.21 (refer to Appendix A). Appendix G shows a summary of correlations between different questions and factors, and significance value.

- **Factor 1: Benefits from purchasing software from a vendor**

The correlation between Factor 1 (Benefits from purchasing software from a vendor) and question E.1.8 (The relevance of implementation of the system) was statistically significant, as well as practically significant ($r = 0.505$, $p = 0.000$). Respondents who felt strongly about considering to purchase software as an IS solution also felt that implementation of the system is relevant.

The correlation between Factor 1 (Benefits from purchasing software from a vendor) and question E.1.9 (The relevance of support to the system) was statistically significant, though the result cannot be generalised, as well as practically visible ($r = 0.448$, $p = 0.000$). Respondents who felt strongly about considering to purchase software as a IS solution also felt that support to the system is relevant.

The correlation between Factor 1 (Benefits from purchasing software from a vendor) and question E.1.13 (The relevance of documentation and training) was statistically significant, though the result cannot be generalised, as well as practically visible (r = 0.374, p = 0.000). Respondents who felt strongly about considering to purchase software as an IS solution also felt that documentation and training is relevant.

The correlation between Factor 1 (Benefits from purchasing software from a vendor) and question E.1.18 (The relevance of business functionality) was statistically significant, though the result cannot be generalised, as well as practically visible (r = 0.367, p = 0.000). Respondents who felt strongly about considering to purchase software as an IS solution also felt that business functionality is relevant.

The correlation between Factor 1 (Benefits from purchasing software from a vendor) and question E.1.11 (The relevance of system performance) was statistically significant, though the result cannot be generalised, as well as practically visible (r = 0.351, p = 0.001). Respondents who felt strongly about considering to purchase software as an IS solution also felt that system performance is relevant.

The correlation between Factor 1 (Benefits from purchasing software from a vendor) and question E.1.1 (The relevance of competitive advantage) was statistically significant, though the result cannot be generalised, as well as practically visible (r = 0.342, p = 0.001). Respondents who felt strongly about considering to purchase software as an IS solution also felt that competitive advantage is relevant.

The correlation between Factor 1 (Benefits from purchasing software from a vendor) and question E.1.21 (The relevance of increased turnover) was statistically significant, though the result cannot be generalised, as well as practically visible (r = 0.339, p = 0.001). Respondents who felt strongly about considering to purchase software as an IS solution also felt that increased turnover is relevant.

The correlation between Factor 1 (Benefits from purchasing software from a vendor) and question E.1.15 (The relevance of available resources) was small but still significant (r = -0.293, p = 0.008). Respondents who felt that when the decision is made to

purchase software as an IS solution did not always feel that available resources is a relevant consideration.

- **Factor 2: Benefits from open source offerings**

The correlation between Factor 2 (Benefits from open source offerings) and question E.1.16 (The relevance of the number of expected annual transactions) was statistically significant, though the result cannot be generalised, as well as practically visible (r = 0.373, p = 0.000). Respondents who felt strongly about considering open source offerings as an IS solution also felt that the number of expected annual transactions is relevant.

The correlation between Factor 2 (Benefits from open source offerings) and question E.1.15 (The relevance of the size of the organisation) was statistically significant, though the result cannot be generalised, as well as practically visible (r = 0.319, p = 0.000). Respondents who felt strongly about considering open source offerings as an IS solution also felt that the size of the organisation is relevant.

The correlation between Factor 2 (Benefits from open source offerings) and question E.1.18 (The relevance of business functionality) was statistically significant (r = -0.332, p = 0.001). Respondents who felt that when the decision is made to use open source offerings as an IS solution did not always feel that business functionality are a relevant consideration.

The correlation between Factor 2 (Benefits from open source offerings) and question E.1.13 (The relevance of documentation and training) was small but still significant (r = -0.264, p = 0.022). Respondents who felt that when the decision is made to use open source offerings as an IS solution did not always feel that documentation and training are a relevant consideration.

The correlation between Factor 2 (Benefits from open source offerings) and question E.1.19 (The relevance of technical functionality) was small but still significant (r = -0.254, p = 0.014). Respondents who felt that when the decision is made to use open

source offerings as an IS solution did not always feel that technical functionality are a relevant consideration.

The correlation between Factor 2 (Benefits from open source offerings) and question E.1.21 (The relevance of increased turnover) was small but still significant (r = -0.248, p = 0.017). Respondents who felt that when the decision is made to use open source offerings as an IS solution did not always feel that increased turnover are a relevant consideration.

The correlation between Factor 2 (Benefits from open source offerings) and question E.1.14 (The relevance of vendor issues) was small but still significant (r = -0.247, p = 0.017). Respondents who felt that when the decision is made to use open source offerings as an IS solution did not always feel that vendor issues are a relevant consideration.

- **Factor 3: Benefits from SaaS (Software as a service)**

The correlation between Factor 3 (Benefits from SaaS) and question E.1.1 (The relevance of competitive advantage) was small but still significant (r = 0.282, p = 0.006). Respondents who felt strongly about considering SaaS as an IS solution also felt that competitive advantage is relevant.

The correlation between Factor 3 (Benefits from SaaS) and question E.1.18 (The relevance of business functionality) was small but still significant (r = 0.252, p = 0.015). Respondents who felt strongly about considering SaaS as an IS solution also felt that business functionality is relevant.

The correlation between Factor 3 (Benefits from SaaS) and question E.1.4 (The relevance of expertise) was small but still significant (r = 0.247, p = 0.018). Respondents who felt strongly about considering SaaS as an IS solution also felt that expertise is relevant.

The correlation between Factor 3 (Benefits from SaaS) and question E.1.11 (The relevance of system performance) was small but still significant (r = 0.220, p = 0.035).

Respondents who felt strongly about considering SaaS as an IS solution also felt that system performance is relevant.

- **Factor 4: Benefits from the outsourcing of development and other IT functions**

The correlation between Factor 4 (Benefits from outsourcing of development and other IT functions) and question E.1.1 (The relevance of competitive advantage) was statistically significant, though the result cannot be generalised, as well as practically visible (r = 0.366, p = 0.000). Respondents who felt strongly about considering outsourcing of development and other IT functions as an IS solution also felt that competitive advantage is relevant.

The correlation between Factor 4 (Benefits from outsourcing of development and other IT functions) and question E.1.9 (The relevance of support to the system) was statistically significant, though the result cannot be generalised, as well as practically visible (r = 0.365, p = 0.000). Respondents who felt strongly about considering outsourcing of development and other IT functions as an IS solution also felt that support to the system is relevant.

The correlation between Factor 4 (Benefits from outsourcing of development and other IT functions) and question E.1.18 (The relevance of business functionality) was statistically significant, though the result cannot be generalised, as well as practically visible (r = 0.344, p = 0.001). Respondents who felt strongly about considering outsourcing of development and other IT functions as an IS solution also felt that business functionality is relevant.

The correlation between Factor 4 (Benefits from outsourcing of development and other IT functions) and question E.1.13 (The relevance of documentation and training) was statistically significant, though the result cannot be generalised, as well as practically visible (r = 0.305, p = 0.003). Respondents who felt strongly about considering outsourcing of development and other IT functions as an IS solution also felt that of documentation and training is relevant.

The correlation between Factor 4 (Benefits from outsourcing of development and other IT functions) and question E.1.19 (The relevance of support to the system) was small but still significant (r = 0.291, p = 0.005). Respondents who felt strongly about considering outsourcing of development and other IT functions as an IS solution also felt that support to the system is relevant.

The correlation between Factor 4 (Benefits from outsourcing of development and other IT functions) and question E.1.8 (The relevance of the implementation of the system) was small but still significant (r = 0.282, p = 0.006). Respondents who felt strongly about considering outsourcing of development and other IT functions as an IS solution also felt that the implementation of the system is relevant.

The correlation between Factor 4 (Benefits from outsourcing of development and other IT functions) and question E.1.5 (The relevance of available resources) was small but still significant (r = 0.277, p = 0.007). Respondents who felt strongly about considering outsourcing of development and other IT functions as an IS solution also felt that available resources is relevant.

The correlation between Factor 4 (Benefits from outsourcing of development and other IT functions) and question E.1.2 (The relevance of security) was small but still significant (r = 0.276, p = 0.008). Respondents who felt strongly about considering outsourcing of development and other IT functions as an IS solution also felt that security is relevant.

- **Factor 5: Benefits from developing in-house all or part of the effort**

The correlation between Factor 5 (Benefits from developing in-house all or part of the effort) and question E.1.11 (The relevance of system performance) was statistically significant, as well as practically significant (r = 0.541, p = 0.000). Respondents who felt strongly about considering developing in-house all or part of the effort as an IS solution also felt that system performance is relevant.

The correlation between Factor 5 (Benefits from developing in-house all or part of the effort) and question E.1.8 (The relevance of implementation of the system) was

statistically significant, as well as practically significant (r = 0.518, p = 0.000). Respondents who felt strongly about considering developing in-house all or part of the effort as an IS solution also felt that implementation of the system is relevant.

The correlation between Factor 5 (Benefits from developing in-house all or part of the effort) and question E.1.18 (The relevance of business functionality) was statistically significant, as well as practically significant (r = 0.515, p = 0.000). Respondents who felt strongly about considering developing in-house all or part of the effort as an IS solution also felt that business functionality is relevant.

The correlation between Factor 5 (Benefits from developing in-house all or part of the effort) and question E.1.9 (The relevance of support to system) was statistically significant, though the result cannot be generalised, as well as practically visible (r = 0.473, p = 0.000). Respondents who felt strongly about considering developing in-house all or part of the effort as an IS solution also felt that support to system is relevant.

The correlation between Factor 5 (Benefits from developing in-house all or part of the effort) and question E.1.13 (The relevance of documentation and training) was statistically significant, though the result cannot be generalised, as well as practically visible (r = 0.471, p = 0.000). Respondents who felt strongly about considering developing in-house all or part of the effort as an IS solution also felt that documentation and training is relevant.

The correlation between Factor 5 (Benefits from developing in-house all or part of the effort) and question E.1.1 (The relevance of competitive advantage) was statistically significant, though the result cannot be generalised, as well as practically visible (r = 0.394, p = 0.000). Respondents who felt strongly about considering developing in-house all or part of the effort as an IS solution also felt that competitive advantage is relevant.

The correlation between Factor 5 (Benefits from developing in-house all or part of the effort) and question E.1.12 (The relevance of quality) was statistically significant, though the result cannot be generalised, as well as practically visible (r = 0.391, p = 0.000). Respondents who felt strongly about considering developing in-house all or part of the effort as an IS solution also felt that quality is relevant.

The correlation between Factor 5 (Benefits from developing in-house all or part of the effort) and question E.1.5 (The relevance of available resources) was statistically significant, though the result cannot be generalised, as well as practically visible (r = 0.388, p = 0.000). Respondents who felt strongly about considering developing in-house all or part of the effort as an IS solution also felt that available resources is relevant.

The correlation of data between the dimension groupings (section 3.7.3) and Section E of the questionnaire (refer to Appendix A) confirms the literature study done in chapter two. The criteria as defined by SDU (2010:8) and Simon (2009:1) were used as a basis to setup the questions for Section D and Section E of the questionnaire. A correlation coefficient would not be significant unless its p value is less than the corrected significance level. There is strong evidence of correlation and practical significance of medium to large relevance between the factors that have an influence on the decision to make, buy or rent information systems.

From the correlation of data between the dimension groupings (refer to section 3.7.3) and question E.1.1 to question E.1.21 from Section E of the questionnaire (refer to Appendix A) it can be perceived what factors have the biggest influence on the decision to make, buy or rent in the Heavy Engineering industry in South Africa. **Table 3-2** (Dimension Groups and Correlation Matrix) shows a summarised grid of the finding in this section.

Table 3-2: Dimension Groups and Correlation Matrix

	E.1.1	E.1.2	E.1.3	E.1.4	E.1.5	E.1.6	E.1.7	E.1.8	E.1.9	E.1.10	E.1.11	E.1.12	E.1.13	E.1.14	E.1.15	E.1.16	E.1.17	E.1.18	E.1.19	E.1.20	E.1.21
	Competitive Advantage	Security	Skills	Expertise	Available resources	Cost	Time	Implementation of system	Support to system are available	Maintenance and upgrades	System performance	Quality	Documentation and training	Vendor issues (contract length and or supplier relationship)	The size of the organisation	Number of expected annual transactions by your organisation	Software control	Business functionality	Technical functionality	Productivity improvements	Increased Turnover
Factor 1	X				X			X	X		X		X					X			X
Factor 2															X	X					
Factor 3	X			X							X							X			
Factor 4	X	X	X		X			X	X		X		X					X	X		
Factor 5	X	X	X	X	X		X	X	X	X	X	X	X					X	X	X	X

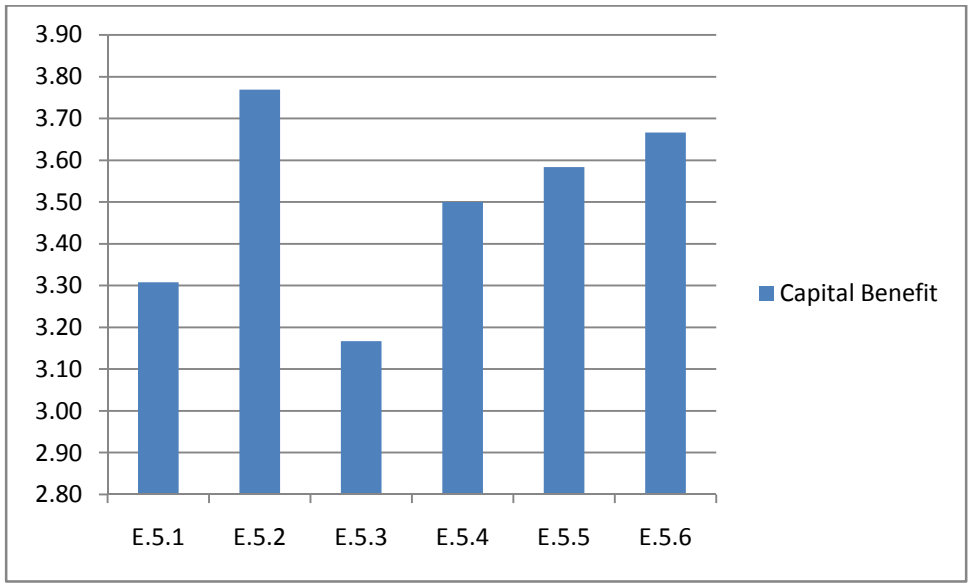
Table 3.2 shows the individual factors that have an influence on the discussion to make, buy or rent information systems. These factors alone can only assist in the discussion to make, buy or rent information systems. Defining the factors that influence the decision to make, buy or rent information systems should also include capital benefits calculations.

Capital benefit of new or enhanced information system

The competitive and demanding business environment of today's world has forced players in the marketplace to be more efficient, to emphasise a leaner organisation and continuously innovate new procedures to stay ahead of competitors (Sashikala, 2010:15). This raised questions about how to measure the investment towards information systems. Managers are increasingly searching for methods to measuring the investment in information systems. The following analysis were obtained from the

data analysis in Section E of the questionnaire (refer to Appendix A); Questions E.5.1 to questions E.5.6. **Graph 3.8** shows the detail for question E.5.1 to question E.5.6 by manager on the mean scores, where a score of 5 indicates that the consideration is very relevant. Questions asked vary from NPV (Net Present value), ROI (Return on Investment), Breakeven, EVA (Economic value added), TCO (Total cost of ownership) and Balanced Scorecard as an approach to calculate the capital benefit of new and or enhanced information systems to their organisation.

Graph 3-8: Capital benefit of new and enhanced information system



Graph 3.8 shows the mean scores by grouping compiled from Appendix B. Breakeven question E.5.3 scored the lowest overall on the mean at 3.17. ROI (Return on Investment) question E.5.2 scored the highest on the mean at 3.77. Since a score of 5 implies that the consideration is very relevant, it can be perceived from the respondents that any of the approaches can be used to measure the investment towards information systems in the heavy engineering environment in South Africa.

3.7.6. Group means

Differences between the means of groups of data were analysed using an independent t-test and confirmed using the Mann-Whitney non parametric test. The following

comparisons were performed: Manager vs. Non Manager, Market Leader vs. Market Follower and Sequential IS integration vs. Simultaneous IS integration.

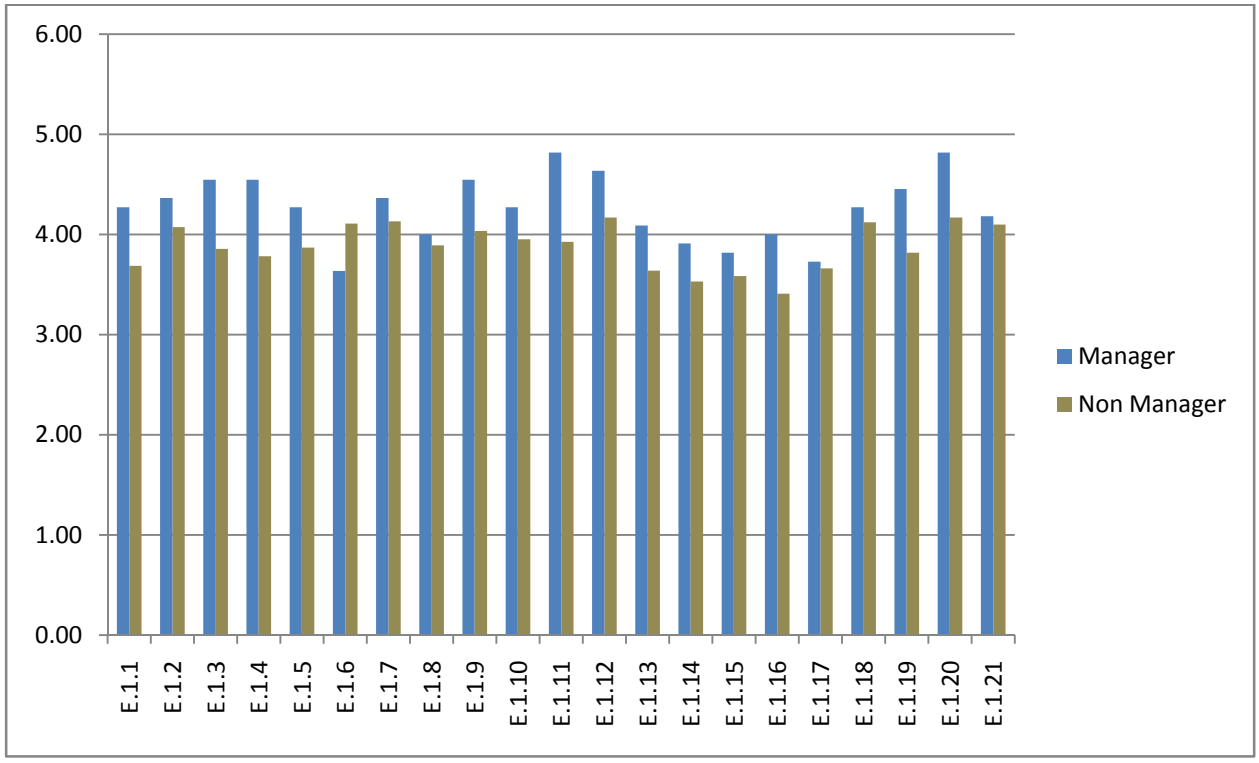
Manager versus non manager; Question 3 of Section A (refer to Appendix A).
A detailed table were compiled (Appendix D) detailing the number of respondents (n), mean, Std. Dev, p-value (t-test), p-value (Mann-Whitney) and effect size (d-value) for all the relevant questions.

The respondents were divided into two groups namely managers and non managers. Section E of the questionnaire (refer to Appendix A) set out to measure the opinion of the respondents. From the data compiled in Appendix D the following conclusion could be drawn. The total number of respondents was 94, 11 as managers and 83 as non managers.

Factors that affect the decision to make, buy or rent information systems

A large or practically significant effect or difference between the mean responses of manager vs. non-manager was found for questions E.1.4 (expertise) (d = 0.802), E.1.11 (system performance) (d = 0.8) and E.1.19 (technical functionality) (d = 0.827). A medium effect or practically visible difference between the mean responses of manager vs. non-manager was found for question E.1.1 (competitive advantage) (d = 0.516), E.1.3 (expertise) (d = 0.706), E.1.9 (system support) (d = 0.573), E.1.12 (quality) (d = 0.523), E.1.16 (expected annual transactions) (d=0.605) and E.1.19 (technical functionality) (d = 0.558). A small effect or difference between the mean responses of manager vs. non-manager was found for all other questions (d > 0.5). The t-test and Mann-Whitney did not at all times both indicate statistical significance. **Graph 3.9** shows the detail for question E.1.1 to question E.1.21 by manager and non manager on the mean scores, where a score of 5 indicates that the consideration is very relevant. Questions asked vary from competitive advantage, security, skills, expertise, available resources, cost, time, implementation, support, maintenance, performance, quality, documentation, vendor issues, size of organisation, expected annual transactions, software control, functionality, productivity and increased turnover.

Graph 3-9: Factors that affect the decision to make, buy or rent information systems



A large or practically significant effect was found for expertise question E.1.4 with an effect size of 0.802 (T-test p = 0.001, Mann-Whitney p = 0.011), system performance question E.1.12 with an effect size of 0.8 (T-test p = 0.000, Mann-Whitney p = 0.005) and productivity improvements question E.1.20 with an effect size of 0.827 (T-test p = 0.000, Mann-Whitney p =0.007), these questions were found to have the biggest impact on the decision to make, buy or rent information systems. Skills question E.1.3 with a medium effect size of 0.706 (T-test p = 0.002, Mann-Whitney p =0.025) were found to have the second biggest impact on the decision to make, buy or rent information systems. **Table 3.3** (make, buy response table grid) consists of the mean value, Std. Dev of questions E.2.1 to question E.4.5.2. The grid/table was created to show the difference in response from the empirical study to the literature study done in Chapter 2 (refer to table 2.1).

Table 3-3: Make, Buy and Rent Response table grid

Question group	Question	Description	Custom Develop (Question E.2)			Purchase (Question E.3)			Outsourced (Question E.4)			Respondents
			Literature Study	Mean	Std. Deviation	Literature Study	Mean	Std. Deviation	Literature Study	Mean	Std. Deviation	N
Business Need	1.1	The need is unique		4.27	.764		2.88	1.260		3.33	1.432	94
	1.2	The need is common		2.41	1.149		4.00	.939		2.78	1.118	94
	1.3	The need is not a core competency		2.28	.921		3.43	1.231		3.36	1.252	94
In-house experience	2.1	Functional experience exist		4.07	.751		2.96	1.311		2.80	1.141	94
	2.2	Functional experience does not exist		2.46	1.161		3.57	1.196		3.82	.994	94
Project Skills	3.1	Desire to build in-house skills		3.95	1.126		2.64	1.115		3.18	1.414	94
	3.2	Skills are not strategic		2.54	1.138		3.33	1.091		3.26	1.259	94
	3.3	The decision to outsource is strategic		3.41	1.066		3.60	1.129		3.33	1.297	94
Project Management	4.1	Project management capabilities exist within organisation		4.22	.906		2.70	1.153		3.31	1.312	94
	4.2	Project management capabilities does not exist within organisation		2.22	1.118		3.64	1.217		3.29	1.292	94
Time Frame	5.1	Flexible		4.06	.971		3.69	.928		3.61	.941	94
	5.2	Short		2.72	1.299		3.70	.971		3.17	1.284	94

Condition	Colour
Expected	
Unexpected	
Literature Study	

Table 3.3 shows the detail for question E.2.1 to question E.4.5.2 by the mean scores, where a score of 5 indicates that the consideration is very relevant. The data were compared on the mean value and was only considered for the managers (Question 3 of Section A). The conditions can be explained as follows, Condition “Literature study” refers back to **Table 2.1** in chapter two, the condition “Expected” is where the mean scores indicates that the consideration is very relevant, the condition “Unexpected” is where the mean score indicates a slight difference from that of the literature study. From **Table 3.3** and also Appendix B (response table) it can be perceived that the empirical study confirms the literature study.

Market leader versus market follower; Question 1 of Section B (refer to Appendix A).

A detailed table was compiled (Appendix E) detailing the number of respondents (n), mean, Std. Dev, p-value (t-test), p-value (Mann-Whitney) and effect size (d-value) for all the relevant questions.

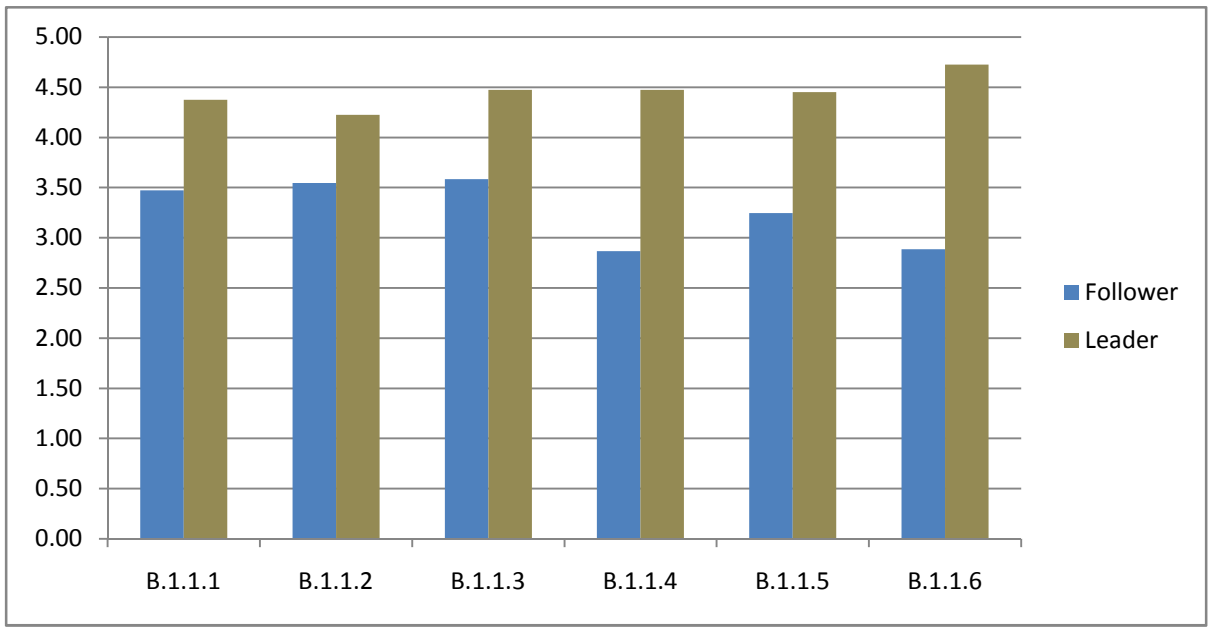
It is important to measure the differences in opinion for an organisational adoption of technology and the advantages and disadvantages of being a market leader or a market follower. Section B of the questionnaire (refer to Appendix A) set out to measure the opinion of the respondents. From the data compiled in Appendix E the following conclusion could be drawn. The total number of respondents was 93, 40 as market leaders and 53 as market followers.

Advantages of being a Market Leader vs. Market Follower

The effect size of the advantages of being a market leader vs. a market follower (question B.1.1.1 to question B.1.1.6) showed that there is a medium or practically visible difference to large effect or practically significant where the d-values range from 0.53 to 1.57. The in-dependent t-test and the Mann-Whitney test showed $p \leq 0.05$ ($p = 0.000$ and $p = 0.008$) (refer to Appendix E). **Graph 3.10** shows the detail for question B.1.1.1 to question B.1.1.6 by market leader vs. market follower on the mean scores, where a score of 5 indicates that the consideration is very relevant. Questions asked vary from greater efficiency, lower cost, higher profits, reputation for innovation,

knowledge and competitive advantage as a result of being a market leader versus being a market follower.

Graph 3-10: Advantages of being a market leader versus market follower



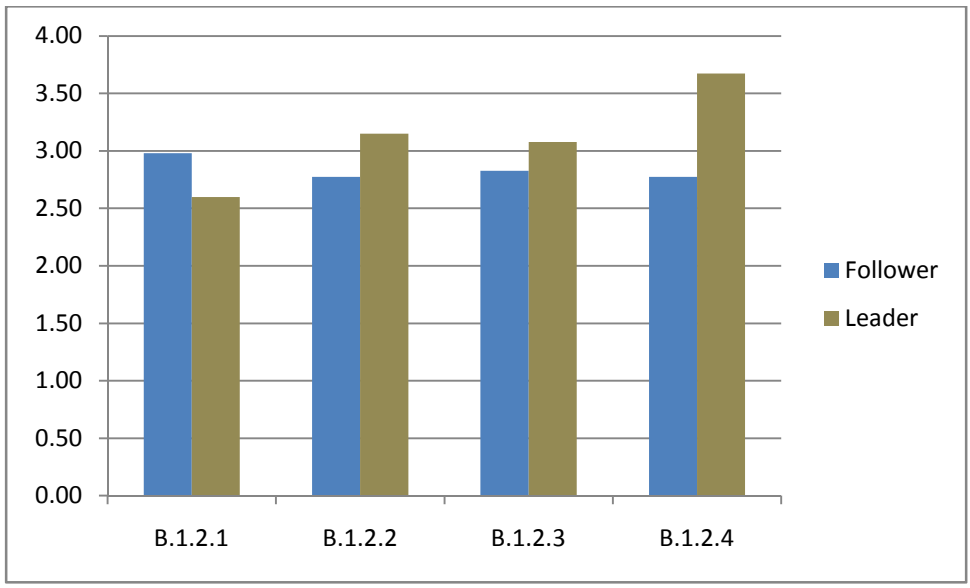
A higher mean score for the market leader versus the market follower were found even though the market follower had a higher response from the research study than that of the market follower (Number of Followers = 53; Number of Leaders = 40). A conclusion can be formulated that being a market leader can have advantages above being a market follower.

Disadvantages of being a market leader or market follower

The effect size of the disadvantages of being a market leader vs. a market follower (question B.1.2.1 to question B.1.2.4) showed that there is a small to medium effect or practically visible difference where the d-values range from 0.248 to 0.626. The independent t-test and the Mann-Whitney test showed $p \geq 0.05$ ($p = 0.105$ and $p = 0.291$) (refer to Appendix E). **Graph 3.11** shows the detail for question B.1.2.1 to question B.1.2.4 by market leader vs. market follower on the mean scores, where a score of 5 indicates that the consideration is very relevant. Questions asked vary from risk (reputational), cost of development, cost of marketing and the adverse impact on

existing products as disadvantages as a result of being a market leader versus being a market follower.

Graph 3-11: Disadvantages of being a market leader versus market follower



A higher mean score for the market leader vs. the market follower were found for questions B.1.2.2, B.1.2.3 and B.1.2.4. For question B.1.2.1 it was found that the market follower mean is bigger than that of the market follower. It is seen that there is a risk (reputational) in being a market follower than being a market leader. A conclusion can be formulated that the respondents perceive being a market leader can have disadvantages to being a market follower.

The research is confirming the literature study in chapter two, where there are advantages and disadvantages for a market leader and market follower. Whether to be a market leader or market follower depends on the source and the application of the technology (Stenbacka & Tomback, 1994:385). There are many advantages and disadvantages of being a technology leader or follower. Some advantages include little or no competition, greater efficiency and lower cost, higher profits, reputation for innovation, entry barriers (patents), and knowledge (learning). Some disadvantages include risk, cost of development and marketing, and adverse impacts on existing products (Maheran *et al.,* 2008:105)

Sequential versus Simultaneous integration of information systems within an organisation; Question 2 of Section C (refer to Appendix A). The researcher would like to inform the reader that the independent option and the 'not sure' option in Section C question 2 were excluded from the analysis as there were no responses received from the respondents.

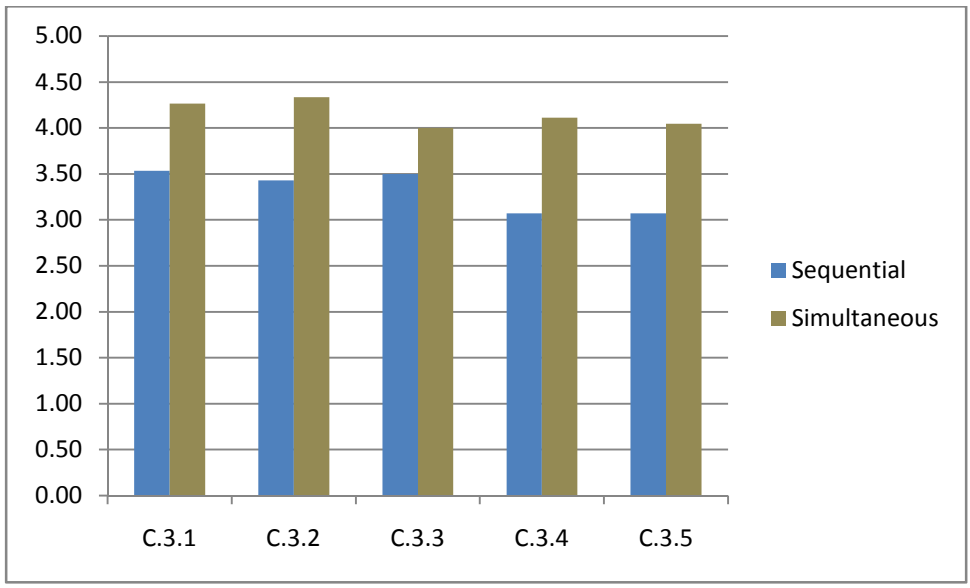
A detailed table was compiled (Appendix F) detailing the number of respondents (n), mean, Std.Dev, p-value (t-test), p-value (Mann-Whitney) and effect size (d-value) for all the relevant questions. Section C of the questionnaire test if and to what extent the technology strategy is aligned with the organisational strategy. It also tests if the strategy chosen by the organisation is sequential (strategy formulation follows and support business strategy formulation) or simultaneous (strategy formulation and business strategy formulation are done concurrently).

Section C of the questionnaire (refer to Appendix A) set out to measure the opinion of the respondents. From the data compiled in Appendix F the following conclusion could be drawn. The total number of respondents was 73, 28 sequential and 45 simultaneous.

The effect size showed a large effect or practically significant difference between the mean responses of Sequential vs. Simultaneous for question C.3.5 ("In your opinion does your organisational technology strategy fit the organisations business processes") ($d = 0.844$), medium effect or practically visible difference between the mean responses of Sequential vs. Simultaneous for questions C.3.1 ($d = 0.532$), C.3.2 ($d = 0.635$), C.3.4 ($d = 0.781$) a small effect for question C.3.3 ($d = 0.35$). The independent t-test and Mann-Whitney test showed p-values differ from $p \leq 0.05$ for questions C.3.1, C.3.2, C.3.4, C.3.5 and $p \geq 0.05$ for question C.3.3. **Graph 3.12** shows the detail for question C.3.1 to question C.3.5 as sequential and simultaneous on the mean scores, where a score of 5 indicates that the consideration is very relevant. Questions asked vary from "does the alignment of a technology strategy give your organisation a competitive advantage, does the alignment of a technology strategy help your organisation to achieve operational excellence, does the alignment of a technology strategy create and support business unit partnership, does the technology strategy fit with your

organisational strategy, and does your organisational technology strategy fit the organisational strategy."

Graph 3-12: Technology strategy alignment with organisational strategy



From **Graph 3.12** it is shown that simultaneous (strategy formulation and business strategy formulation are done concurrently) scored higher overall on the mean scores when respondents were asked to evaluate the relevance of alignment of technology strategy than sequential (strategy formulation follows and support business strategy formulation). The results in both Appendix F and **Graph 3.12** perceive the importance of organisations to have a technology strategy that is aligned with the organisational strategy. The literature study in chapter two highlights the importance of the alignment between the organisation's overall strategy and their technology strategy with the underlying support of the business processes that defines the competitive advantage of an organisation. Increasingly with the evolution of technology the emphasis on business strategy to incorporate IS is increasing more and more every day (Jukic & Jukic, 2010:62; Bocij *et al.,* 2008:538).

3.8. CONCLUSION

The aim of this study is to better understand the dynamic interrelationships between the factors affecting the decision to make, buy or rent information systems in the Heavy Engineering industry in South Africa. This has an effect on the decision across strategic, tactical and operational levels. The essence of these relationships is based on the meaning that participants at different levels assign to the factors in the organisational context to comprehend the impact and interrelationships between these factors. The respondents were divided into two groups namely managers and non managers; this was intentional as managers should be capable to give direct insight into the interrelationship between factors that affect the decision to make, buy or rent information systems. Ninety four returned questionnaires yielded that 11.7 percent were managers versus the 88.3 percent non managers. This was used to determine the decision factors on section E of the questionnaire (refer to Appendix A). Expertise question E.1., system performance question E.1.12 and productivity question E.1.20 were found to have the biggest impact on the decision to make, buy or rent information systems. Skills question E.1.3 was found to have the second biggest impact on the decision to make, buy or rent information systems.

We have grouped certain variables into a single variable to measure the overall attractiveness of the option to make, buy or rent information systems. We have done this by means of the mean scores and have tested for the reliability of scale with Cronbach's alpha (a). This was applied to Section D of the questionnaire (refer to Appendix A) where we test for the perception of what options are available to the make, buy and rent of information systems.

The Spearman's rho correlation method was used to verify if there are correlations between different questions and factors and if they were practically significant. The correlation was concluded on Section D and Section E of the questionnaire (refer to Appendix A). Results for purchase software have highlighted that documentation and training, and business functionality was statistically significant though the result cannot be generalized, as well as practically visible. Results for Open source offerings have highlighted that security, cost and time was significant. Results for SaaS (software as a

service) have highlighted that competitive advantage, expertise, software control and business functionality was significant. Results for outsourcing all or part of the effort have highlighted that cost, implementation of the system, quality and increased turnover was significant. Since a score of 5 implies that the consideration is very relevant, it is evident that all the factors play a role when choosing which option to consider when seeking fulfilling of an organisation's need for an information system.

Further analysis were done on correlation of data between the dimension groupings (refer to section 3.7.3) and question E.1.1 to question E.1.21 from Section E of the questionnaire (refer to Appendix A). This allowed the researcher to perceive what factors have the biggest influence on the decision to make, buy or rent in the Heavy Engineering industry in South Africa. **Table 3-2** (Dimension Groups and Correlation Matrix) shows a summarised grid of the finding.

3.9. CHAPTER SUMMARY

Methodological issues as well as considerations with regard to gathering the data were discussed at the start of this chapter. A questionnaire was designed to collect data to obtain the information needed to solve the research problem. A total of five hundred and sixty survey questionnaires were sent out by electronic mail to various heavy engineering organisations within the industry. The response rate from the survey was 17 percent and yielded 94 returned questionnaires. The internal consistency of the questionnaire was tested and it was found that a moderate to high level of consistency exists.

The survey results were then presented in frequency tables. The data was analysed using descriptive statistics as well as inferring possible trends or conclusions based on relationships between certain responses on specific related questions and referring to the literature study of Chapter 2.

Some question of the questionnaire were grouped into single variables to measure overall attractiveness of which option is the best when seeking to fulfil an organisation's requirements for information technology in the heavy engineering environment. These were done on the basis by means of the mean scores and have been tested for the

reliability of scale with Cronbach's alpha (a). Data correlation was used to determine the perceptions of the factors that have an influence on the overall decision to make, buy or rent information systems. Further analysis was done on correlation of data between the dimension groupings and factors that influence the decision to make, buy or rent information systems. This allowed the researcher to perceive what factors have the biggest influence on the decision to make, buy or rent in the Heavy Engineering industry in South Africa.

There is no simple or easy answer to the question of whether organisations are best served by renting, buying, or building systems. In the absence of a compelling business need, organisations should purchase or rent a tested proven solution rather than build one from scratch. From a business perspective, the amount of time, money, and effort required to build a system will dissuade all but the most naïve or stubborn senior managers. The case for building is perhaps strongest for organisations that have a specific need with no apparent software application providing the solution on the market, at least for a reasonable cost (Simon, 2009:1).

Overall the linkage between the literature study and the empirical research was also drawn on a number of aspects. It can also be concluded that a good fit between the literature study results and that of the empirical results exists. In the following chapter these conclusions will be discussed and recommendations will be made.

CHAPTER 4: CONCLUSIONS AND RECOMMENDATIONS

4.1 INTRODUCTION

The background of the study was set in chapter two through a comprehensive study of information management systems configurations. Throughout chapter 2 the focus was on literature on the make, buy or rent options available when seeking to fulfil organisational requirements for IS. The literature focused on factors influencing the decision to make, buy or rent IS. The literature study portrayed the ideal state or methodologies for acquiring IS and the best practices used in evaluating the best option for the organisation. The importance of the study is to identify factors that need to be taken into account when each of these options (make, buy or rent) is evaluated and also the implications to and for the organisation.

Chapter 3 set the background to the design of the questionnaire, the processing of the data and analysis of the data gathered and the results obtained.

This chapter presents the conclusion, recommendations and the major findings of this study. The purpose of this chapter is to conclude the empirical study and make recommendations on the findings in chapter 3. Recommendations are provided for further research on the decision to make, buy or rent information systems in the Heavy Engineering industry within South Africa.

4.2 CONCLUSIONS ON THE EMPIRICAL STUDY

4.2.1 Market leader versus market follower

Technology is changing the way organisations are doing business and the effect of new technologies on organisations can be tremendous. Whether to be a market leader or market follower depends on the source and the application of the technology (Stenbacka & Tomback, 1994:385). Through the survey the researcher has tested the adoption of technology in the Heavy Engineering industry in South Africa. The survey results found that 43 percent indicated that their organisation adopted technology as a market leader and 57 percent as market follower. Questions were asked to determine

the advantages and disadvantage of being a market leader versus a market follower. These questions were derived from the literature study done in Chapter 2 (Maheran *et al*., 2008:105).

The survey indicated that if an organisation has chosen a technology strategy as a market leader that they will have the following advantages in order of importance (perceived by the respondents): competitive advantage, reputation for innovation, higher profits, knowledge (learning), greater efficiency and lower cost. The survey also indicated that if an organisation has chosen a market follower strategy that they will have the following advantages in order of importance (perceived by the respondents): higher profits, lower cost, greater efficiency, knowledge (learning), competitive advantage and reputation for innovation.

Disadvantages from being a market leader were perceived by the respondents in order of importance as: adverse impact on existing products, cost of development, cost of marketing and risk (reputational). Disadvantages from being a market follower were perceived by the respondents in order of importance as: risk (reputational), cost of marketing, cost of development and adverse impact on existing products.

Adopting a market leader technology strategy has scored higher in mean values from the respondents (refer to Chapter 3 Group Means) although 57 percent of the responses received indicated a market follower strategy as the strategy adopted by their organisations. This can be perceived that within the Heavy Engineering industry organisations are more likely to follow a market follower technology strategy than a market leader technology strategy.

4.2.2 Sequential versus simultaneous

The importance of alignment of information systems with the underlying support of the business processes defines the competitive advantage of an organisation. Increasingly with the evolution of technology the emphasis on business strategy to incorporate information systems are increasing more and more every day (Jukic & Jukic, 2010:62; Bocij *et al.,* 2008:538). Through the survey we have tested if organisation in the heavy engineering industry within South Africa have a technology strategy that is formed

sequential (strategy formulation follows and support business strategy formulation) or simultaneous (strategy formulation and business strategy formulation are done concurrently) with their organisational strategy. The survey result found that 38 percent indicated that their organisation follows a sequential approach and 62 percent indicates that their organisation follows a simultaneous approach.

The survey indicated that for an organisation where strategy formulation follows and support business strategy formulation (sequential) respondents perceived that the alignment of their technology strategy with their organisation strategy allow the organisation to achieve competitive advantage, creates and support business unit partnership, and helps the organisation to achieve operational excellence. Where strategy formulation and business strategy formulation are done concurrently (simultaneous) respondents perceived that the alignment of their technology strategy with their organisation strategy allow the organisation to achieve operational excellence, competitive advantage and creates and support business unit partnership within the organisation.

Simultaneous (strategy formulation and business strategy formulation are done concurrently) scored higher overall on the mean scores when respondents were asked to evaluate the relevance of alignment of technology strategy than sequential (strategy formulation follows and support business strategy formulation) (refer to Chapter 3 Group Means). This can be perceived that within the Heavy Engineering industry strategy formulation and business strategy formulation are done concurrently (simultaneous). Further research regarding the level of alignment between an organisation's information system strategy and organisational strategy is required.

The literature study in chapter two highlights the importance of the alignment between organisations' overall strategy and their technology strategy with the underlying support of the business processes that defines the competitive advantage of an organisation. Increasingly with the evolution of technology the emphasis on business strategy to incorporate IS are increasing more and more every day (Jukic & Jukic, 2010:62; Bocij *et al.,* 2008:538).

4.2.3 Factors that affect the decision to make, buy or rent information systems

The information technology environment requires a great deal of investment towards information systems. The make, buy or rent options give managers options to consider when they require a new or enhanced information system. It is therefore important for managers and organisations to consider all factors influencing the decision to make, buy or rent information systems when seeking to upgrade or replace legacy systems with new information systems.

The respondents were divided into two groups namely managers and non managers; the perspective of both managers and non managers were measured. The survey result found that 11.7 percent were managers versus the 88.3 percent non managers. Questions were asked to determine the factors that have the biggest influence on the decision to make, buy or rent information systems. The basis of these questions was derived from the literature study done in Chapter 2 (Gallauger, 2010:1; Simon, 2009:1). The survey results have found that expertise, system performance, productivity improvements and skills have the biggest impact on the decision to make, buy or rent information systems.

Using correlation between the factors that influence the decision and the criteria for evaluating the decision to make, buy or rent information systems, the following factors have been found to have the biggest impact on each of the configurations used in the heavy engineering environment.

- Respondents who felt strongly about considering to purchase software as an IS solution felt that documentation, training and business functionality are relevant in the decision. The respondents have also indicated that the size of the organisation and the number of expected transactions were not relevant.
- Respondents who felt that if security and cost are taken into account when the decision is made to buy/make/rent IS did not always feel that open source systems are a relevant consideration.

- Respondents who felt strongly about considering software as a service as a IS solution also felt that competitive advantage, expertise, software control, and business functionality are relevant in the decision.

Further analysis were done on the factors using dimension grouping (refer to section 3.7.5). Using correlation between the factors that influence the decision and the dimension groupings the following factors have been found to be relevant in the decision.

- Benefits from purchasing software from a vendor:
    - Competitive advantage;
    - Available resources;
    - The implementation of the system;
    - Support to the system are available;
    - System performance;
    - Documentation and training;
    - Business functionality;
    - Increased turnover.
- Benefits from open source offerings:
    - The size of the organisation;
    - The number of expected annual transactions by the organisation.
- Benefits from SaaS (Software as a service):
    - Competitive advantage;
    - Expertise;
    - System performance;
    - Business functionality.

- Benefits from the outsourcing of development and other IT functions:
    - Competitive advantage;
    - Security;
    - Skills;
    - Available resources;
    - Implementation of the system;
    - Support to the system;
    - System performance;
    - Documentation and training;
    - Business functionality;
    - Technical functionality.
- Benefits from developing in-house all or part of the effort:
    - Competitive advantage;
    - Security;
    - Skills;
    - Expertise;
    - Available resources;
    - Time;
    - Implementation of the system;
    - Support to the system;
    - Maintenance and upgrades;
    - System performance;
    - Quality;
    - Documentation and training;
    - Business functionality;
    - Technical functionality;
    - Productivity improvements;
    - Increased turnover.

Using the factors influencing the make, buy, or rent decision, Gallauger (2010:1) and Simon (2009:1) have defined that we can begin to evaluate the decision to make, buy or rent with the criteria for analysis and the purpose of decision-making that includes the business need, in-house experience, project skills, project management and time frame.

The survey results have found that these criteria for evaluation and decision-making for the Heavy Engineering industry in South Africa support these literature findings. By using **Table 2-1** and **Table 3-2** in conjunction with one another a framework is provided that can be used for the purpose of decision-making for the make, buy or rent of information systems in the heavy engineering environment in South Africa. Additionally, we must also measure the capital benefit of an information system.

4.2.4 Capital benefit of new and enhanced information system

The competitive and demanding business environment of today's world have forced players in the marketplace to be more efficient, to emphasise a leaner organisation and continuously innovate new procedures to stay ahead of competitors (Sashikala, 2010:15). This raised questions about how to measure the investment towards information systems. Managers are increasingly searching for methods to measure the investment in information systems.

Through the survey it has been researched what methods are used by organisations in the Heavy Engineering industry in South Africa. The survey questions used to evaluate the capital benefits of information systems were only asked to respondents who were managers. Different methods were researched in literature Chapter 2 and the respondents have been asked to evaluate these options. All of these options have been found and considered as being relevant. The respondents have indicated in order of importance (perceived by the respondents) that ROI (Return on Investment), the Balanced Scorecard, TCO (Total Cost of Ownership, EVA (Economic value added), NPV (Net Present Value) and breakeven are used to calculate the capital benefit for information systems.

The make, buy, or rent decision may apply on a case-by-case basis that might be evaluated by the organisation, division, project or project component (Bocij *et al.,* 2008:112).

4.3 RECOMMENDATIONS

Managers have numerous options available when determining how to satisfy the software requirements of their organisations. Evaluating all of the options available will have an effect on how organisations do business. This study has identified factors that need to be taken into account when each of these options (make, buy or rent) is evaluated and also the implications to and for the organisation. Identifying at which point is it feasible for the organisation to use either of these options (make, buy or rent), as part of their IS strategy that will give the organisation the competitive advantage in all aspects of business. Organisations must adopt technology and continuously revaluate their technology strategy.

The following recommendations are made to assist managers/organisations in their task when evaluating the decision to make, buy or rent information systems.

4.3.1 Technology evolution: market leader or follower

A manager/organisation must always ensure that they keep track of technology evolution. The following are recommendations for technology evolution.

- Organisation must ensure that they evaluate their position on technology and prepare themselves for the future by studying emerging trends and technologies.
- Study technology trends that are changing the industry and that have an influence on your organisation.
- Ensure that the organisation's technology strategy is coherent with the organisation's basic strategy.
- Organisations must ensure that they do analysis on a case by case basis regarding the position of the organisation with regards to their technology needs.

Managers/organisations must embrace technology as part of their everyday cycle; technology will only increase and ask more of organisations to keep up in the business environment. Studying technology trends that have an influence on the organisation will only increase the organisation's overall competitiveness.

4.3.2 Information System supporting business processes

Information systems must support business in the overall strategy and must therefore support the organisational business processes. The importance of alignment of information systems with the underlying support of the business processes defines the competitive advantage of an organisation. Increasingly with the evolution of technology the emphasis on business strategy to incorporate IS is increasing more and more every day. It is therefore important for organisations to have a technology strategy that is aligned with the organisational strategy.

4.3.3 Factors that affect the decision to make, buy or rent information systems

It is important to identify the factors that influence the decision when seeking to upgrade or replace legacy systems with new information systems. Consider all the relevant factors and all the relevant configurations (make, buy or rent) available. It is important to realise that for most organisations, technology decisions are not binary options for the whole organisation in all situations. Not all organisations will opt for an IT configuration that is one hundred percent in-house developed, or will use open source (OSS) offerings available, or would be completely outsourced or alternatively will use SaaS (Software as a service).

By using **Table 2-1** and **Table 3-2** in conjunction with one another a framework is provided that can be used for the purpose of decision-making for the make, buy or rent of information systems in the heavy engineering environment in South Africa. Additionally, we must also measure the capital benefit of an information system. Capital benefit can be measured using any of the following approaches derived from literature and tested through the empirical study.

- NPV (Net Present Value) – Net value of future discounted cash flows,
- ROI (Return on Investment) – A figure of merit used to help make capital investment decisions,
- Breakeven – The breakeven point in economic is the point at which cost or expenses and income are equal,
- EVA (Economic Value Added) – A way to determine the value created above the required return for the shareholders of a company,
- TCO (Total Cost of Ownership) – A method of cost analysis.

Information system investment must be managed just like other capital investments. It is not always easy to measure the direct result of investment in information systems. The benefit of information systems must be calculated not only from a financial position but must include other alternative measures to incorporate the total benefit (Grant *et al.,* 2010:277). The objectives and investment drivers form an integrated part of an organisation's decision to investment in IS. Bocij *et al.* (2008:539) and Kaplan and Norton (2004:32) concur that the decision is not based on financial return only but must include both the intangible and tangible benefits.

An organisation's decision to adopt a new technology depends on the economic environment in which the investment decision is made and on the type of technology involved. To be a market leader or follower of technology depends on the source and application of the technology. In some cases it is better to be a follower than a market leader in technology applicability. If the technologies is unproven and has risk to the organisation it is better to be a close follower than a leader.

4.4 CRITICAL EVALUATION OF THE STUDY

The success of this study is based upon realising the primary and secondary objectives, as indicated in section 1.4 of this study.

4.4.1 Primary objectives re-visited

The primary objective of the research was to establish the use of information systems in the Heavy Engineering industry in South Africa and the decision to make, buy or rent

information systems. To address the primary objective the secondary objectives were formulated.

4.4.2 Secondary objectives re-visited

- Perform a literature study to research the decision to make, buy or rent IS.
- To research the factors that have an influence on the decision to make, buy or rent IS.
- Research the competitive advantages for Make, buy or rent IS.
- Research the effective utilisation of information technologies including cost reduction, performance improvement, quality enhancement, and the creation of new products and services for IS.
- To research the need and application of IS in the Heavy Engineering industry in South Africa.
- Research the expected outcomes of an IS.
- Research expected outcomes from the Heavy Engineering industry.
- Research the IT configuration used in the Heavy Engineering industry. (make, buy or rent)

The first secondary objective namely, to perform a literature study to research the decision to make, buy or rent information systems by means of a literature study was achieved through a comprehensive literature study in chapter two. This chapter acted as a motivation to this question by supplying a structured understanding of the different options available when an organisation wants to enhance an existing information system or replace an old information system.

The second secondary objective namely, to research the factors that have an influence on the decision to make, buy or rent IS by means of a literature study was achieved through a comprehensive literature study in chapter two and the detailed empirical research discussed in chapter three and concluded in chapter four.

The third secondary objective, to research the competitive advantages for make, buy or rent IS was achieved through a comprehensive literature study in chapter two and the detailed empirical research discussed in chapter three and concluded in chapter four.

The fourth secondary objective, to research the effective utilisation of information technologies including cost reduction, performance improvement, quality enhancement, and the creation of new products and services for IS was realised through the detailed empirical research discussed in chapter three and concluded in chapter four.

The fifth secondary objective, to research the need and application of IS in the Heavy Engineering industry in South Africa was achieved through a comprehensive literature study in chapter two and the detailed empirical research discussed in chapter three and concluded in chapter four.

The sixth secondary objective, research the expected outcomes of an IS was realised by means of a literature study through the detailed empirical research discussed in chapter three and concluded in chapter four.

The seventh secondary objective, to research expected outcomes from the Heavy Engineering industry was realised through the detailed empirical research discussed in chapter three and concluded in chapter four.

The eighth secondary objective, to research the IT configuration used in the Heavy Engineering industry (make, buy or rent) was realised through the detailed empirical research discussed in chapter three and concluded in chapter four.

Through achieving all the secondary objectives it can therefore be concluded that the primary objective namely, to establish the use of information systems in the Heavy Engineering industry in South Africa and the decision to make, buy or rent information systems was achieved.

4.5 SUGGESTIONS FOR FURTHER RESEARCH

There was no evidence found of prior research in the Heavy Engineering industry in South Africa that focuses on the decision to make, buy or rent information systems. Flowing from this study there are a number of research fields that require more detailed analysis namely:

- Effects that information systems have on productivity (productivity paradox);
- Calculating the Capital benefit in information technology;
- The effects of Malware (malicious software/services) services on information technology;
- Implementation strategies for the make, buy or rent decision;
- Change management process/principles when implementing a information system;
- The extent of outsourcing information systems in the Heavy Engineering industry;
- New and improved information system (Should we upgrade or stay);
- Strategic alignment of information system with organisational strategy (measuring of alignment and to what extent);
- Information Management best practices, training and education;
- Information Management risk assessment;
- Information overload, living in today's world where technology is changing at an alarming rate. Technology is advancing: are we keeping up, what effects is this having on the users?
- Multiple effects on technology evolution incorporating the different laws of technology.

4.6 CONCLUSION

The aim of this dissertation was to establish the use of information systems in the Heavy Engineering industry in South Africa and the decision to make, buy or rent information system. Special focus was placed on the factors that influence the decision to make, buy or rent information systems. The make, buy or rent options have been discussed in detail as well as the factors that influence the decision. An extensive

literature study was conducted on the factors that influence the decision to make, buy or rent. The literature study portrays the ideal state or methodologies for acquiring IS and the best practices used in evaluating the best option for the organisation. Information systems form part of the corporate strategy, competitive positioning and must be aligned with the overall strategy of the organisation. An extensive survey was compiled to determine the opinions about the different options managers/organisations have to consider when seeking to fulfil organisational requirements for IS. A framework was proposed that can be used for the purpose of decision-making for the make, buy or rent of information systems in the heavy engineering environment in South Africa. It can thus be concluded that the research outcomes set out for this dissertation have been met.

4.7 SUMMARY

The purpose of this chapter was to conclude on the empirical study with conclusions and recommendations from the empirical research. That was followed by a critical evaluation of the study in regard to the achievement of the research objectives. Suggestions for future studies were also recommended.

Adopting a market leader technology strategy have scored higher in mean values from the respondents (refer to Chapter 3 Group Means) although 57 percent of the responses received indicated a market follower strategy as the strategy adopted by their organisations. This can be perceived that within the Heavy Engineering industry organisations are more likely to follow a market follower technology strategy than a market leader technology strategy.

Simultaneous (strategy formulation and business strategy formulation are done concurrently) scored higher overall on the mean scores when respondents were asked to evaluate the relevance of alignment of technology strategy than sequential (strategy formulation follows and support business strategy formulation) (refer to Chapter 3 Group Means). This can be perceived that within the Heavy Engineering industry strategy formulation and business strategy formulation are done concurrently (simultaneous). Further research regarding the level of alignment between an organisation's information system strategy and organisational strategy is required.

The respondents were divided into two groups namely managers and non managers, the perspective of both managers and non managers were measured. The survey result found that 11.7 percent were managers versus the 88.3 percent non managers. Questions were asked to determine the factors that have the biggest influence on the decision to make, buy or rent information systems. The basis of these questions was derived from the literature study done in Chapter 2 (Gallauger, 2010:1; Simon, 2009:1). The survey results have found that expertise, system performance, productivity improvements and skills have the biggest impact on the decision to make, buy or rent information systems.

It is important to identify the factors that influence the decision when seeking to upgrade or replace legacy systems with new information systems. Consider all the relevant factors and all the relevant configurations (make, buy or rent) available. It is important to realise that for most organisations, technology decisions are not binary options for the whole organisation in all situations. Not all organisations will opt for an IT configuration that is one hundred percent in-house developed, or will use open source (OSS) offerings available, or would be completely outsourced or alternatively will use SaaS (Software as a service).

A framework has been presented that can be used for the purpose of decision-making for the make, buy or rent of information systems in the heavy engineering environment in South Africa. Additionally we must also measure the capital benefit of an information system. Capital benefit can be measure using any of the following approaches derived from literature and tested through the empirical study. Through the survey we have researched what methods are used by organisations in the Heavy Engineering industry in South Africa. The survey questions used to evaluate the capital benefits of information systems were only asked from respondents who were managers. Different methods were researched in Chapter 2 and the respondents have been asked to evaluate these options. All of these options have been found and considered as being relevant. The respondents have indicated in order of importance (perceived by the respondents) that ROI (Return on Investment), the Balanced Scorecard, TCO (Total

Cost of Ownership, EVA (Economic value added), NPV (Net Present Value) and breakeven are used to calculate the capital benefit for information systems.

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APPENDIX A: QUANTITATIVE QUESTIONNAIRE

Dear Respondent,

Thank you for completing this survey. The survey will take approximately **20min** to complete. The researcher is investigating the decision to Make, buy or rent information systems in the Heavy Engineering environment in South Africa. The Questionnaire is aimed at managers directly involved in striving to fulfil organisational requirements for information systems, and the end users of the information systems. Your opinion as manager or end user will be measured in the questionnaire and your honesty will be appreciated. The questionnaire will be completed anonymously, and all information will be treated as confidential. This study will assist us in determining the decision to Make, buy or rent information systems when seeking to fulfil an organisation's need to obtain or replace existing information systems.

If you wish to receive feedback regarding the results of this survey, please supply your e-mail address below:
E-mail: _____@_____

If you have any queries please contact:
Researcher: Thomas F. Matthee – thomasm@dcd.co.za

Section A – Demographics

In this section the researcher will determine the demographics of the participant.

1. Gender

Male	Female

2. Age (in years)

3. Respondent (Mark with cross)

   3.1 Manager

   3.2 End User

4. If you are in Management please indicate the following.

   4.1 Number of employees reporting to you

5. Number of years in organisation

6. Number of years in industry

7. What is your level of education?

8. What do you think is the organisation's Turnover (millions)?

Not Sure	0 - 100	101 - 499	> 500

9. What do you think is the organisation's investment in technology as percentage of turnover? %

Section B – Technology

In this section the researcher will determine the organisational adoption of technology.

1. In your opinion does your organisation adopt technology as a .....

Market Leader	Market Follower

Rate each one of the following factors applicable on the abovementioned question on a scale of 1 to 5 according to level of importance to your organisation. (1 = Not Relevant, 5 = Very Relevant)

In your opinion being a Market ..... (Leader or Follower "As defined per question 1 Above") will lead to the following advantages for your organisation?					
1.1.1 Greater efficiency	1	2	3	4	5
1.1.2 Lower Cost	1	2	3	4	5
1.1.3 Higher Profits	1	2	3	4	5
1.1.4 Reputation for innovation	1	2	3	4	5
1.1.5 Knowledge (learning)	1	2	3	4	5
1.1.6 Competitive advantage	1	2	3	4	5
1.1.7 Other advantage (Please specify write and rate)					
	1	2	3	4	5
	1	2	3	4	5
In your opinion being a Market ..... (Leader or Follower "As defined per question 1 Above") will lead to the following disadvantages for your organisation?					
1.2.1 Risk (for example, reputational)	1	2	3	4	5
1.2.2 Cost of Development	1	2	3	4	5
1.2.3 Cost of Marketing	1	2	3	4	5
1.2.4 Adverse impact on existing products	1	2	3	4	5
1.2.5 Other disadvantage (Please specify write and rate)					
	1	2	3	4	5
	1	2	3	4	5

Section C - Alignment with the overall organisational strategy

In this section the researcher will determine if the technology strategy is aligned with the organisational strategy.

1. In your opinion does your organisation make use of a technology strategy ?

Not Sure	Yes	No

2. How would you rate the level of information system (IS) integration with your organisation? (Choose one)

☐ **Independent:** IS strategy formulation and business strategy formulation are separate, unrelated processes.

☐ **Sequential:** IS strategy formulation follows and supports business strategy formulation.

☐ **Simultaneous:** IS strategy formulation and business strategy formulation are done concurrently.

☐ **Not Sure**

Rate each one of the following factors on a scale of 1 to 5 according to level of importance to your organisation? (1 = Not Relevant, 5 = Very Relevant)

3.1 In your opinion does the alignment of a technology strategy give your organisation a competitive advantage?	1	2	3	4	5
3.2 In your opinion does the alignment of a technology strategy help the organisation to achieve operational excellence?	1	2	3	4	5
3.3 Alignment of a technology strategy creates and support business unit partnership within the organisation (business units work together).	1	2	3	4	5
3.4 In your opinion does your technology strategy fit with your organisation's strategic goals?	1	2	3	4	5
3.5 In your opinion does your organisational technology strategy fit the organisation's business processes?	1	2	3	4	5
3.6 Other factors influencing technology strategy are? (Please specify; write and rate)					
	1	2	3	4	5
	1	2	3	4	5

Section D - Perceptions of what options are available to the make, buy or rent of information systems.

In this section the researcher will get a better understanding of what factors need to be considered when making the decision to make, buy or rent of information systems.

Rate each one of the following factors on a scale of 1 to 5 according to level of importance to your organisation? (1 = Not Relevant, 5 = Very Relevant)

1. Which of the following options do you think you should consider when seeking to fulfil your organisation's requirement for information systems?					
1.1 The use of Purchase Packaged software from a vendor	1	2	3	4	5
1.2 The use of open source offerings	1	2	3	4	5
1.3 The use of SaaS (Software as a service)	1	2	3	4	5
1.4 Outsource development and other IT functions	1	2	3	4	5
1.5 Develop in-house all or part of the effort	1	2	3	4	5
1.6 Other options used (Please specify write and rate) *					
	1	2	3	4	5
	1	2	3	4	5

2. In your opinion what is the percentage of information system configurations/solutions used in your organisation?	**%**
2.1 Purchase Packaged software from a vendor?	
2.2 Use of open source offerings?	
2.3 Use of SaaS (Software as a service)?	
2.4 Outsource development and other IT functions?	
2.5 Develop in-house all or part of the effort?	
2.6 Other options written as used per previous question 1.6 above (Please specify write and indicate percentage use)	

* The additional option will be discussed in detail from question 9 of this section.

3. In your opinion what should be the percentage of configurations/solutions used in your organisation?	**%**
3.1 Purchase Packaged software from a vendor?	
3.2 Use open source offerings?	
3.3 Use SaaS (Software as a service)?	
3.4 Outsource development and other IT functions?	
3.5 Develop in-house all or part of the effort?	
3.6 Other options written as per previous question 1 of this section above (Please specify write and indicate percentage use)	

Rate each one of the following elements on a scale of 1 to 5 according to the relevance. (1 = Not Relevant, 5 = Very Relevant)

4. In your opinion purchasing software from a vendor has the following benefits.					
4.1 Time saved in development	1	2	3	4	5
4.2 Software are field tested	1	2	3	4	5
4.3 Software are robust	1	2	3	4	5
4.4 Software incorporates best practices from industry	1	2	3	4	5
4.5 No need to re-invent the wheel	1	2	3	4	5
4.6 Uniform user interfaces	1	2	3	4	5
4.7 Ease of use	1	2	3	4	5
4.8 Easier migration to integrated solutions	1	2	3	4	5
4.9 Support to system is available	1	2	3	4	5
4.10 Good business and functionality fit to organisation	1	2	3	4	5
4.11 Customization of software to fit organisational requirements	1	2	3	4	5
4.12 Cost of Licensing	1	2	3	4	5
4.13 Other benefits (Please specify write and rate)					
	1	2	3	4	5
	1	2	3	4	5

5. In your opinion open source offerings have the following benefits.					
5.1 Time saved in development	1	2	3	4	5
5.2 Software are field tested	1	2	3	4	5
5.3 Software are robust	1	2	3	4	5
5.4 Software incorporates best practices from industry	1	2	3	4	5
5.5 No need to re-invent the wheel	1	2	3	4	5
5.6 Uniform user interfaces	1	2	3	4	5
5.7 Ease of use	1	2	3	4	5
5.8 Easier migration to integrated solutions	1	2	3	4	5
5.9 Support to system are available	1	2	3	4	5
5.10 Good business and functionality fit to organisation	1	2	3	4	5
5.11 Customization of software to fit organisational requirements	1	2	3	4	5
5.12 Cost of Licensing	1	2	3	4	5
5.13 Other benefits (Please specify write and rate)					
	1	2	3	4	5
	1	2	3	4	5

6. In your opinion SaaS (Software as a service) offerings have the following benefits.					
6.1 Time saved in development	1	2	3	4	5
6.2 Software are field tested	1	2	3	4	5
6.3 Software are robust	1	2	3	4	5
6.4 Software incorporates best practices from industry	1	2	3	4	5
6.5 No need to re-invent the wheel	1	2	3	4	5
6.6 Uniform user interfaces	1	2	3	4	5
6.7 Ease of use	1	2	3	4	5
6.8 Easier migration to integrated solutions	1	2	3	4	5
6.9 Support to system are available	1	2	3	4	5
6.10 Good business and functionality fit to organisation	1	2	3	4	5
6.11 Customization of software to fit organisational requirements	1	2	3	4	5
6.12 Cost of Licensing	1	2	3	4	5
6.13 Other benefits (Please specify write and rate)					
	1	2	3	4	5
	1	2	3	4	5

7. In your opinion to outsource development or other IT functions has the following benefits.					
7.1 Software are robust	1	2	3	4	5
7.2 Software incorporates best practices from industry	1	2	3	4	5
7.3 No need to re-invent the wheel	1	2	3	4	5
7.4 Uniform user interfaces	1	2	3	4	5
7.5 Ease of use	1	2	3	4	5
7.6 Easier migration to integrated solutions	1	2	3	4	5
7.7 Support to system are available	1	2	3	4	5
7.8 Good business and functionality fit to organisation	1	2	3	4	5
7.9 Customization of software to fit organisational requirements	1	2	3	4	5
7.10 Cost of Licensing	1	2	3	4	5
7.11 Other benefits (Please specify write and rate)					
	1	2	3	4	5
	1	2	3	4	5

8. In your opinion to develop in-house all or part of the effort allows organisations the following benefits.					
8.1 Software are robust	1	2	3	4	5
8.2 Software incorporates best practices from industry	1	2	3	4	5
8.3 No need to re-invent the wheel	1	2	3	4	5
8.4 Uniform user interfaces	1	2	3	4	5
8.5 Ease of use	1	2	3	4	5
8.6 Easier migration to integrated solutions	1	2	3	4	5
8.7 Support to system are available	1	2	3	4	5
8.8 Good business and functionality fit to organisation	1	2	3	4	5
8.9 Customization of software to fit organisational requirements	1	2	3	4	5
8.10 Cost of Licensing	1	2	3	4	5
8.11 Other benefits (Please specify write and rate)					
	1	2	3	4	5
	1	2	3	4	5

The following 3 questions must be completed from the additional configurations written from question 1.6 of this section.

9. Complete the following questions on the first written option as benefits to your organisation.					
9.1 Software are robust	1	2	3	4	5
9.2 Software incorporates best practices from industry	1	2	3	4	5
9.3 No need to re-invent the wheel	1	2	3	4	5
9.4 Uniform user interfaces	1	2	3	4	5
9.5 Ease of use	1	2	3	4	5
9.6 Easier migration to integrated solutions	1	2	3	4	5
9.7 Support to system are available	1	2	3	4	5
9.8 Good business and functionality fit to organisation	1	2	3	4	5
9.9 Customization of software to fit organisational requirements	1	2	3	4	5
9.10 Cost of Licensing	1	2	3	4	5
9.11 Other benefits (Please specify write and rate)					
	1	2	3	4	5
	1	2	3	4	5

10. Complete the following on the second written option as benefits to your organisation.					
10.1 Software are robust	1	2	3	4	5
10.2 Software incorporates best practices from industry	1	2	3	4	5
10.3 No need to re-invent the wheel	1	2	3	4	5
10.4 Uniform user interfaces	1	2	3	4	5
10.5 Ease of use	1	2	3	4	5
10.6 Easier migration to integrated solutions	1	2	3	4	5
10.7 Support to system are available	1	2	3	4	5
10.8 Good business and functionality fit to organisation	1	2	3	4	5
10.9 Customization of software to fit organisational requirements	1	2	3	4	5
10.10 Cost of Licensing	1	2	3	4	5
10.11 Other benefits (Please specify write and rate)					
	1	2	3	4	5
	1	2	3	4	5

11. Complete the following on the first written option as benefits to your organisations.					
11.1 Software are robust	1	2	3	4	5
11.2 Software incorporates best practices from industry	1	2	3	4	5
11.3 No need to re-invent the wheel	1	2	3	4	5
11.4 Uniform user interfaces	1	2	3	4	5
11.5 Ease of use	1	2	3	4	5
11.6 Easier migration to integrated solutions	1	2	3	4	5
11.7 Support to system are available	1	2	3	4	5
11.8 Good business and functionality fit to organisation	1	2	3	4	5
11.9 Customization of software to fit organisational requirements	1	2	3	4	5
11.10 Cost of Licensing	1	2	3	4	5
11.11 Other benefits (Please specify write and rate)					
	1	2	3	4	5
	1	2	3	4	5

Section E - Factors that have an influence on the decision to make, buy or rent

In this section the researcher will get a better understanding of the factors that have an influence on the decision to make, buy or rent.

Rate each one of the following elements on a scale of 1 to 5 according to the relevance to your organisation when seeking to upgrade or replace legacy systems with new information systems in your organisation. (1 = Not Relevant, 5 = Very Relevant)

1. In your opinion the following factors have an influence on the decision to make, buy or rent information systems.					
1.1 Competitive Advantage	1	2	3	4	5
1.2 Security	1	2	3	4	5
1.3 Skills	1	2	3	4	5
1.4 Expertise	1	2	3	4	5
1.5 Available resources	1	2	3	4	5
1.6 Cost	1	2	3	4	5
1.7 Time	1	2	3	4	5
1.8 Implementation of system	1	2	3	4	5
1.9 Support to system are available	1	2	3	4	5
1.10 Maintenance and upgrades	1	2	3	4	5
1.11 System performance	1	2	3	4	5
1.12 Quality	1	2	3	4	5
1.13 Documentation and training	1	2	3	4	5
1.14 Vendor issues (contract length and or supplier relationship)	1	2	3	4	5
1.15 The size of the organisation	1	2	3	4	5
1.16 Number of expected annual transactions by your organisation	1	2	3	4	5
1.17 Software control	1	2	3	4	5
1.18 Business functionality	1	2	3	4	5
1.19 Technical functionality	1	2	3	4	5
1.20 Productivity improvements	1	2	3	4	5
1.21 Increased Turnover	1	2	3	4	5
1.22 Other factors that have a influence (Please specify write and rate)					
	1	2	3	4	5
	1	2	3	4	5

Rate each one of the following elements on a scale of 1 to 5 according to the relevance.

(1 = Not Relevant, 5 = Very Relevant)

2. In your opinion the criteria for evaluating the decision to develop an information system in-house depends on the following factors when seeking to upgrade or replace legacy systems with new information systems in your organisation.					
2.1 Where the business need is					
Unique	1	2	3	4	5
Common	1	2	3	4	5
Not a core competency	1	2	3	4	5
2.2 In-house					
Function experience exist	1	2	3	4	5
Technical experience does not exist	1	2	3	4	5
2.3 Project Skills					
Desire to build in-house skills	1	2	3	4	5
Skills are not strategic	1	2	3	4	5
The decision to outsource is strategic	1	2	3	4	5
2.4 Project Management					
Project management capabilities exist within organisation	1	2	3	4	5
Project management capabilities does not exist within organisation	1	2	3	4	5
2.5 Time Frame					
Flexible	1	2	3	4	5
Short	1	2	3	4	5

3. In your opinion the criteria for evaluating the decision to purchase an information system depends on the following factors when seeking to upgrade or replace legacy systems with new information systems in your organisation.					
3.1 Where the business need is					
Unique	1	2	3	4	5
Common	1	2	3	4	5
Not a core competency	1	2	3	4	5
3.2 In-house					
Function experience exist	1	2	3	4	5
Technical experience does not exist	1	2	3	4	5
3.3 Project Skills					
Desire to build in-house skills	1	2	3	4	5
Skills are not strategic	1	2	3	4	5
The decision to outsource is strategic	1	2	3	4	5
3.4 Project Management					
Project management capabilities exist within organisation	1	2	3	4	5
Project management capabilities do not exist within organisation	1	2	3	4	5
3.5 Time Frame					
Flexible	1	2	3	4	5
Short	1	2	3	4	5

4. In your opinion the criteria for evaluating the decision to in-source an information system depends on the following factors when seeking to upgrade or replace legacy systems with new information systems in your organisation.					
4.1 Where the business need is					
Unique	1	2	3	4	5
Common	1	2	3	4	5
Not a core competency	1	2	3	4	5
4.2 In-house					
Function experience exist	1	2	3	4	5
Technical experience does not exist	1	2	3	4	5
4.3 Project Skills					
Desire to build in-house skills	1	2	3	4	5
Skills are not strategic	1	2	3	4	5
The decision to outsource are strategic	1	2	3	4	5
4.4 Project Management					
Project management capabilities exist within organisation	1	2	3	4	5
Project management capabilities do not exist within organisation	1	2	3	4	5
4.5 Time Frame					
Flexible	1	2	3	4	5
Short	1	2	3	4	5

The following question must only be completed if you are part of management:

Select the approaches that are relevant and rate each one of the following elements on a scale of 1 to 5 according to their relevance. (1 = Not Relevant, 5 = Very Relevant)

5. Does your organisation make use of any of the following approaches to calculate the capital benefit of new/enhanced information systems to your organisation?					
5.1 NPV (Net Present Value)	1	2	3	4	5
5.2 ROI (Return on Investment)	1	2	3	4	5
5.3 Breakeven	1	2	3	4	5
5.4 EVA (Economic value added)	1	2	3	4	5
5.5 TCO (Total cost of Ownership)	1	2	3	4	5
5.6 Balanced Scorecard	1	2	3	4	5
5.7 Other (please specify)					
	1	2	3	4	5
	1	2	3	4	5

If you have any opinion or can add additional comments or alternatives please feel free to add your comments below.

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Thank you for completing the questionnaire!

APPENDIX B: RESPONSE SUMMARY TABLE

Response Summary Table									
Question	**Description**	**Valid %**					**# Missing**	**Mean**	**Std.Dev**
		1	**2**	**3**	**4**	**5**			
B.1.1	**In your opinion being a Market ..... (Leader or Follower) will lead to the following advantages for your organisation**								
B.1.1.1	Greater efficiency	1.1	6.4	27.7	35.1	29.8	**0**	3.86	.957
B.1.1.2	Lower Cost	6.4	11.7	12.8	28.7	40.4	**0**	3.85	1.253
B.1.1.3	Higher Profits	0.0	3.2	28.7	36.2	31.9	**0**	3.97	.861
B.1.1.4	Reputation for innovation	5.3	19.1	19.1	28.7	27.7	**0**	3.54	1.233
B.1.1.5	Knowledge (learning)	3.2	10.6	19.1	41.5	25.5	**0**	3.76	1.054
B.1.1.6	Competitive advantage	7.4	14.9	19.1	21.3	37.2	**0**	3.66	1.316
B.1.2	**In your opinion being a Market ..... (Leader or Follower) will lead to the following disadvantages for your organisation**								
B.1.2.1	Risk (for example; reputational)	11.7	26.6	35.1	21.3	5.3	**0**	2.82	1.067
B.1.2.2	Cost of Development	11.7	21.3	37.2	21.3	8.5	**0**	2.94	1.115
B.1.2.3	Cost of Marketing	6.5	26.1	40.2	21.7	5.4	**2**	2.93	.981
B.1.2.4	Adverse impact on existing products	11.7	20.2	27.7	23.4	17.0	**0**	3.14	1.258
C.3	**In your opinion rate the following:**								
C.3.1	In your opinion does the alignment of a technology strategy give your organisation a competitive advantage?	2.1	11.7	14.9	26.6	44.7	**0**	4.00	1.126
C.3.2	In your opinion does the alignment of a technology strategy help the organisation to achieve operational excellence?	3.2	9.6	14.9	27.7	44.7	**0**	4.01	1.131
C.3.3	Alignment of a technology strategy creates and support business unit partnership within the organisation. (business units work together)	3.2	13.8	19.1	29.8	34.0	**0**	3.78	1.156
C.3.4	In your opinion does your technology strategy fit with your organisation's strategic goals?	5.3	11.7	17.0	33.0	33.0	**0**	3.77	1.186
C.3.5	In your opinion does your organisational technology strategy fit the organisation's business processes?	2.1	12.8	22.3	41.5	21.3	**0**	3.67	1.020
D.1	**Which of the following options do you think you should consider when seeking to fulfil your organisation's requirement for information systems?**								
D.1.1	The use of Purchase Packaged software from a vendor	5.3	13.8	33.0	30.9	17.0	**0**	3.40	1.091
D.1.2	The use of open source offerings	21.3	21.3	36.2	18.1	3.2	**0**	2.61	1.109
D.1.3	The use of SaaS (Software as a	0.0	13.8	44.7	25.5	16.0	**0**	3.44	.922

	service)								
D.1.4	Outsource development and other IT functions	17.0	24.5	40.4	10.6	7.4	**0**	2.67	1.111
D.1.5	Develop in-house all or part of the effort	1.1	10.6	27.7	29.8	30.9	**0**	3.79	1.036
D.4	**In your opinion purchasing software from a vendor has the following benefits.**								
D.4.1	Time saved in development	0.0	2.2	15.1	44.1	38.7	**1**	4.19	.770
D.4.2	Software are field tested	4.3	6.4	10.6	44.7	34.0	**0**	3.98	1.047
D.4.3	Software are robust	2.1	10.6	31.9	29.8	25.5	**0**	3.66	1.043
D.4.4	Software incorporates best practices from industry	5.3	13.8	25.5	27.7	27.7	**0**	3.59	1.186
D.4.5	No need to re-invent the wheel	0.0	1.1	19.1	51.1	28.7	**0**	4.07	.722
D.4.6	Uniform user interfaces	3.2	10.6	31.9	41.5	12.8	**0**	3.50	.959
D.4.7	Ease of use	0.0	3.2	47.9	36.2	12.8	**0**	3.59	.754
D.4.8	Easier migration to integrated solutions	3.2	12.8	38.3	24.5	21.3	**0**	3.48	1.065
D.4.9	Support to system are available	4.3	5.3	22.3	50.0	18.1	**0**	3.72	.966
D.4.10	Good business and functionality fit to organisation	4.3	13.8	39.4	35.1	7.4	**1**	3.28	.944
D.4.11	Customization of software to fit organisational requirements	10.6	10.6	34.0	30.9	13.8	**1**	3.27	1.156
D.4.12	Cost of Licensing	6.4	14.9	26.6	25.5	26.6	**1**	3.51	1.216
D.5	**In your opinion open source offerings have the following benefits.**								
D.5.1	Time saved in development	11.8	14.0	19.4	28.0	26.9	**1**	3.44	1.339
D.5.2	Software are field tested	12.9	29.0	38.7	14.0	5.4	**1**	2.70	1.040
D.5.3	Software are robust	18.3	21.5	29.0	24.7	6.5	**1**	2.80	1.194
D.5.4	Software incorporates best practices from industry	23.9	21.7	30.4	17.4	6.5	**2**	2.61	1.213
D.5.5	No need to re-invent the wheel	17.4	14.1	38.0	25.0	5.4	**2**	2.87	1.141
D.5.6	Uniform user interfaces	14.1	31.5	31.5	15.2	7.6	**2**	2.71	1.125
D.5.7	Ease of use	8.7	30.4	21.7	26.1	13.0	**2**	3.04	1.204
D.5.8	Easier migration to integrated solutions	6.6	36.3	18.7	27.5	11.0	**2**	3.00	1.164
D.5.9	Support to system are available	29.3	13.0	26.1	19.6	12.0	**2**	2.72	1.385
D.5.10	Good business and functionality fit to organisation	21.7	19.6	30.4	23.9	4.3	**1**	2.70	1.184
D.5.11	Customization of software to fit organisational requirements	20.7	18.5	19.6	18.5	22.8	**1**	3.04	1.459
D.5.12	Cost of Licensing	17.4	16.3	18.5	33.7	14.1	**1**	3.11	1.330
D.6	**In your opinion SaaS (Software as a service) offerings have the following benefits.**								
D.6.1	Time saved in development	0.0	4.3	31.5	44.6	19.6	**2**	3.79	.806
D.6.2	Software are field tested	0.0	2.2	33.7	46.7	17.4	**2**	3.79	.749
D.6.3	Software are robust	0.0	2.2	29.3	51.1	18.5	**2**	3.86	.735
D.6.4	Software incorporates best practices from industry	0.0	15.4	31.9	29.7	23.1	**3**	3.60	1.010
D.6.5	No need to re-invent the wheel	10.9	7.6	21.7	34.8	25.0	**2**	3.55	1.252
D.6.6	Uniform user interfaces	2.2	18.5	28.3	44.6	6.5	**2**	3.35	.931
D.6.7	Ease of use	1.1	13.0	30.4	42.4	13.0	**2**	3.53	.919

D.6.8	Easier migration to integrated solutions	0.0	1.1	33.7	51.1	14.1	**2**	3.78	.693
D.6.9	Support to system are available	1.1	3.3	27.2	44.6	23.9	**2**	3.87	.854
D.6.10	Good business and functionality fit to organisation	0.0	10.9	42.4	26.1	20.7	**2**	3.57	.941
D.6.11	Customization of software to fit organisational requirements	13.0	12.0	25.0	39.1	10.9	**2**	3.23	1.196
D.6.12	Cost of Licensing	8.7	17.4	33.7	26.1	14.1	**2**	3.20	1.151
D.7	**In your opinion to outsource development or other IT functions has the following benefits**								
D.7.1	Software are robust	0.0	10.9	39.1	34.8	15.2	**2**	3.54	.882
D.7.2	Software incorporates best practices from industry	9.8	10.9	37.0	31.5	10.9	**2**	3.23	1.100
D.7.3	No need to re-invent the wheel	3.3	9.8	52.2	28.3	6.5	**2**	3.25	.847
D.7.4	Uniform user interfaces	0.0	8.7	43.5	40.2	7.6	**2**	3.47	.762
D.7.5	Ease of use	6.5	9.8	29.3	34.8	20.7	**2**	3.53	1.124
D.7.6	Easier migration to integrated solutions	2.2	12.0	38.0	37.0	10.9	**2**	3.42	.917
D.7.7	Support to system are available	4.3	12.0	22.8	38.0	22.8	**2**	3.63	1.097
D.7.8	Good business and functionality fit to organisation	1.1	6.5	42.4	34.8	15.2	**2**	3.57	.868
D.7.9	Customization of software to fit organisational requirements	2.2	9.8	22.8	34.8	30.4	**2**	3.82	1.048
D.7.10	Cost of Licensing	8.7	18.5	32.6	29.3	10.9	**2**	3.15	1.119
D.8	**In your opinion to develop in-house, all or part of the effort allows organisations the following benefits**								
D.8.1	Software are robust	3.2	8.5	25.5	31.9	30.9	**0**	3.79	1.076
D.8.2	Software incorporates best practices from industry	2.1	8.5	28.7	38.3	22.3	**0**	3.70	.982
D.8.3	No need to re-invent the wheel	6.4	30.9	29.8	19.1	13.8	**0**	3.03	1.150
D.8.4	Uniform user interfaces	1.1	10.6	29.8	42.6	16.0	**0**	3.62	.917
D.8.5	Ease of use	0.0	5.3	25.5	37.2	31.9	**0**	3.96	.891
D.8.6	Easier migration to integrated solutions	2.1	4.3	17.0	44.7	31.9	**0**	4.00	.927
D.8.7	Support to system are available	6.4	3.2	16.0	26.6	47.9	**0**	4.06	1.162
D.8.8	Good business and functionality fit to organisation	0.0	3.2	13.8	29.8	53.2	**0**	4.33	.835
D.8.9	Customization of software to fit organisational requirements	2.1	7.4	8.5	18.1	63.0	**0**	4.34	1.053
D.8.10	Cost of Licensing	8.5	19.1	27.7	12.8	31.9	**0**	3.40	1.339
E.1	**In your opinion the following factors have an influence on the decision to make, buy or rent information systems.**								
E.1.1	Competitive Advantage	5.3	8.5	18.1	41.5	26.6	**0**	3.76	1.104
E.1.2	Security	0.0	3.2	26.6	26.6	43.6	**0**	4.11	.910
E.1.3	Skills	0.0	9.6	20.2	37.2	33.0	**0**	3.94	.959
E.1.4	Expertise	0.0	6.4	31.9	29.8	31.9	**1**	3.87	.942
E.1.5	Available resources	3.2	7.4	13.8	45.7	29.8	**1**	3.91	1.012
E.1.6	Cost	2.1	3.2	22.3	31.9	40.4	**1**	4.05	.977

E.1.7	Time	0.0	2.1	20.2	37.2	40.4	**1**	4.16	.820
E.1.8	Implementation of system	4.3	8.5	14.9	37.2	35.1	**1**	3.90	1.108
E.1.9	Support to system are available	0.0	3.2	22.3	37.2	36.2	**1**	4.10	.868
E.1.10	Maintenance and upgrades	0.0	1.1	26.6	44.7	27.7	**0**	3.99	.769
E.1.11	System performance	3.2	7.4	16.0	29.8	43.6	**0**	4.03	1.092
E.1.12	Quality	0.0	3.2	19.1	29.8	47.9	**0**	4.22	.869
E.1.13	Documentation and training	4.3	11.7	21.3	36.2	26.6	**0**	3.69	1.117
E.1.14	Vendor issues (contract length and or supplier relationship)	2.1	11.7	33.0	33.0	20.2	**0**	3.57	1.011
E.1.15	The size of the organisation	2.2	7.5	34.4	38.7	17.2	**0**	3.61	.933
E.1.16	Number of expected annual transactions by your organisation	1.1	14.9	35.1	33.0	16.0	**0**	3.48	.970
E.1.17	Software control	0.0	4.3	41.5	37.2	17.0	**0**	3.67	.808
E.1.18	Business functionality	0.0	4.3	24.5	24.5	46.8	**0**	4.14	.934
E.1.19	Technical functionality	4.3	5.3	25.5	26.6	38.3	**0**	3.89	1.112
E.1.20	Productivity improvements	0.0	1.1	17.2	37.6	44.1	**0**	4.25	.775
E.1.21	Increased Turnover	1.1	8.6	18.3	22.6	49.5	**0**	4.11	1.058
E.2	**In your opinion the criteria for evaluating the decision to develop an information systems in-house depends on the following factors when seeking to upgrade or replace legacy systems with new information systems in your organisation.**								
E.2.1.1	Where the Business need is Unique	0.0	3.2	9.6	44.7	42.6	**0**	4.27	.764
E.2.1.2	Where the Business need is Common	26.6	27.7	27.7	13.8	4.3	**0**	2.41	1.149
E.2.1.3	Where the Business need is not a core competency	25.5	27.7	40.4	6.4	0.0	**0**	2.28	.921
E.2.2.1	In house functional experience exist	0.0	2.1	18.1	50.0	29.8	**0**	4.07	.751
E.2.2.2	Technical experience does not exist	26.6	26.6	23.4	21.3	2.1	**0**	2.46	1.161
E.2.3.1	Desire to build in house project skills	5.4	6.5	14.0	36.6	37.6	**1**	3.95	1.126
E.2.3.2	Project skills are not strategic	21.5	29.0	28.0	17.2	4.3	**1**	2.54	1.138
E.2.3.3	The decision to outsource is strategic	4.3	11.8	41.9	22.6	19.4	**1**	3.41	1.066
E.2.4.1	Project management capabilities exist within the organisation	0.0	4.3	19.1	26.6	50.0	**0**	4.22	.906
E.2.4.2	Project management capabilities does not exist within the organisation	34.0	25.5	27.7	9.6	3.2	**0**	2.22	1.118
E.2.5.1	Time frame is flexible	2.1	5.3	14.9	39.4	38.3	**0**	4.06	.971
E.2.5.2	Time frame is short	24.5	19.1	24.5	23.4	8.5	**0**	2.72	1.299
E.3	**In your opinion the criteria for evaluating the decision to purchase an information system depends on the following factors when seeking to upgrade or replace legacy systems with new information systems in your organisation.**								
E.3.1.1	Where the Business need is Unique	17.0	23.4	24.5	24.5	10.6	**0**	2.88	1.260
E.3.1.2	Where the Business need is Common	2.1	5.3	14.9	45.7	31.9	**0**	4.00	.939
E.3.1.3	Where the Business need is not a core competency	3.2	23.4	30.9	12.8	29.8	**0**	3.43	1.231
E.3.2.1	In house functional experience exist	14.9	22.3	35.1	7.4	20.2	**0**	2.96	1.311
E.3.2.2	Technical experience does not exist	6.4	11.7	27.7	26.6	27.7	**0**	3.57	1.196
E.3.3.1	Desire to build in house project skills	19.1	25.5	30.9	21.3	3.2	**0**	2.64	1.115

E.3.3.2	Project skills are not strategic	5.3	16.0	35.1	27.7	16.0	**0**	3.33	1.091
E.3.3.3	The decision to outsource is strategic	8.5	5.3	24.5	41.5	20.2	**0**	3.60	1.129
E.3.4.1	Project management capabilities exist within the organisation	18.1	23.4	36.2	14.9	7.4	**0**	2.70	1.153
E.3.4.2	Project management capabilities does not exist within the organisation	3.2	19.1	21.3	23.4	33.0	**0**	3.64	1.217
E.3.5.1	Time frame is flexible	4.3	0.0	37.2	39.4	19.1	**0**	3.69	.928
E.3.5.2	Time frame is short	3.2	3.2	37.2	33.0	23.4	**0**	3.70	.971
E.4	**In your opinion the criteria for evaluating the decision to in-source an information system depends on the following factors when seeking to upgrade or replace legacy systems with new information systems in your organisation.**								
E.4.1.1	Where the Business need is Unique	17.0	11.7	20.2	23.4	27.7	**0**	3.33	1.432
E.4.1.2	Where the Business need is Common	14.9	24.5	35.1	19.1	6.4	**0**	2.78	1.118
E.4.1.3	Where the Business need is not a core competency	13.8	6.4	27.7	34.0	18.1	**0**	3.36	1.252
E.4.2.1	In house functional experience exist	18.1	16.0	40.4	19.1	6.4	**0**	2.80	1.141
E.4.2.2	Technical experience does not exist	4.3	3.2	24.5	42.6	25.5	**0**	3.82	.994
E.4.3.1	Desire to build in house project skills	17.2	14.0	28.0	15.1	25.8	**1**	3.18	1.414
E.4.3.2	Project skills are not strategic	12.9	12.9	26.9	30.1	17.2	**1**	3.26	1.259
E.4.3.3	The decision to outsource are strategic	11.8	12.9	29.0	22.6	23.7	**1**	3.33	1.297
E.4.4.1	Project management capabilities exist within the organisation	13.8	12.8	22.3	30.9	20.2	**0**	3.31	1.312
E.4.4.2	Project management capabilities does not exist within the organisation	8.5	23.4	22.3	22.3	23.4	**0**	3.29	1.292
E.4.5.1	Time frame is flexible	2.1	4.3	45.7	26.6	21.3	**0**	3.61	.941
E.4.5.2	Time frame is short	17.0	10.6	23.4	36.2	12.8	**0**	3.17	1.284
E.5	**Does your organisation make use of any of the following approaches to calculate the capital benefit of new/enhanced information systems to your organisation?**								
E.5.1	NPV (Net Present Value)	15.4	23.1	15.4	7.7	38.5	**81**	3.31	1.601
E.5.2	ROI (Return on Investment)	7.7	15.4	15.4	15.4	46.2	**81**	3.77	1.423
E.5.3	Breakeven	8.3	25.0	33.3	8.3	25.0	**82**	3.17	1.337
E.5.4	EVA (Economic value added)	8.3	16.7	8.3	50.0	16.7	**82**	3.50	1.243
E.5.5	TCO (Total cost of Ownership)	0.0	25.0	16.7	33.3	25.0	**82**	3.58	1.165
E.5.6	Balance Scorecard	0.0	16.7	16.7	50.0	16.7	**82**	3.67	.985

APPENDIX C: ORGANISATION MAIL LIST

COMPANY NAME
OSTER Engineering
ATAVIC Engineering
Prodin Engineering
Elgin Engineering
Kappa Heavy Engineering (Pty) Ltd
AMG Engineering
S-TECH HEAVY ENGINEERING (PTY) LTD
DCD-DORBYL Heavy Engineering Vereeniging
DCD-DORBYL Heavy Engineering Venco
DCD-DORBYL RSD
DCD-DORBYL Cape Town Marine
DCD-DORBYL Ringrollers
Union Carriage & Wagon

APPENDIX D: MANAGER VERSUS NON MANAGER GROUP MEANS

Question	Description	Manager	N	Mean	Std.Dev	Independent sample t-test	Mann-Whitney	Effect size
						p-value	p-value	
E.1.1	Competitive Advantage	Yes	11	4.27	0.647	0.020	0.115	0.516
		No	83	3.69	1.136			
E.1.2	Security	Yes	11	4.36	0.809	0.289	0.337	0.316
		No	83	4.07	0.921			
E.1.3	Skills	Yes	11	4.55	0.522	0.002	0.025	0.706
		No	83	3.86	0.977			
E.1.4	Expertise	Yes	11	4.55	0.522	0.001	0.011	0.802
		No	83	3.78	0.951			
E.1.5	Available resources	Yes	11	4.27	1.009	0.233	0.133	0.401
		No	83	3.87	1.009			
E.1.6	Cost	Yes	11	3.64	1.286	0.263	0.249	0.367
		No	83	4.11	0.924			
E.1.7	Time	Yes	11	4.36	0.674	0.317	0.435	0.276
		No	83	4.13	0.838			
E.1.8	Implementation of system	Yes	11	4.00	0.632	0.641	0.809	0.094
		No	83	3.89	1.158			
E.1.9	Support to system are available	Yes	11	4.55	0.522	0.013	0.068	0.573
		No	83	4.04	0.890			
E.1.10	Maintenance and upgrades	Yes	11	4.27	0.786	0.225	0.194	0.408
		No	83	3.95	0.764			
E.1.11	System performance	Yes	11	4.82	0.405	0.000	0.005	0.800
		No	83	3.93	1.113			
E.1.12	Quality	Yes	11	4.64	0.505	0.018	0.117	0.523
		No	83	4.17	0.895			
E.1.13	Documentation and training	Yes	11	4.09	0.944	0.167	0.205	0.399
		No	83	3.64	1.132			
E.1.14	Vendor issues (contract length and or supplier relationship)	Yes	11	3.91	0.944	0.237	0.227	0.373
		No	83	3.53	1.016			
E.1.15	The size of the organisation	Yes	11	3.82	0.982	0.471	0.451	0.237
		No	82	3.59	0.929			
E.1.16	Number of expected annual transactions by your organisation	Yes	11	4.00	0.775	0.037	0.057	0.605
		No	83	3.41	0.976			
E.1.17	Software control	Yes	11	3.73	0.786	0.803	0.855	0.079
		No	83	3.66	0.816			
E.1.18	Business functionality	Yes	11	4.27	0.786	0.566	0.724	0.159
		No	83	4.12	0.955			

Question	Description	Manager	N	Mean	Std.Dev	Independent sample t-test	Mann-Whitney	Effect size
E.1.19	Technical functionality	Yes	11	4.45	0.688	0.017	0.080	0.558
		No	83	3.82	1.139			
E.1.20	Productivity improvements	Yes	11	4.82	0.405	0.000	0.007	0.827
		No	82	4.17	0.783			
E.1.21	Increased Turnover	Yes	11	4.18	0.874	0.775	0.995	0.078
		No	82	4.10	1.084			
		No	83	3.78	0.613			

APPENDIX E: LEADER VERSUS FOLLOWER

Question	Description	Leader (1) or Follower (2)	N	Mean	Std.Dev	Independed sample t-test	Mann-Whitney	Effect size
						p-value	p-value	
B.1.1	**In your opinion being a Market ..... (Leader or Follower) will lead to the following advantages for your organisation?**							
B.1.1.1	Greater efficiency	1	40	4.38	0.740	0.000	0.000	0.969
		2	53	3.47	0.932			
B.1.1.2	Lower Cost	1	40	4.23	1.121	0.008	0.005	0.530
		2	53	3.55	1.280			
B.1.1.3	Higher Profits	1	40	4.48	0.716	0.000	0.000	1.155
		2	53	3.58	0.770			
B.1.1.4	Reputation for innovation	1	40	4.48	0.640	0.000	0.000	1.448
		2	53	2.87	1.110			
B.1.1.5	Knowledge (learning)	1	40	4.45	0.552	0.000	0.000	1.143
		2	53	3.25	1.054			
B.1.1.6	Competitive advantage	1	40	4.73	0.506	0.000	0.000	1.570
		2	53	2.89	1.171			
B.1.2	**In your opinion being a Market ..... (Leader or Follower) will lead to the following disadvantages for your organisation?**							
B.1.2.1	Risk (for example, reputational)	1	40	2.60	1.236	0.105	0.044	0.308
		2	53	2.98	0.909			
B.1.2.2	Cost of Development	1	40	3.15	1.210	0.118	0.154	0.311
		2	53	2.77	1.031			
B.1.2.3	Cost of Marketing	1	39	3.08	1.010	0.237	0.291	0.248
		2	52	2.83	0.964			
B.1.2.4	Adverse impact on existing products	1	40	3.68	1.439	0.001	0.000	0.626
		2	53	2.77	0.912			

APPENDIX F: SEQUENTIAL VERSUS SIMULTANEOUS

Question	Description	Seq. (2) or Sim. (3)	N	Mean	Std.Dev	Independed sample t-test	Mann-Whitney	Effect size
						p-value	p-value	
		3	45	2.91	1.411			
C.3	**In your opinion rate the following**							
C.3.1	In your opinion does the alignment of a technology strategy give your organisation a competitive advantage?	2	28	3.54	1.374	0.016	0.032	0.532
		3	45	4.27	0.863			
C.3.2	In your opinion does the alignment of a technology strategy help the organisation to achieve operational excellence?.	2	28	3.43	1.425	0.005	0.004	0.635
		3	45	4.33	0.929			
C.3.3	Alignment of a technology strategy creates and supports business unit partnership within the organisation. (business units work together)	2	28	3.50	1.427	0.121	0.139	0.350
		3	45	4.00	1.108			
C.3.4	In your opinion does your technology strategy fit with your organisation's strategic goals?	2	28	3.07	1.331	0.001	0.001	0.781
		3	45	4.11	1.049			
C.3.5	In your opinion does your organisational technology strategy fit the organisation's business processes?	2	28	3.07	1.152	0.000	0.000	0.844
		3	45	4.04	0.852			
		3	45	3.98	0.450			

APPENDIX G: DIMENSION REDUCTION AND CORRELATION

			E.1.1 Competitive Advantage	E.1.2 Security	E.1.3 Skills	E.1.4 Expertise	E.1.5 Available resources	E.1.6 Cost	E.1.7 Time	E.1.8 Implementation of system	E.1.9 Support to system are available	E.1.10 Maintenance and upgrades	E.1.11 System performance	E.1.12 Quality
Factor 1	Purchasing software from a vendor has the following benefits	Correlation Coefficient	.342**	.234*	-.042	.170	.273**	.126	.193	.505**	.448**	.124	.351**	.202
		Sig. (2-tailed)	.001	.023	.689	.101	.008	.225	.063	.000	.000	.233	.001	.051
		N	94	94	94	94	94	94	94	94	94	94	94	94
Factor 2	Open source offerings has the following benefits	Correlation Coefficient	-.095	-.165	-.153	-.146	-.123	-.133	-.188	-.200	-.107	.011	-.132	-.237*
		Sig. (2-tailed)	.367	.115	.142	.163	.242	.202	.071	.055	.305	.913	.206	.022
		N	93	93	93	93	93	93	93	93	93	93	93	93
Factor 3	Saas (Software as a service) offerings has the following benefits	Correlation Coefficient	.282**	.013	.188	.247*	.125	.010	.121	.173	.167	.104	.220*	.076
		Sig. (2-tailed)	.006	.899	.073	.018	.237	.923	.249	.100	.111	.326	.035	.472
		N	92	92	92	92	92	92	92	92	92	92	92	92
Factor 4	Outsource development or other IT functions has the following	Correlation Coefficient	.366**	.276**	.214*	.198	.277**	.019	.131	.282**	.365**	.104	.264*	.193
		Sig. (2-tailed)	.000	.008	.041	.059	.007	.856	.214	.006	.000	.324	.011	.065

	benefits	N	92	92	92	92	92	92	92	92	92	92	92	92
Factor 5	Develop in-house all or part of the effort allows organisations the following benefits	Correlation Coefficient	.394**	.345**	.276**	.328**	.388**	.110	.257*	.518**	.473**	.287**	.541**	.391**
		Sig. (2-tailed)	.000	.001	.007	.001	.000	.292	.012	.000	.000	.005	.000	.000
		N	94	94	94	94	94	94	94	94	94	94	94	94

*. Correlation is significant at the 0.05 level (2-tailed).

**. Correlation is significant at the 0.01 level (2-tailed).

			E.1.13	E.1.14	E.1.15	E.1.16	E.1.17	E.1.18	E.1.19	E.1.20	E.1.21
			Documentation and training	Vendor issues (contract length and or supplier relationship)	The size of the organisation	Number of expected annual transactions by your organisation	Software control	Business functionality	Technical functionality	Productivity improvements	Increased Turnover
		Mean	4.25	4.11	3.94	3.87	3.91	4.05	4.16	3.90	4.10
Factor 1	Purchasing software from a vendor has the following benefits	Correlation Coefficient	.374**	-.064	-.293**	-.226*	-.048	.367**	.188	.163	.339**
		Sig. (2-tailed)	.000	.538	.004	.029	.646	.000	.070	.118	.001
		N	94	94	93	94	94	94	94	93	93
Factor 2	Open source offerings has the following benefits	Correlation Coefficient	-.264*	.247*	.319**	.373**	-.050	-.332**	-.254*	-.216*	-.248*
		Sig. (2-tailed)	.011	.017	.002	.000	.634	.001	.014	.038	.017
		N	93	93	92	93	93	93	93	92	92
Factor 3	Saas (Software as a service) offerings has the following benefits	Correlation Coefficient	.125	.036	-.165	-.023	.005	.252*	.163	.016	.031
		Sig. (2-tailed)	.236	.733	.119	.828	.963	.015	.121	.880	.768
		N	92	92	91	92	92	92	92	92	92
Factor 4	Outsource development or other IT functions has the following benefits	Correlation Coefficient	.305**	.026	-.175	-.114	.049	.344**	.291**	.148	.126
		Sig. (2-tailed)	.003	.805	.097	.281	.643	.001	.005	.160	.231
		N	92	92	91	92	92	92	92	92	92
Factor 5	Develop in-house all or part of the effort allows organisations the following benefits	Correlation Coefficient	.471**	.062	-.075	-.072	.144	.515**	.383**	.265*	.361**
		Sig. (2-tailed)	.000	.552	.477	.492	.167	.000	.000	.010	.000
		N	94	94	93	94	94	94	94	93	93

*. Correlation is significant at the 0.05 level (2-tailed). **. Correlation is significant at the 0.01 level (2-tailed).

APPENDIX H: TEXT EDITOR'S DECLARATION

Thursday, October 27, 2011

THOMAS FRANCOIS MATTHEE

Re: Letter of confirmation of language editing

The MBA mini-dissertation "**Make, buy or rent decision for information systems in the heavy engineering industry***"* was language, technically and typographically edited. THE sources and referencing technique applied was checked to comply with the specific Harvard technique as per North-West University prescriptions.

Antoinette Bisschoff

Officially approved language editor of the NWU