UNIVERSITY OF KWAZULU-NATAL


**Case Study: An Evaluation of the implementation of an Enterprise Resource Planning System (ERP) at a South African municipal entity.**


by


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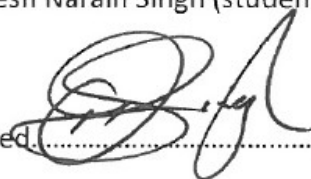Supervisor:  DR UG Singh


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*Declaration*

This research has not been previously accepted for any degree and is not being currently considered for any other degree at any other university.

I declare that this dissertation contains my own work except where specifically acknowledged.

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*Acknowledgements*

*Abstract*

*Enterprise resource planning (ERP) is a computer based software application that is widely implemented in many business organisations. These systems have evolved over the years into component based modules with the ability to easily integrate with other systems, provide real time information and improve information sharing and collaboration. Choosing an ERP system is a complex process and the literature clearly illustrates the failure of organisations to effectively specify, select and implement ERP systems resulting in the inability to effectively harness the associated benefits.*

*This study focuses on a South African water utility and the processes followed in procuring and implementing an ERP system. It is interesting to note, that in this study, despite the utility having experienced a failed ERP implementation decided to replace the same? ERP system. A rigorous process was followed to find a replacement ERP system only to set aside all alternate commercial of-the-shelf systems and re-implement the original failed ERP system.*

*To gain insight of the processes followed, the COTS theoretical framework is presented to bring the reader's attention to associated theoretical studies. In this study, we will conduct a systematic literature review on ERP systems, its background, implementation processes and associated implementation outcomes. This research, presents a case study that will describe and explore the process of ERP implementation at the water utility. We will document the process the utility followed in acquiring and setting up functional and non-functional evaluation criteria for the ERP system. Further, we have considered the processes of preparation, evaluation, selection and implementation. The analysis of the implementation process has brought to light the importance of defining ERP scopes based on business requirements, specifications based on the business scopes and evaluation criterion. The findings and results from this case study will contribute to the conceptual and contextual understanding of the specification, selection and implementation of ERP systems.*

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# List of Acronyms

| | |
|---|---|
| AHP | Analytic Hierarchy Process |
| BOM | Bill of Material |
| CAP | Cots Acquisition Process |
| CAP-EC | Cap Execution Component |
| CAP-IC | Cap Initialization Component |
| CAP-RC | Cap Reuse Component |
| CBSD | COTS-Based Software Development |
| CFO | Chief Financial Officer |
| COTS | Commercial Of-The-Shelf |
| CRE | COTS-Based Requirements Engineering |
| CSF | Critical Success Factors |
| EC | Execution Component |
| ERP | Enterprise Resource Planning |
| IC | Initialisation Component |
| ICT | Information, Communications and Telecommunications |
| IS | Information Systems |
| IT | Information Technology |
| OTSO | Off-The-Shelf Option |
| PORE | Procurement-Oriented Requirements Engineering |
| RC | Reuse Component |
| SCM | Supply Chain Management |
| SDP | System Design Process |
| SE | Systems Engineer |
| SP | Supply Process |
| SST | Social Shaping of Technology |
| TCO | Total Cost of Ownership |
| VPN | Virtual Private Network |
| WAN | Wide Area Networks |
| WSM | Weighted Scoring Method |

# 1. Introduction

## 1.1. Background of Entity

*"Water does not resist. Water flows. When you plunge your hand into it, all you feel is a caress. Water is not a solid wall, it will not stop you. But water always goes where it wants to go, and nothing in the end can stand against it. Water is patient. Dripping water wears away a stone. Remember that, my child. Remember you are half water. If you can't go through an obstacle, go around it. Water does." -Margaret Atwood, The Penelopiad*

A local water and sanitation utility was initially the first entity of its kind which provided a full spectrum of bulk and reticulation water and sanitation services, and in this case, on a regional basis, to its three fully owned shareholders, within the district. Following a section 78 assessment undertaken in 2011, the entity has transferred the water reticulation services back to the municipalities, and now only operates as a bulk water services provider to the shareholders. The utility established itself to be an industry leader with emphasis on a high quality water product, and prides itself on this achievement. The company provides bulk water from various water treatment plants and services approximately 250 000 households. The company's head office and laboratory facilities are situated within its jurisdiction. The utilities' business focus is on the provision of quality bulk water services to its shareholders for distribution by them directly to customers. The entity also provides local laboratory services to the municipalities at affordable prices.

A study was carried out between 1997 and 2000 that included all municipalities in the uThukela catchment area. This included Newcastle, uThukela and Umzinyathi municipalities. The study further included participants from industry and labour, agriculture, organised business, civil-society-based organisations, and non-government organisations. This was made possible with the backing from the South African Department of Water and Sanitation and the Australian government (AUSAID). The outcome of the study was a formation of a partnership which was established in September 2001. In November 2003 the partnership was incorporated because of the conversion from a partnership to a company with limited liabilities. A thirty-year strategic plan known as the SP2030 was developed to model various options to better the entity to effectively execute

its mandate of water and sanitation services. The entity was changed to a bulk water services provider as a result of a Provincial Cabinet decision dated 6 June 2013, which became effective from 1 July 2013.

The entities services provisioning and deliverables focus as provided in the Strategic Plan 2030 (SP2030) which was approved by the shareholders, are as follows:

> "Providing safe bulk drinking water for all our shareholder municipalities to distribute to their customers and rural participants (farmers and remote industries), providing raw bulk water to farmers and industries outside the developed areas, recognising affordable yet effective environmental and catchment management, creating and sustaining a pristine environment, being an important participant in the economy, being a world-class recognised utility for doing more with less, projecting a model example for capacity-building and empowerment, optimal deployment of appropriate and focused technologies, including, information technology and systems, having a dynamic, pulsating and young professional workforce, facilitating unique sourcing deployment, facilitating resourcing at agreed risk, and being a leader in digital workflow processes."

Implementing systems often prove to be costly and often go over the budget; implementation takes longer than initially planned and the end product under-delivers or does not meet the intended business requirements. According to the auditor generals' report for 2013 he states under the section titled, "Risks and concerns associated with systems development and changes in IT systems across government", the first risk identified is "User requirements are not clearly defined". In the same report the auditor general further states in the section titled "Systems implemented at public entities" that many entities procure ERP systems and lack the skill and resources to implement these systems. He further gives examples of replacement of transversal systems that have failed. After seven years, and spending approximately R650 million, the project implementation is still not finalised.

On the establishment of the utility in 2007 an ERP system was implemented but it failed to satisfy the organisation's operational and strategic objectives. Post implementation, the following shortcomings were identified; poor project planning, insufficient user training, implementing vendor lacked technical insight, lack of management involvement, poor testing procedures and no user sign-offs. As a result, the utility was unable to operate

effectively, due to its inability to reconcile the creditors ledger, reconcile sub-ledgers to the main ledger, report on financial information, its financial position and determine actual expenditure to budget. As a result, the utility was not in the position to produce the statutory annual financial statements.

In a desperate attempt to speedily remedy the crisis position that management found themselves in, a decision was taken to implement a new ERP, as the current system was defunct. In this case study the selection and implementation of the new ERP system will be studied.

## 1.2. Research Purpose

According to Amid et al. (2012), Enterprise Resource Planning (ERP) Systems are information systems that are computer based. These systems have evolved over the past years and are now able to perform organisational transactional tasks, customer responses, facilitate integrated real-time production planning and reporting. De Carvalho and Johansson (2009), further state that over the past years, the largest investments in the information systems industry is related to ERP systems. The benefits realised from the implementation of ERP systems include, real-time financial information, real-time production planning, standardise business processes throughout the organisation, and efficient reporting. Managers are now able to better manage their resources (Nah and Delgado, 2006).

Amid et al. (2012) further state that although the implementation of ERP systems may have associated benefits in terms of productivity and competitive advantages, a significantly high risk, approximately 70%, of implementation failure exists. Three quarters of all ERP implementations fail in realising the expected benefits and therefore many implementations are unsuccessful. These ERP implementations were on average over budget by 178% and the project implementation time-lines were 2.5 times longer than initially planned. These implementations only delivery a mere 30% of the expected benefit. These statistics imply that the implementation of ERPs are costly, complex and require substantial planning.

In this research, a case study of an ERP implementation, in a South African municipal entity, will be evaluated in terms of a Commercial of-the-shelf (COTS) theoretical framework. The purpose of the study is therefore to understand the processes followed by the entity in the implementation of the ERP system. This will be achieved by gaining insight on the processes of specification, evaluation, selection, and implementation.

## 1.3. Research Question

This study was guided by the following research question.

- What are the processes followed in the implementation of the ERP system?

To achieve the outcomes of the research question above the following sub-questions were formulated and answered:

- What process was followed in the ERP evaluation criterion setup?
- What frameworks gave insight that informed the implementation?

## 2. Literature Review

In the endeavour to improve organisational performance, increase output, reduce costs and become world class players in their respective arenas of businesses, executives are faced with challenging decisions. "Which ERP should the business procure?" is one of these challenges. The use of large Information Systems (IS) is now common to many organisations and are now tools used to manage many complex business components and processes (Edwards, 2013). One large repository of information, business processes and reporting that is becoming vital to strategic decision-making is Enterprise Resource Planning (ERP). This is a change from organisations having several stand-alone systems with minimal or no data integration resulting in significant effects in performance (Mukwasi, 2013).

This literature review is an attempt to assess the knowledge base on ERP systems. First, we will define ERP to understand what it actually is both as a software product and well as a business tool, thereafter, we will look into the evolution and history and history over the past decades. We will further look at the benefits, risks and factors that contribute to the successful implementation of ERP systems.

### 2.1. ERP, what is it?

The ERP systems ethos is to integrate all business processes into a single unified software based solution.   This is achieved with considerations in information technology (IT) architecture (computers, networks, severs, internet), software based repositories (databases) and business rules and processes built into the software. The primary objective would be to have all business information consolidated, accurate and easily available. Below is a list of cited definitions and what different authors believe an ERP is:

Wei and Wang (2004) describe an Enterprise Resource Planning (ERP) system as an integrated enterprise computing system that has the ability to automate the flow of material, information and financial resources among other functions within an organisation or enterprise on a common database whilst Singla (2008) describes Enterprise Resource Planning software systems (ERP) as encompassing a wide range of software products that can support day-to-day business operations and decision-making processes. An ERP can serve many industries and

numerous functional areas in a consolidated integrated manner, attempting to automate operations such as inventory control, supply chain management, manufacturing scheduling and production, customer relationship management ,sales support, financial and cost accounting, human resources and almost any other data oriented management process (Singh and Singh, 2015).

An Enterprise Resource Planning system is a set of business modules that interconnects functional areas of an organisation, such as production, accounting, finance, customer services and purchasing into a tightly integrated single business system that resides on a common platform for the exchange and flow of information across the enterprise (Beheshti et al., 2014).

Enterprise Resource Planning (ERP) systems, according to Skok and Legge (2002), can be defined as the implementation of standard software modules that are core for business processes, usually combined with bespoke customization for gain competitive differentiation. The aim of such a system is to provide breadth of integration and the depth of functionality across multi-functional and often multi-national organizations.

Enterprise Resource Planning (ERP) is an information technology software system integrating various business processes to improve speed and accessibility of information flow across an organisation (Das Neves et al., 2004).

Finally, according to Seo (2013), Enterprise Resource Planning (ERP) is a computer based software solution that integrates business functions and data into a single system to be shared across a company.

Considering the different definitions and understandings, from above, we can conclude that ERP systems are computer software that consists of various modules (production, finance, human resources, payroll, customer care, inventories etc.) related to specific business functions where information and business processes are stored in a central database. This allows for significant data availability and collaboration between business functions. This data is then extrapolated to support the decision-making process (Chofreh et al., 2014).

## 2.2. Background of ERP systems

The evolution of ERP systems is well illustrated in Figure 1 below titled "Evolution of ERP".
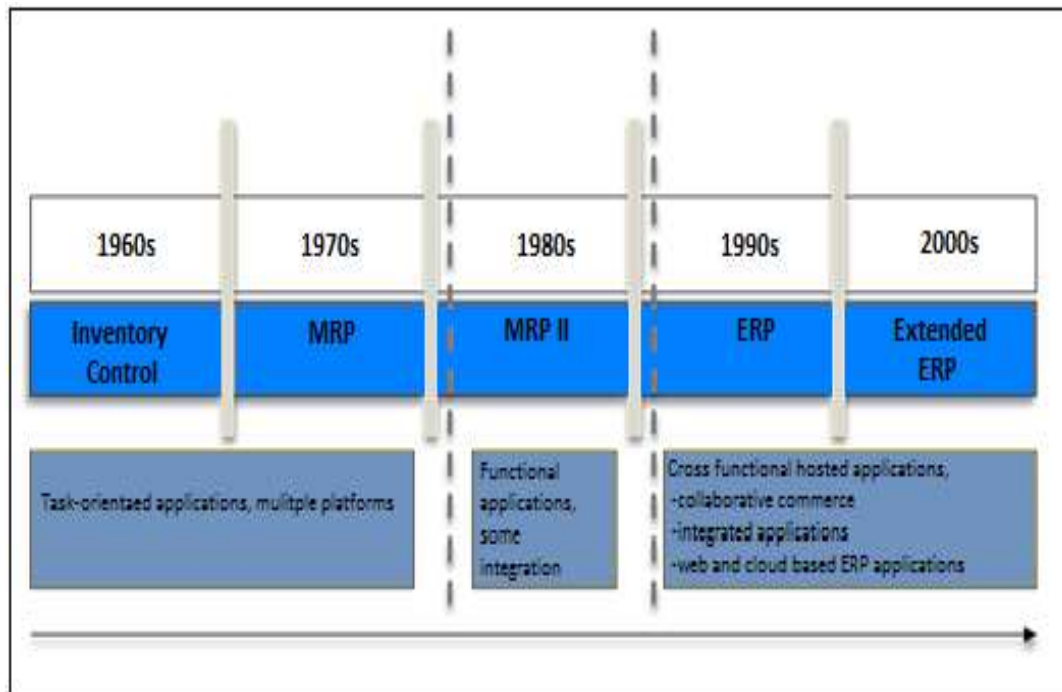


Figure 1 Evolution of ERP ( Rufael, 2007)

The ERP system was born in the manufacturing industries in the 1960s, where focus was on inventory and inventory control or what was known as bill of material (BOM) processing. MRP ran on mainframe computing for processing, and inputs were made from dumb terminals (Rufael, 2007) . The idea was to minimize large amounts manufacturing inventory and to create efficiencies. Bespoke computer software was designed around business processes to achieve this. It was in the 1970's the focus shifted to the control of optimal inventory for the manufacturing process, hence the term "MRP" or Material Requirements Planning (Adam 2010;  Umble et al. 2003).

Ganesh et al., (2014) states that MRP-I was software that automated production planning and inventory control so that the manufacturing process was completed in a seamless manner.

The system achieved the following:

- determined input material for the production process,
- manufactured products from input material are planned and delivered to customers,
- maintained stock levels,
- scheduled manufacturing activities that meet customer delivery schedule, and
- scheduled material purchasing activities to meet manufacturing activities.

A second generation MRP evolved in the 1980s, known as MRP-II systems. These systems were in construction and manufacturing industries, where the correct quantity of inventory was calculated as required, as well as to manage inventories on hand (Restemis and Okpor, 2013). MRP-II was further developed to include powerful calculations for shop floor control, capacity planning, scheduling and other functions. Purchasing, one of the first modules to be included, allowed organisations to cater for cost data and selling price capabilities (Rufael, 2007). With the integration of varied aspects of an organisation there was no duplication of data, improved accuracy and high data integrity (Ganesh et al., 2014). The benefits included:

- accurate, consistent and effective approach to business operations,
- improved control and monitoring of operations,
- adaptation of internal business processes due to the change in market conditions,
- ability of implement any change resulting from customer feedback,
- improved availability of information for faster decision-making,
- consistency and improved information sharing, and
- improved utilisation of materials and inventory.

It was during the 1990s that MRP-II systems started to integrate with other business functions such as human resources, project management, inventory and manufacturing (Adam, 2010). It was at this time that Gartner Group coined the term "Enterprise Resource Planning" which was the next generation of MRP-II (Hart, 2010). The further development of ERP systems was an endeavour to integrate the functions of the entire company. This led to the expansion of ERP systems to co-ordinate company functions globally by using Wide Area Networks (WAN)

(Rufael, 2007).  In the 2000's ERP systems where extended to include different hosted platforms and functionality. Web-based and cloud based systems are gaining popularity.

ERP systems were now able to integrate business function including finance, inventory, distribution, manufacturing, project management, sales and marketing ,accounting, transportation and service and maintenance (Adam 2010; Restemis and Okpor 2013).The ERP system spectrum was now more encompassing and was able to overcome many of the limitations to MRP and MRP II.

Ganesh et al. (2014) states that ERP systems integrate business processes of department functions into one unified system. This integrated system with different components or modules of software and hardware take care of the varied business processes, thereby creating one unified view of the business. The main concept of a unified system is the use of a single enterprise database.

## 2.3. Benefits of ERP

Over the years it has become evident that with the implementation of IT systems, resultant benefits arise, such as cost cutting, improved output and automation of repetitive operations. Merely by implementing the appropriate information technologies organisations can streamline processes and enjoy the benefits of increased turnaround times, automate transaction processing, substituting labour and improved operational volumes (Shang and Seddon, 2000).

Table 1 The benefits of ERP systems (Rufael, 2007)

| Dimensions | Sub dimensions |
|---|---|
| **Operational** | Cost reduction |
| | Cycle time reduction |
| | Productivity improvement |
| | Quality Improvement |
| | Customer service improvement |
| **Managerial** | Better resource Management |
| | Improved decision-making and planning |
| | Performance improvement |
| **Strategic** | Support for business growth and alliance |
| | Building business Innovation and cost leadership |
| | Building external linkages and e-commerce |
| | Generating product differentiation |
| | Sustain competitiveness |
| **IT infrastructure** | Building business flexibility |
| | IT cost reduction |
| | Increased IT infrastructure Capability |
| **Organizational** | Changing work Pattern |
| | Facilitating organizational learning |
| | Empowerment |
| | Building Common Vision |
| | Shifting work focus |
| | Increased Employee morale and satisfaction |

An ERP system also has advantages in terms of improved access to information, when compared to legacy systems with disparate data stores leading to difficulties in developing reports and manipulating data. With modern ERP systems organisations have great flexibility and capabilities regarding data warehousing (Swartz and Orgill, 2001). Rufael (2007) and Swartz and Orgill (2001) agree by stating that all data for transactional processing and reporting can be easily managed from one unified central data repository.

Improved workflow and business processes are another benefit associated with ERP systems (Rufael, 2007).

As an example, electronic online requisitioning is a powerful ERP component that allows for a paperless environment with intelligent computer based approval algorithms, rather than a cumbersome and time-consuming paper based process. Unlike the paper based process, ERP systems encompass powerful features, like processing requisitions against budgets, alerts to budget managers on overspent budgets, alerts on underspent budgets and control measures in terms of delegation of authorities (Swartz and Orgill, 2001). According to Rufael (2007), ERP systems allow managers to have a corporate wide view of value creation and costing structures. Further to that organisations become more customer driven rather than product driven.

Shang and Seddon (2000) and Restemis and Okpor (2013) argue that there are five types of dimensional benefits derived from ERP systems. These benefits are operational, managerial, strategic, IT infrastructure and organisational. Table 1 above, lists the operational and sub-dimensions of ERP benefits and are further explained below.

### *Operational Benefits*

ERP systems, by design automates business processes and therefore should bring some benefits such as cost reduction, improved productivity, improved turnaround times, quality, reduced development risks, greater customer service and increased global competition.

### *Managerial Benefits*

ERP systems benefit senior managers with a centralised database with built in data analysis tools for the manipulation and extrapolation of information. This results in improved resource management, planning, and decision-making and performance improvements across organisational divisions.

### *Strategic Benefits*

Executives focus on competitiveness stem from leadership, cost and product differentiation which is made possible by ERP systems. Integrated IT systems create opportunities for differentiation by customising products and services to meet individual consumer requirements at substantially lower costs. Strategic benefits made possible by ERP systems include: business growth, innovation, alliance, cost, differentiation and external linkages.

*IT infrastructure Benefits*

Sharable, scalable and reusable IT infrastructure resources provide a platform to enable business applications. Therefore, IT infrastructure investment should be a fundamental objective of organisations. Standard application and infrastructure architecture can support business flexibility, reduce IT costs and increased capability for the fast implementation of new business applications.

*Organisational Benefits*

IT is highly relied upon for its flexible system co-ordination and integrated processing in supporting a flattened organisational structure and in achieving common employee communications and in empowering users. Organisational learning behaviour can be easily facilitated using IT tools, system accumulated information and application knowledge. ERP systems can improve organisational capabilities by building common vision, empowering workers, supporting organisational changes and facilitating a learning culture.

Steyn (2008) however states that in an assessment of China Telecoms ERP implementation project, the following key resulting benefits where highlighted:

- scalable and flexible ERP allowed for initial focus on essential business needs,
- fast implementation while maintaining full adaptability,
- comprehensive business analysis and insight, supporting rapid decision-making and improved operational control, and
- improved information flow enhancing internal collaboration and increased employee productivity.

**Table 2 Top 10 benefits and ERP systems (Roman, 2009)**

| Rank | Benefit | % of Institutions Reporting this as a Top 10 Benefit |
|------|---------|------------------------------------------------------|
| 1 | Enhanced Technology | 91% |
| 2 | Efficiency | 91% |
| 3 | Integrated Information | 66% |
| 4 | Reporting | 66% |
| 5 | User friendly | 66% |
| 6 | Access to Data | 50% |
| 7 | Customer Service | 50% |
| 8 | Functionality | 41% |
| 9 | Communication | 25% |
| 10 | Security | 25% |

Table 2 above outlines a list, in rank order, of data collected from hundreds of stakeholders in twelve higher education institutions that were preparing to implement an ERP solution. Roman (2009) ranked the order of the most voiced benefits desired by the institute. Whilst the benefits of each institution vary, he identified a typical list of benefits and indicated the percentage of institutions reporting each concern in their top ten.

Figure 2 shows some common benefits realised from ERP implementations in 246 firms and 64 countries, from Panorama Consulting Solutions
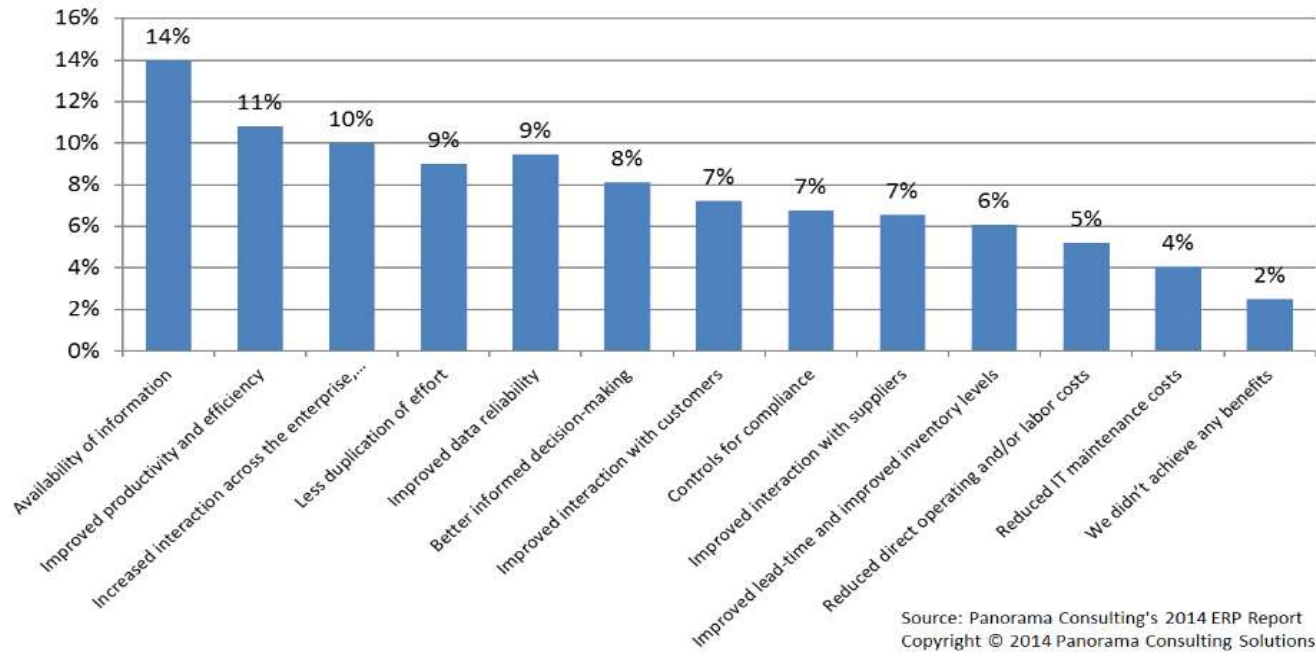


**Figure 2 Some common benefits realised from ERP implementations**

The figure above is referenced from the 2014 ERP report by Panorama Consulting Solutions, (Panorama Solutions, 2014) that sets out to investigate ERP selection, implementation and satisfaction trends in the industry. With regards to the specific benefits realised, as illustrated above, the top five benefits identified by organisations included availability of information, improved productivity, increased interaction, less duplication of effort, and improved data reliability.

It is clear that there are many benefits to implementing ERP systems, as they provide end-to-end automation and integration, resulting in optimised processes, functions and workflows. As a result of ERP systems, business process and operations can be leveraged by improved quality of data and information, by corporate wide information sharing, by improved decision-making, by significant cost reductions and by increased productivity (Adam, 2010). Velcu (2008) further notes that an important concluding consideration is that goals for implementing enterprise wide ERP system must be assessed and its impact on business performance evaluated. Roman (2009) argues that although each organisation is unique, there seems to be many common benefits to the implementation of ERP systems, for example, improved IT infrastructure, increased efficiencies and effective business processes, and integrated, streamlined information.

## 2.4. ERP Failures

According to Umble et al. (2003) 50% to 75% of American firms experience some degree of failure with ERP implementations  This trend continues according to Amid et al. (2012) were 67% to 90% of ERP implementations fail. 35% of implantations are cancelled and the remaining 65% result in cost and scheduling overruns.

Hawari and Heeks (2010) argues that high failure rates in ERP implementation continue to block the associated benefits.  This study looked at ERP implementations across the world, more specifically in developing countries. They studied the reasons as to why ERP implementations failed and how this could be mitigated. The study revealed that ERP implementations were time consuming, complex and misunderstood by stakeholders.  There exists a misalignment between practical good practices in ERP implementations and the theories thereof.

Al Rashid (2013) proposes a holistic model for ERP implementation that is centred on the roles and responsibilities management among ERP stakeholders. The model attempts to close the gap between theory and practice.

Chou and Chang (2008) argues that ERP implementation failure rates range from 40% to 60% and may be attributed to disparate interests between customer organisations looking for business specific solutions and ERP vendors who prefer a generic or "vanilla" solution applicable to a broader market. Their attempts to close the alignment between organisational processes and functions with best practice of ERP.

Turton (2010) states that realising benefits from ERP implementations are not automatic and that the risk of partial or total failure is extremely high. ERP adoption, implementation, usage and evaluation issues must be clearly understood. The study further states that end user involvement and training seems to be critical to success, understanding functionality, management of change, proper project management and stringent testing procedures.

The main reasons cited by Rufael (2007) the ERP implementation failures are the lack of commitment shown by top management. There is a failure to recognise that ERP systems are only a software tool and business processes need to be adapted accordingly. The training and education from the side of the vendor are insufficient and they lack the technical expertise.

In a study by Kralji'c et al., (2011), titled "ERP Implementation's Risk Factors in State Owned Company in Post-Socialist Transitioning Country", conducted on a state owned company in Bosnia and Herzegovina, the author identified a list of factors that contributed to ERP implementation failure. These factors include: inadequate tendering procedure, incompetent team members that are responsible for defining the requirements and deliverables when compiling the tender documentation, corruption in the decision-making process, time-consuming decision-making process, poor working habits of management and employees, legislative changes due to amendments in law, and the lack of local support (Singh & Singh, 2015).

Bitsini (2015) states that ERP implementations remain problematic in the public sector, although enormous investments are made the risk of failure is still high. He further states that the public sector continues to grow, and the particularities of public sector make ERP implementation studies necessary.

## 2.5. ERP Critical Success Factors (CSFs) in ERP Implementation

According to Nah and Delgado (2006) there are seven critical success factors (CSFs) for an ERP implementation. These consist of, in order of importance, business plan and vision, ERP team composition, skills and compensation, top management support and championship, communication, change management and project management. They further argue that of the seven CSFs team composition, skills and compensation are the most critical factors to overall ERP implementation and upgrade. It is important that the team is well constituted with "the best and brightest people". This team must be empowered to take hard decisions and not constantly look for approval from managers. They state that compensation or incentives are related to team performance and these should be considered. At the end, the project team is fully responsible for the implementation and should be recognised accordingly.  Brown (2004), Ganesh et al. (2014), and Shanks et al. (2003)  argue that some of the contributing factors to implementation success is project management structuring  and processes, that is, the structure and processes adopted to manage project costs, to control scope, to limit customisations, to deliver documentation and training, and to involve executive management, institutional communication and change management.

According to Loonam and McDonagh (2005) companies undergo three sages when they plan to implement a successful ERP system:

- Pre-implementation: the company would decide on the reason for implementing an ERP system, what benefit the system will bring, what is required prior to the ERP implementation and, what are the CSFs that would assist in achieving a successful implementation,

- Implementation: this requires the organisation to plan and identify possible problems or challenges that may arise during the implementation stage. During this phase organisational and technical issues arise, and

- Post-implementation: companies are required to keep up with the changes in technology to be able to respond to technology changes.

Shaul and Tauber (2013), however, in their article titled "Critical success factors in enterprise resource planning systems: Review of the last decade" argues that the importance of the

planning phase of ERP adoption is often disregarded where ERP implementations are less successful. The authors argue that action towards revolving and preventing future problems must be identified well before the project phase commences since in many instances only executive managers can address pre-existing challenges faced by the organisation that may threaten the success of the adoption. These challenges are identified as the selection process of the ERP system, project management, senior leadership, data management, training and user involvement.

Al-Sabaawi (2015), in an article titled "Critical success factors for enterprise resource planning implementation success", identifies what CSFs should be given priority for the successful ERP implementation. Eight factors were identified and ranked accordingly: project management, technological infrastructure, communication, departments (stakeholder) participation, change management, business plan and vision, commitment and support of top management, and user training and education.

> Project management – involves skills and knowledge in the coordinating, scheduling and monitoring of defined activities to achieve the objectives in the implementation of a project.

> Technological infrastructure – refers to the ERP software package in its relation to legacy systems and existing organisational technologies in terms of operating systems, hardware platforms, databases and networks. Generally, the ERP software vendor stipulates the required software and hardware configurations.

> Communication – Good communication strategies and execution thereof are required for successful ERP implementation. It allows for stakeholders to fully understand the desired goals, the resultant benefits of the implementation, and the project progress, status and deadlines. An open information policy is encouraged.

> Departments (stakeholder) participation – During ERP implementations there may be various stakeholders involved which include consultants, business specialists and software and hardware vendors. Cohesion and an adequate partnership between them can assist in attaining the goals defined.

> Change management – An ERP implementation can be a time consuming and arduous endeavour, therefore change management plays a critical role. The dynamics of the change process needs to be managed in terms of planning, communication and training.

Business plan and vision – A clear vision and business plan provide a guideline for successful ERP implementation, it is therefore important to identify the business goal prior to an ERP implementation.

Commitment and support of top management – Generally an ERP implementation is a top-down decision and the success thereof depends on the alignment of the ERP adoption with the organisational business goals. The support of top management is important and crucial to the success of ERP implementations. It is necessary for top management to provide the resources, authority and support to the project team. Top management is required to provide leadership, resources, to monitor progress, to provide direction, and to manage change.

User training and education – When ERP systems are being implemented, it is important for end users to be capable of using the system, therefore they should be made aware of the system logic, concepts and features. This can be achieved by implementing hands-on user training. Proper training has a positive effect on ERP implementations.

Shatat (2015) in a study of nineteen companies, including six manufacturing, five services, one construction, six educational and one other company identified 10 factors that are important to the successful implementation of an ERP. A five-point Likert-type scale with a rating from 1 = strongly disagree to 5 = strongly agree was used to gather information on the 20 factors that were identified through an extensive literature review and analysis therefrom. The 20 factors are tabled below:

**Table 3 Critical Success Factors (Shatat, 2015)**

| | CSFs in literature |
|---|---|
| 1 | Top Management Support |
| 2 | Project Management |
| 3 | Business Process Reengineering |
| 4 | User Training & Education |
| 5 | User Involvement |
| 6 | Business Plan & Vision |
| 7 | Careful Package Selection |
| 8 | Change Readiness & Culture |
| 9 | Clear Goals & Objectives |
| 10 | Learning Competency |
| 11 | Minimal Customization |
| 12 | Monitoring & Evaluation of Performance |
| 13 | Project Champion |
| 14 | Strategic IT Planning |
| 15 | Teamwork & Composition |
| 16 | Vendor Support |
| 17 | Appropriate Business & IT Legacy Systems |
| 18 | Data Analysis & Conversion |
| 19 | Education on new Business Processes |
| 20 | Partnership with Vendor |

The managers of the 19 companies ranked the top 10 CSFs from the 20 identified above in Table 3. They agreed that 10 factors where critical in them achieving success in ERP implementation in their organisations. These factors are: Top Management Support, User Involvement, Clear Goals & Objectives, Strategic IT Planning, User Training & Education, Vendor Support, Teamwork & Composition, Project Champion, Monitoring & Evaluation of Performance, and Education on new Business Processes.

However, in the study of two manufacturing companies, Plant and Willcocks (2007) identified the requirement for project team leaders in order to strengthen proper planning in the process change management aspect of implementation.

Leyh (2016) in his study titled "Critical success factors for ERP projects in small and medium-sized enterprises – the perspective of the selected ERP system vendors" identified 320 papers

that pertained to CSFs of ERP projects. From these studies he derived 31 different CSFs. The three most named factors mentioned in 160 of the articles included top management involvement and support, project management and user training. He further collected data, using the qualitative exploratory approach, from German ERP system vendor consultants with long-time experience in more than 100 ERP projects. Contrary to the three most important factors mentioned above, ERP system tests and organisational fit of the ERP systems was identified as the most important factors of ERP implementations from the perspective of the ERP vendor.

## 2.6. ERP Misfit

The issue of misfit is a common problem when organisations adopt ERP systems, that is, the gap that exists between the functionality offered by the software and what is required by the implementing organisation (Edwards, 2013). As a result of this gap, organisations have to decide on adapting to the new functionality, accepting the shortfall, instituting workarounds or customising the ERP package. This problem of fit is exacerbated since ERP implementation is complex due to data standardisation, cross module integration, tight implementation schedules, adoption of business requirements and the involvement of a number of stakeholders. Many organisations do not understand ERP functionality sufficiently to appreciate the implications of implementation. The literature in this regard acknowledges that an ERP and its defined processes are unlikely to satisfy all the functionality required by an organisation (Edwards 2013; Sia et al. 2007; Soh et al. 2000; Soh et al. 2004; Sonnichsen 2009; Strong and Volkoff 2010).

Resolving ERP misfits during the ERP implementation is an essential problem when adopting a system. ERP misfits are viewed as conflicts in functionality, legitimacy and cognition in the stages of implementation (Liu, Wang and Tai, 2011). Strong and Volkoff (2010) identified six misfit domains i.e. functionality, data, usability, role, control, and organisational culture. Within each of these domains exists two types of misfits i.e. deficiencies and impositions. Deficiencies refer to the problems that arise from the ERP not having the features required by the adopting organisation. The users of the system cannot perform specific functions, as the system is unable to perform the required functionality or control. Impositions refers to the ERP

requiring the organisation to perform business functions that are contrary to organisational practices and norms, which negatively affects organisational performance.

Bitsini (2015), argues that with the continued growth of ERP adoptions in developing countries and the high failure rates in successful implementation, organisations cannot fully realise the associated benefits. Wang et al. (2006) argues that ERP systems are the outcome of social processes and that different ERP systems can epitomise social arrangements when developed in different social and cultural contexts. This may lead to misfit problems, during and post ERP implementation. The reason ERP systems do not fit organisational requirements of the implementing organisation is attributed to different business practices and legal and government regulations. A sizeable gap exists between the realities experienced by the implementing organisation and the functions built into the ERP system. In order to realise ERP benefits academics, vendors, organisations and consultants need to better understand the phenomenon of misfit. Wang et al. (2006) bases his study on the theory of social shaping of technology (SST), where historical, cultural and political elements play a role in shaping the design and implementation of technology. From the perspective of SST, technological design is viewed as an outcome of social processes of compromise between complicated, heterogeneous networks of varied stakeholders that have different perspectives, commitments or positions in the structure. The study argues that the overall degree of misfit when adopting a local ERP package is generally lower than when adopting a foreign package. When organisations adopt a foreign package, they must ensure that their requirements can be satisfied and whether customisation of the package is required. Initial implementation misfit can persist throughout the implementation process and have adverse effects that can lead to lowered system quality post implementation.

In a study by Hawari and Heeks (2010) , a model is used to analyse one particular failed ERP implementation in a particular country. The paper applies the design-reality framework and demonstrates its analytical and practical value, including some identified three generic recommendations for limiting the ERP and organisational gap. *Mapping organisational realities* entails a process of determining the actual situation within the organisation and integrating that into the ERP implementation process. *Using hybrids* refers to making use of hybrid ERP professionals who have a combined knowledge of the organisations main business as well as knowledge of information systems. Such individuals can therefore bridge the gap between the ERP system design and the organisational reality. *Being incremental* to the degree possible with the ERP system, overall implementation should be broken down into smaller

steps, thereby reducing the extent of the possible gap between design and business requirements. Although the practicality value of the design-reality model for risk identification and mitigation exists, ERP implementation is highly challenging.

Wu et al. (2005) presents a methodology based on the task-technology fit that identifies data and output misfits in the implementation of an ERP system. The methodology consists of two stages; output misfit analysis and data misfit analysis. The output misfit analysis stage identifies corresponding field (output misfit) and the data metadata for data misfit analysis. The data misfit analysis stage identifies data misfits for the corresponding business process activity. The methodology proposed provides a systematic approach to identify and minimise complexity in identifying data and output misfits thereby improving the ERP implementation and reducing risk of failure. He further states that the task-technology fit methodology can cushion and minimise the possibility of failure and points out the following; ERP systems many offer companies an efficient approach to integrating information systems resources. However, there is no one-size-fits-all solution, ERP systems require a degree of customization to fit the organisation. Organisations must be willing to re-engineer their business processes as embedded in the ERP packages. Tools to identify potential data and output misfits could be time-consuming, technically involved and costly.

Soh et al. (2000) examined organisations that adopted ERP artefacts and the problems that arise from their use. It was found that the common problem when implementing packaged software was the issue of misfit, that is, the gaps that exist between the software functionality and what is required by the adopting organisation. Organisations would then have to decide on adapting to the new ERP functionality, come to terms with the shortfalls, introduce workarounds, or customise the software.

Understanding the phenomenon of fit can help decision makers develop strategies that can increase the probability to realise ERP benefits. The literature suggests that role players should have an explicit knowledge and understanding of this phenomenon and its complexities. Bitsini (2015) suggests the aspects of ERP implementation that require understanding, to improve fit, include change management, project management, management buy-in, organisational culture, communication, user participation and training. Careful consideration to the factors contributing to misalignment of organisational requirements and ERP packages would benefit both the adopting organisation and the ERP vendor.

Yen et al. (2011) states that from a standpoint of managerial implications, unique organisational processes or structures may become obstacles in fully realising the ERP benefits, as this is especially true where organisational strategic advantages are based on flexibility, uniqueness, and low standardisation. They further identifies the aspects of sources and impact on ERP misfit and the decisions managers have to take to resolve the misfit.

## 2.7. ERP Life cycle

Somers and Nelson (2004) identify the activities associated with the implementation of ERP systems. This resulted from using an information theory approach and gathering data from cross sections of 116 organisations that had completed an ERP implementation. van Beijsterveld (2006) identified the ERP like cycle stages as; stages initiation, adoption, adaptation, acceptance, routinization, and infusion. Haddara and Zach (2012) in an article titled "ERP Systems in SMEs: A literature Review" state that in a ERP file-cycle model there should be clear distinction between ERP adoption , ERP acquisition, ERP system evolution and ERP system retirement .In a study by Esteves and Pastor (1999) the author defines and categorises the research issues relating to ERP systems within an ERP life-cycle framework as seen in figure 3. Esteves and Pastor (1999) reviewed 77 articles relating to ERP life-cycle phases and described them accordingly.
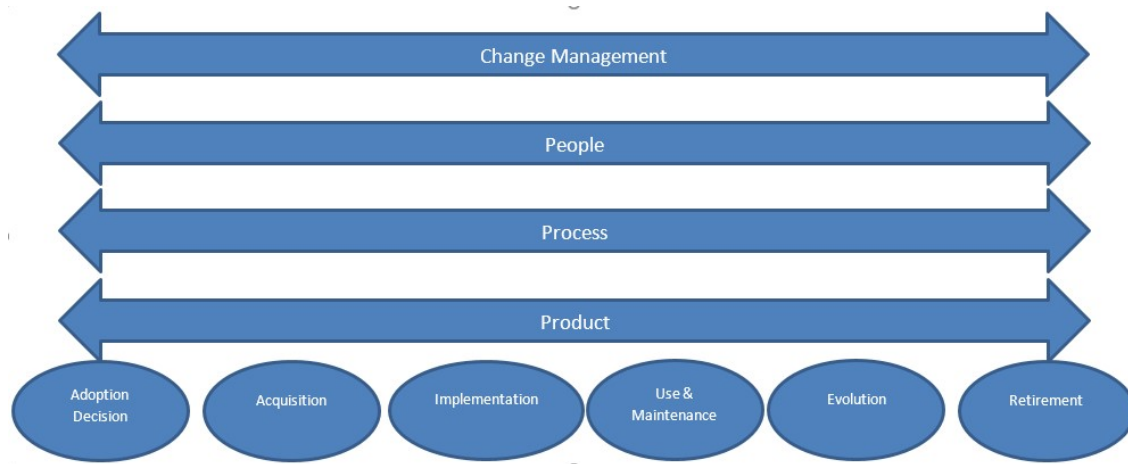
**Figure 3 The ERP life-cycle framework** (Esteves and Pastor1999)

*Adoption Decision:* During this phase, organisations identifies their business and technical needs and reason the requirement for an ERP (Esteves and Pastor 1999; Haddara and Zach 2012; Nah 2002; Stefanou 2000). Markus and Tanis (2000) states that adoption of an ERP may be initiated by Information Systems (IS) specialists or business owners. The business decision makers must consider the general information system approach that will adequately meet critical business challenges and enhance the organisational strategy. The definition of system requirements, goals and benefits, and impact analysis, are included in the decision phase. Somers and Nelson (2004) state that, during this phase, selecting the correct ERP package involves important decisions related to time-frames, budgets, goals and deliverables. Markus and Tanis (2000) argues that not all organisations adopt an ERP although they have some or all the listed motivations to do so. Organisations may choose to implement only certain modules, keeping the legacy systems in place or developing bespoke systems for the organisations' remaining needs. A reason for non-adoption, partial adoption or discontinuance is related to functional fit between what the organisation requires and what the ERP packages offers. Raymond and Uwizeyemungu (2007) has stated that there are three reasons for organisations to adopt an ERP system.

- The need to improve the performance of business operations (strategic decision-making, cost reduction, and adaptability to client requirements),
- The need to integrate systems and data, and to replace legacy systems with one integrated ERP system, and
- The need to set up "best practices" and avoid competitive disadvantage.

ERP systems are adopted to improve operational efficiencies and effectiveness, and over time to gain competitive advantage. Another reason for adoption is cost of entry to a highly competitive industry (Yen et al., 2011).

*Acquisition:* In this phase an ERP system is identified that best fits the organisational requirements (Esteves and Pastor 1999; Haddara and Zach 2012; Nah 2002). The intention is to minimise customisation since customisation can lead to substantial long-term cost implications. At this stage consulting companies are identified, and other factors like price, training and maintenance are analysed. Contractual agreements are also defined (van Beijsterveld, 2006). Stefanou (2000) states that at this phase it is also important to carry out an analysis of the return on investment of the selected ERP package. Tazyeen (2012) states that a two-step acquisition process should be followed: the COTS package selection and the selection of the contractor or vendor. It would be optimal to select an ERP package that closely fits the business functional requirements, and then consider the selection of the vendor. The vendor should be responsible for the entire implementation from requirements, coding, setup, testing, deployment, maintenance, and support.

Palanisamy (2012) argues that the acquisition team has to develop acquisition strategies in order to reduce the uncertainty associated with the acquisition process. The author suggests a single location vendor information session, product demonstrations, visits to vendor sites, and referrals. Palanisamy further states that the acquisition process consists of six distinct iterative processes: planning, information search, selection, evaluation, choice and negotiations.

*Implementation:* ERP implementation is a complex exercise in business process change management and technology management (Wei and Wang, 2004). This phase should not be confused with an implementation project, as an implementation project is much broader than the actual implementation. In the context of the implementation project, the implementation of an ERP system does not end when the system goes live (van Beijsterveld, 2006). This phase consists of the parameterisation or customisation of the ERP software package according to the

requirements of the organisation. This task is usually carried out by consultants who provide various implementation methodologies, experience, and training (Esteves and Pastor, 1999). The ERP application implementation methodology is composed of defined processes that are managed in serval ways to guide the organisation through the implementation process. The methodology provides the tools required to efficiently and effectively plan, conduct and control the steps in the project to successful implementation (Ganesh et al., 2014). According to Haddara and Zach (2012) this phase is the most resource intensive as in includes the actual ERP installation, customisation, business process re-engineering and other activities that will assist in aligning the system with the business requirements. Tazyeen (2012) adds that the implementation phase may also include activities of development for customisations required, data transfer from legacy systems, training of end users and deployment.

*Use & Maintenance:* At this phase the organisation uses the functionality provided by the ERP package in a live environment. Maintenance refers to addressing problem identified post deployment. Updates to the ERP system or issues identified by the users are corrected with the assistance of the ERP vendor. This is based on contractual terms that were identified during the acquisition and implementation phase (Tazyeen, 2012). Alanbay (2005) adds that there should be no restrictions in this type of environment so that whenever an add-on procedure or patch is available, updates can be done immediately. Esteves and Pastor (1999) and van Beijsterveld (2006) state that in this phase the organisation should realise the expected benefits and minimise disruptions. The organisation must be aware of aspects related to functionality, adequacy and usability related to business, and organisational processes. Post implementation, the system must be maintained, since malfunctions may occur, special optimisation requests must be attended to, and general system improvements are to be made. According to Shanks et al. (2003) maintenance generates benefits and the lack thereof entails lost benefits. Since implementing an ERP system is typically a long-term investment, it therefore requires a long-term maintenance strategy.

*Evolution:* In this phase additional capabilities are integrated into the ERP to gain further benefits. This can be classified into evolution "upwards" and evolution "outward". Upwards evolution functionality is geared to decision-making, with application functionality such as advanced planning and scheduling, business intelligence, and data warehousing. Evolution outward to the ERP environment are systems such as supply-chain management, customer relationship management, organisational workflow and electronic commerce (Alanbay 2005; Esteves and Pastor 1999; Nah 2002). Haddara and Elragal (2011) further states that this phase

requires more study as little literature exists in this regard. The evolution phase is a non-trivial process and requires a stable and mature ERP system.

*Retirement:* In this phase the ERP is retired from use, or abandoned with the appearance of new technologies, the inadequacy of the ERP, and approach to the business needs (Haddara and Elragal 2011; Haddara and Zach 2012). The business will decide if they will substitute the ERP with another information system that will adequately suite the business requirements (Nah, 2002). Esteves and Pastor (1999) further state that organisations go through this phase for reasons such as: lack of trust in the ERP vendor or implementation partner, strategic changes and bad implementation experiences.

## 2.8. ERP Cost

Swartz and Orgill (2001) states that one should not underestimate the costs associated with the implementation of an ERP. According to  Momoh et al. (2010), ERP implementation costs were found to be an average of 25 per cent over budget. There are many direct costs that are obvious and are often budgeted and accounted for by the project implementers. These costs however, do not represent the total cost of an implementation.  Koch et al. (1999); and Nakato (2008) identify some of the hidden costs that may result in budget overrun as: training, integration and testing, customisation, data conversion, data analysis, consulting fees, and staff turnover.

Momoh et al. (2010) state that of these costs, five are considered most common. That is, training is the most underrated hidden cost, as the cost to train an entire staff on a new ERP is substantial. The costs and implications to integration and implementation are often overlooked. The hidden costs related to data conversion, organisations often do not recognise the costs associated when transferring data from a legacy system to the new ERP package. To achieve this high level, professionals are required to convert data types to fit the new system, inevitably escalating the cost. Consulting fees are high, and organisations often underestimate the costs. Finally, costs are often overlooked and the notion that an implementation will end on a certain date.

Total cost of ownership (TCO) is a way to evaluate the cost of an ERP. One would need to consider both direct and indirect costs in order to prevent costly surprises in the process of implementation (Burns 2005; Kurbel 2013).

Some ways to avoid hidden or unexpected costs are as follows: avoid ambiguity when specifying requirements, as vendors will be able to say that organisational needs were not clearly communicate, avoid time and material quotes as this is to the advantage of the vendor when there are unknowns, vendors are to work from clear specifications that should be prepared prior to the purchase of the software, one should consider doing a boardroom pilot in order to ensure that all costs are defined before a purchase is made and one should include and consider all direct costs, as in higher end systems, implementation costs could be twice as much as the initial software costs. Maintenance costs are charged on the list price of the software. One should obtain a quote to maintain any customisations if there are software upgrades. This should also be considered for 3rd party products. One of the other significant costs could be related to additional hardware. One needs to be certain regarding recommended configuration, and costs of workstations, servers, storage and networks (Mukwasi, 2013). Include all indirect costs related to additional resources that may be required to complete the project. Future costs should also be considered. This can be related to annual licensing fees and the user use component of licensing. Organisations should attempt to avoid customisations which can prove to be costly during upgrades (Burns, 2005). Mukwasi (2013) states that consideration should also be given to cost of services. These may include services such as Virtual Private Network (VPN), Internet hosting and Web services. Mukwasi (2013) further states that when ERP systems are adopted, the implementation disrupts the normal business operations that may lead to productivity losses. Momoh et al. (2010) argues that unplanned costs associated with new requirements emerging during the implementation is a significant problem.

**Table 4 Direct Costs of ERP implementation (Murray 2009)**

| One-time Project Costs | Recurrent Costs |
|---|---|
| Software licenses | Software licenses |
| Server hardware | Software maintenance |
| Infrastructure | Software upgrades |
| Consulting (external) | End-user support (internal) |
| Project team (internal) | End-user support (external) |
| IT support (internal) | Hardware and infrastructure operation |
| End-user training | Additional end-user training |
| Administrator training | Additional administrator training |
| Project team training | Server and infrastructure maintenance |
| Data adoption and conversion | Server and infrastructure upgrades |

In table 4, Murray (2009) identifies some of the most important one-time and recurring costs. The reason as to why some costs appear in both columns is that these cost types can occur both as one-time and as recurrent.

**Table 5 Indirect cost drivers in ERP implementation (Murray 2009)**

| Indirect Costs |
|---|
| Impact of system downtime |
| Impact of system errors and poor performance |
| Retraining of end-users |
| Additional vendor support |
| Lower end-user productivity |
| Inadequate business processes |

In table 5, Murray (2009) identifies some of the most common indirect cost drivers. Indirect costs are more difficult to quantify when compared to direct. In most cases indirect costs must be estimated, although doing so can be difficult.

Panorama Consulting Solutions in there 2014 ERP report argues that fifty four (54) percent of ERP projects exceed their budgets, this is attributed to a change in the project scope and fifteen (15) percent noted an unanticipated technical or organisational issues that created addition budget requirements. The report further states that on average $2.8 million was spent on ERP initiatives

## 2.9. Theoretical Framework

Tarawneh et al. (2011) proposes a theoretical framework, figure below, for evaluating and selecting and implementing COTS software which includes the theoretic and empirical study. Theoretical study focuses on processes, evaluation criteria and previous frameworks for selecting COTS software. Empirical study focuses on the use of surveys and case study to investigate the aspects from theoretical study in a real-life perspective. The phases of the ERP life cycle consist of acquisition, implementation and maintenance, the researcher intends to use this as the basis of the study, the researcher intends to use the constructs of COTS frameworks, evaluation criteria and processes within this framework, to evaluate the ERP system implementation carried out at the utility in terms of evaluation criteria, processes and frameworks. The framework underpinning this study is based on COTS theories.
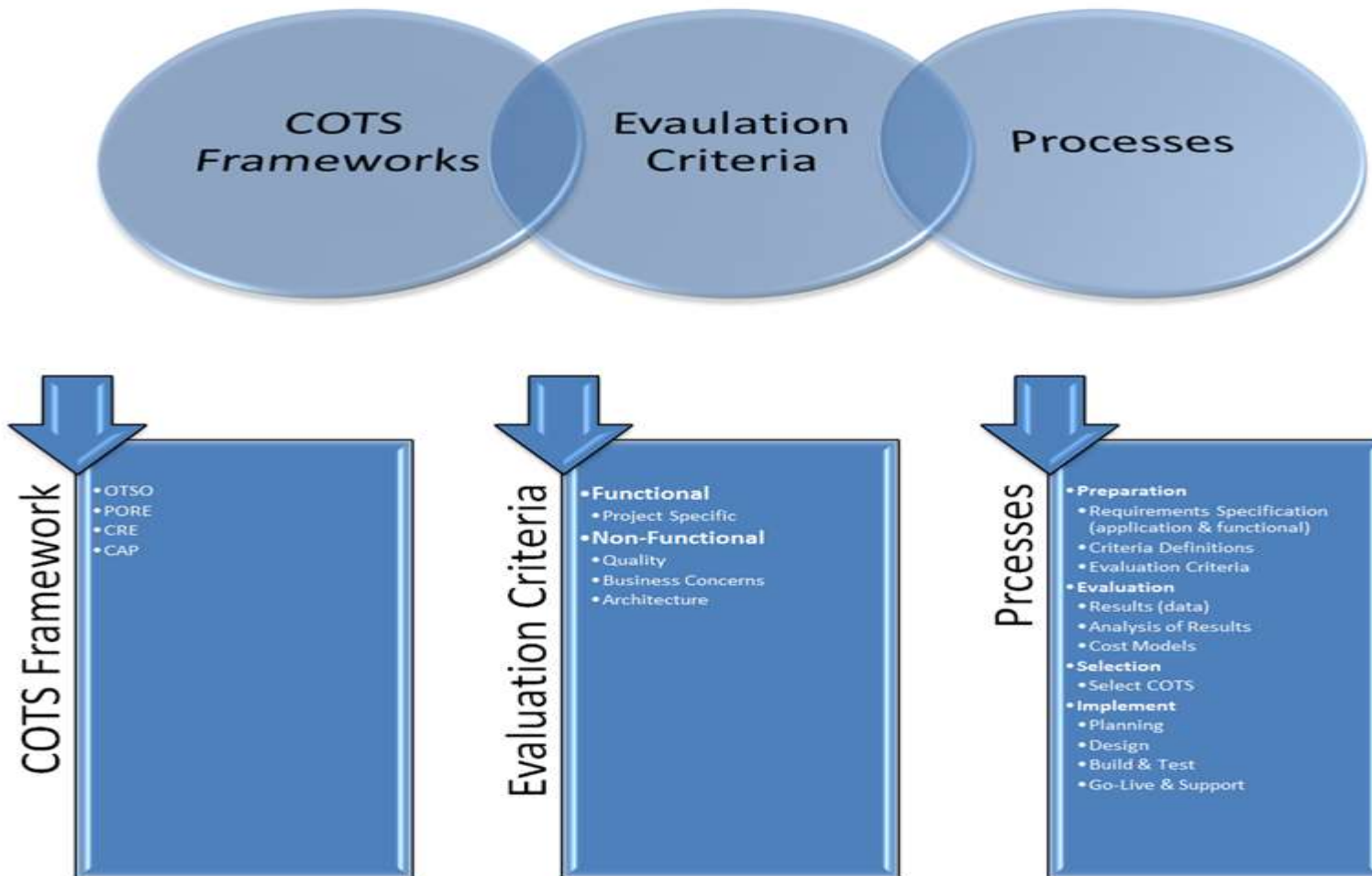
**Figure 4 COTS Framework (Tarawneh et al. 2011).**

COTS software evaluation and selection, as shown in Figure 4, has been adapted, for this study, from (Tarawneh et al. 2011).

COTS software is often delivered as "blackbox" components with limited or variably configurable options and therefore making selecting challenging.

*The researcher will discuss COTS frameworks evaluation criteria and processes in relation to the ERP implementation at the utility as part of this case study.*

**COTS Frameworks:**

- Off-The-Shelf Option (OTSO)
- Procurement-Oriented Requirements Engineering (PORE)
- COTS-based Requirements Engineering (CRE)
- COTS Acquisition Process (CAP)

**Evaluation criteria:**

A. Functional

- Background to the specific implementation. The functional requirements are specific in terms of what the COTS product must do. These requirements relate directly to the actions or functions that the COTS product must perform in order to satisfy the fundamental reason for its existence. Functional requirements in this regard relate directly to the business requirements, that is, a user of the system will describe the things that the product must be able to perform some aspect of his work. These requirements specification will evolve into a contract of the product build. The functional requirements should thus fully describe the actions that the intended COTS product must perform.

B. Non-functional

- Alternate COTS software, user requirements and COTS features.
- Identifying the utilities intent in terms of implementation outcomes and lack of managing and learning from previous selection case knowledge.

- An understanding of the IT infrastructure in terms of software, hardware and networks.

Non-functional requirements can be a significant part of a specification process. It is important to the decision to implement a COTS product, in that, non-functional requirements may include characteristics or attributes such as: security, maintainability, reliability, scalability, efficiency and performance, portability, flexibility, and usability. These aspects are explained in the table 6 below.

**Table 6 Non-functional requirements (Tarawneh et al. 2011).**

| Non-functional requirements | |
|---|---|
| Security | ERP security measures refer to the policies and procedures for the administration of security for the ERP system i.e. password controls to authenticate system access, level of access to functionality and audit functionality. |
| Maintainability | ERP maintainability is defined as the ease at which the system or a component of a system may be modified or changed to correct faults, adapt or change to the environment, correct faults or improve performance or other attributes. |
| Reliability | ERP reliability refers to the probability that the system or a component of the system will produce the intended quality and functionality for a period of time, under specified conditions. |
| Scalability | ERP scalability is the ability of the system to operate efficiently over a given range of configurations. It is the ability of the ERP to meet the throughput objectives as the demand for functionality increases. |
| Efficiency and Performance | ERP efficiency and performance relate to the ability of the software to process tasks or transactions in an acceptable time irrespective of the volume of processes. |
| Portability | ERP portability refers to the ability of the ERP to be ported to a given environment based on the degree of porting cost related to the cost of software redeployment. An ERP is considered to be perfectly portable if it can be ported at zero cost. |
| Flexibility | ERP flexibility refers to the ease at which the system or a component of a system may be changed or modified for use in environments or applications other than with it was intended. |
| Usability | ERP usability refers to the concepts of execution times, user satisfaction, performance and ease of learning. It is the extent to which the ERP can be used by the users to achieve specific goals with efficiency, effectiveness and action in a specified context of use. |

**Processes:**

    C. Preparation process

    D. Evaluation process

        o Evaluation techniques

        o Evaluation strategies

    E. Selection process

    F. Supporting process

Commercial off-the-shelf (COTS) is a term for commercial software and services that are available in the commercial marketplace that can be used or bought, and requires configuration to a specific requirement, and is an alternative to custom developed software. Commercial off-the-self software and services are delivered and built from third party vendors. COTS can be purchased, leased or licensed to the general public. COTS provide some of the following strengths:

- reduced costs of applications,
- increased reliability when compared to custom built software,
- COTS improve maintainability because systems documentation is available with the software application,
- due to competition, the quality of the application is improved,
- COTS offer higher complexity because specialists in the industry are involved in the development,
- the marketplace, not industry, drives the development of the software, and
- delivery schedule is reduced due to basic schedule of operations.

Risks associated with COTS based software development are categorised into five categories based on the software development stages. The risks in each category may overlap with risks in other categories and may also cut across multiple categories of the development life cycle. Despite the risks and challenges associated with COTS software, it continues to thrive and is being implemented in many major corporations (Miller and Yeoh, 2006).

In COTS software systems applications are developed by integrating one or more COTS products. These COTS products are packaged as a source code library, shared library, linkable

binary library, stand-alone executable program or a combination of packages. COTS products are classified into horizontal and vertical functionalities. Horizontal functionalities have no specific domain and are shared across different domains. Examples can include input/output functions, networking protocols and web browsers. Vertical functionalities, on the other hand, have specific domains and are used only in a specific application domain such as enterprise resource planning, accounting and health care management (Wanyama, 2006).

There are distinct differences in traditional and COTS- based software development processes. The traditional or conventional software development process follows a pre-defined sequence of activities whereas the CBSD is based on a constant, simultaneous and iterative trade-off among user requirements, software architecture and COTS components. The diagram below illustrates the activities of traditional and CBSD software development processes. Figure 5: COTS-based software development adapted from (Wanyama, 2006)
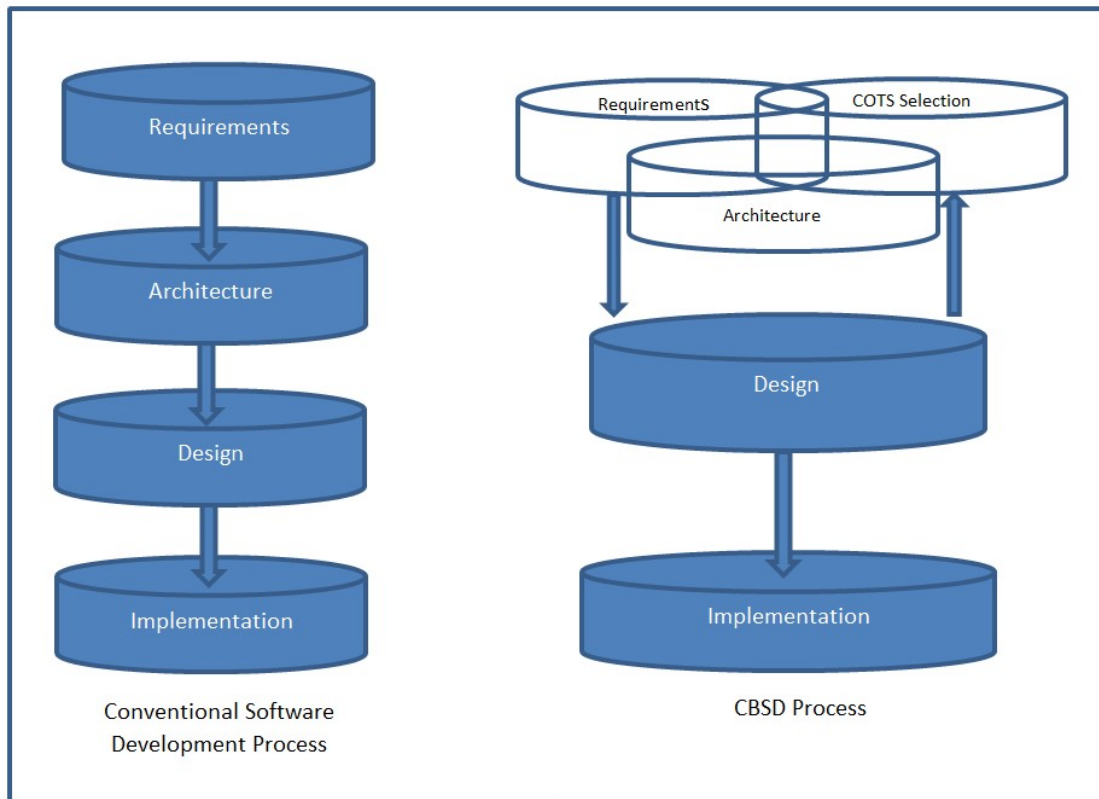


**Figure 5 COTS-Based software development (Wanyama, 2006)**

Figure 5 above shows a comparison between the traditional and COTS-based software development processes. The conventional software development process makes use of a pre-established sequence of activities i.e.: requirements, architecture, design, and implementation whereas the CBSD process is based on a constant, simultaneous and iterative trade-off among COTS components, user requirements and architecture.

The COTS software evaluation and selection process is an important part of COTS-based software development (CBSD). In order to handle the risks associated with COTS software evaluation and selection many models have been developed. When selecting suitable COTS software, it is important to identify the evaluation criteria. According to Tarawneh et al. (2011) evaluation criteria are identified or decomposed through the evaluation criteria definition in a hierarchical decomposition which starts from the high level requirement down to a well-defined low level specific requirement. This criterion is defined by the analysis of many influencing factors such as application requirements, application architecture, projects objectives, budgets, infrastructure architecture, etc.

In order to select the "best-fit" COTS software product an adequate comprehension is required of the various characteristics of the COTS selection process. There are many methods dealing with the evaluation of COTS software. For the purpose of this study we will briefly discuss the Procurement-Oriented Requirements Engineering (PORE) method, the Off-The-Shelf-Option framework (OTSO), COTS Acquisition Process (CAP) and COTS-Based Requirements Engineering (CRE).

### *Procurement-Oriented Requirements Engineering (PORE)*

The PORE method is a template based approach to provision requirements acquisition. An iterative process of requirements acquisition and product evaluation is used (Alves and Castro 2001; Ncube and Maiden 2000). PORE integrates a set of techniques, methods and tools such as multi-criteria decision-making techniques, requirements acquisition techniques and knowledge engineering techniques (Ncube and Maiden, 2000). The PORE method also has guidelines for the designing of evaluation test cases, however, PORE is unclear in specifying requirements and the elimination of products. The PORE template based approach provides only an initial view of the steps that are required in a systematic evaluation (Ncube and Maiden 1999; Tarawneh et al. 2011).
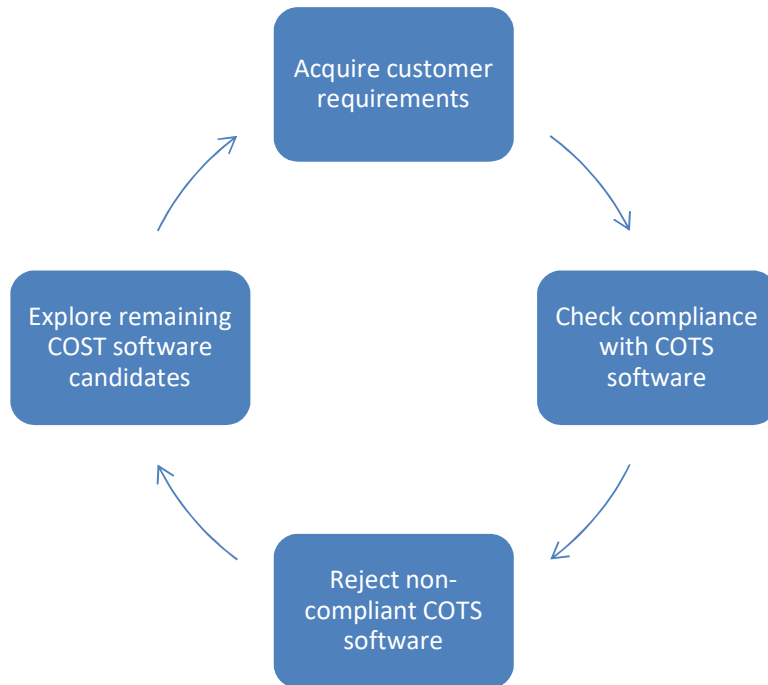
**Figure 6 PORE's iterative process of requirements acquisition and COTS software selection (Tarawneh et al. 2011)**

As in Figure 6, the PORE method of COTS software selection supports an iterative process of requirements acquisition and software selection. For each iteration the software team will:

1. acquire user requirements that will assist in discriminating between the COTS software candidates,
2. undertake a process of multi-criteria decision-making to identify non-compliance of candidates with user requirements,
3. reject non-compliant COTS software candidates, and
4. explore further remaining COTS software candidates to determine possible new requirements that may discriminate between further candidates.

*Off-The-Shelf-Option Framework (OTSO)*

According to Tarawneh et al. (2011) and Cechich and Taryano (2003), the OTSO method supports the search, evaluation and selection of reusable software, and further provides techniques for the defining of evaluation criteria and the comparing of  costs and benefits of software product alternatives. The evaluation process assists in defining how well COTS products meet the evaluation criteria. This process is followed by analysis phase where systematic multiple criteria decision-making techniques are employed to select the most appropriate COTS product.  During the evaluation of alternatives, the evaluation data is used in the decision-making process (Kontio et al. 1995; Miller and Yeoh 2006). A weighted scoring method (WSM) is a common approach where criteria are defined, and each criterion is assigned a score or weight and each COTS product is given a scored based on the evaluated criterion. The analysis of results also relies on the Analytic Hierarchy Process (AHP) for consolidating the evaluation data for decision-making purposes (Kontio, 1995).

Once the selected COTS product is identified and implemented, it is assessed to collect information that is used to improve the selection process and provide feedback to the potential reuse of the selection method.
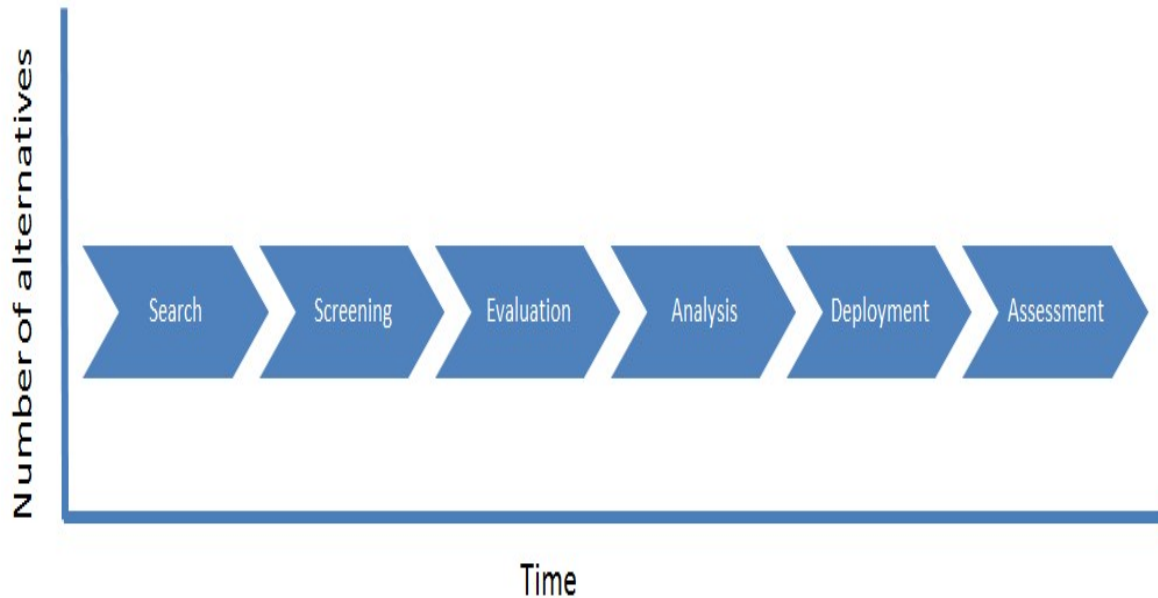
**Figure 7 OTSO phases in re-usable component selection process (Kontio, 1995)**

The OTSO selection process is divided into six main phases as presented in Figure 7. The horizontal axis represents the progress of the evaluation in terms of time, and the vertical axis represents the number of alternatives considered at each phase. The first phase is the search phase that would consist of several candidate alternatives. In the screening phase the candidates with the most potential are identified in order to carry out a more detailed evaluation. A detailed evaluation is carried out on the limited number of alternative candidates to ascertain how well each of the candidates meets the evaluation criteria. The results of the evaluation are systematically documented. In the analysis phase multiple systematic, criteria decision-making techniques are used to arrive at a decision. Once the decision has been made, the candidate is selected and deployed. At the end, in order to improve the selection process, it is necessary to assess the candidate COTS used in the project.

### *COTS Acquisition Process (CAP)*

The COTS Acquisition Process (CAP) consists of three main components, namely: CAP Initialization Component (CAP-IC), CAP Execution Component (CAP-EC), and CAP Reuse Component (CAP-RC) (Tarawneh et al. 2011; Wanyama 2006). The CAP-IC component consists of activities of defining the basis for making a COTS selection decision, and further defining a plan for measuring the different COTS alternatives against the defined system requirements (Ochs et al. 2000). In this component the COTS evaluation criteria are defined, and an estimate is determined on the effort required to evaluate the alternative COTS products. Finally, the CAP-IC is reviewed to ensure that there is an effective search and evaluation of COTS products. CAP-EC consists of two activities, the CAP search and the CAP-EC Review. For the search activity, data is collected according to a measurement plan for the alternative COTS products. The data from this process is used for the purposes of screening by applying acceptance thresholds to the measure of COTS alternatives. The accepted COTS products data are then analysed according to a measurement plan, and a priority-based ranking (best to worse) is established. The top ranked COTS product alternatives are checked for the determination on a make-or-buy decision (Cechich and Taryano, 2003). In the CAP-RC component, information generated from the COTS selection process are packaged for reuse in future acquisition processes (Cechich and Taryano, 2003; Tarawneh et al. 2011; Wanyama 2006).
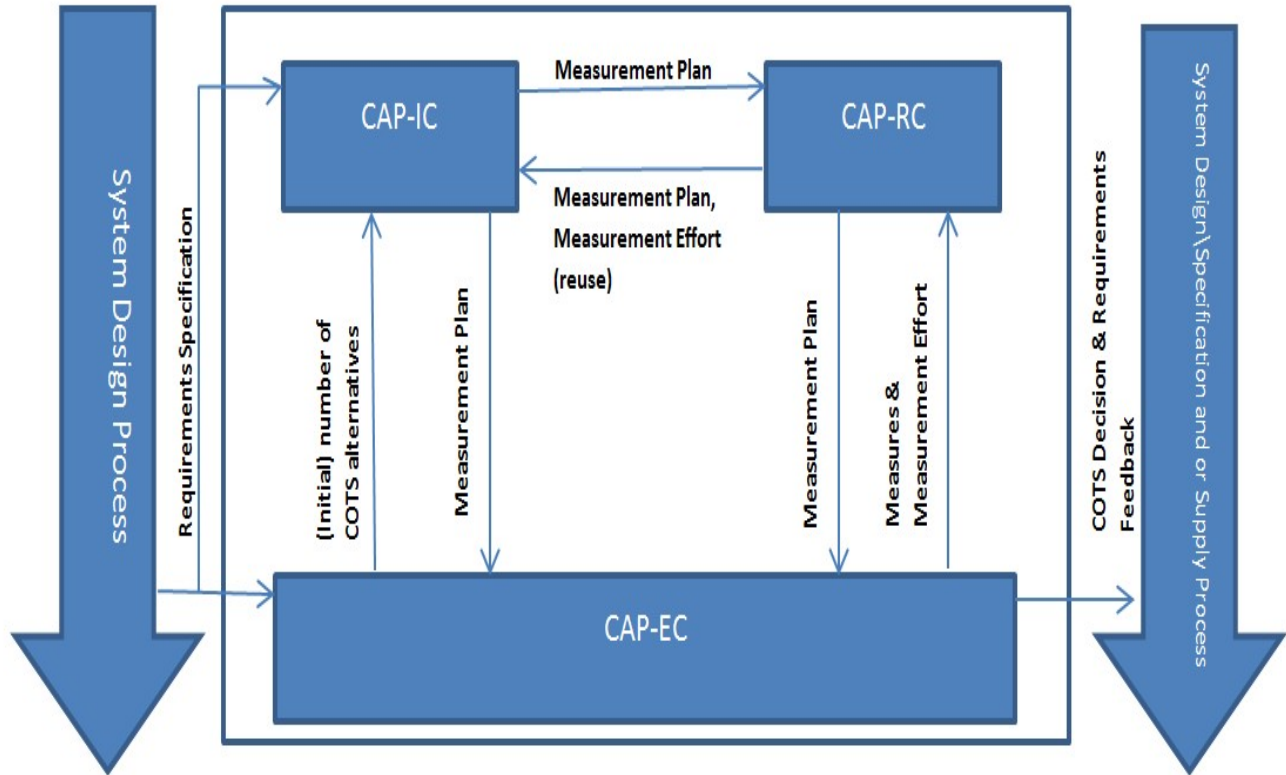
**Figure 8 CAP components, internal and external information-flow (Wanyama 2006).**

Figure 8 above shows the processes that interface with CAP, the external processes "System design Process" (SDP) and "Supply Process" (SP). SDP provides input into the CAP in the form of system requirements related to the respective system component that will be implemented through the COTS usage. If there is adequate COTS software available, SP will proceed with the negotiation and procurement of the COTS software. Moreover, SDP will receive input from CAP if there isn't adequate COTS software identified, and the requirements functionality would be developed in-house or by an external supplier. SDP will then trigger the required follow-up processes, e.g. functional specification, designing, coding etc., in order to acquire the required functionality built.

### *COTS-Based Requirements Engineering (CRE)*

According to Alves and Castro (2001), Tarawneh et al. (2011) COTS-Based Requirements Engineering (CRE) is an iterative COTS software selection method that chooses COTS products by rejection. It is developed to enable a systematic, repeatable and requirements-driven COTS selection process. The COTS products that fail to meet the user requirements are rejected and removed from the vendor list. As the list of detailed user requirements increase, the vendor list decreases. This is an iterative process whereby the requirements acquisition process enables COTS production selection, and the selection process informs the requirements acquisition. CRE consists of four iterative phases: Identification, Description, Evaluation and Acceptance. This method suggests that the entire selection process is driven by the requirements engineering process in order to discriminate the COTS products (Rolland, 1999).
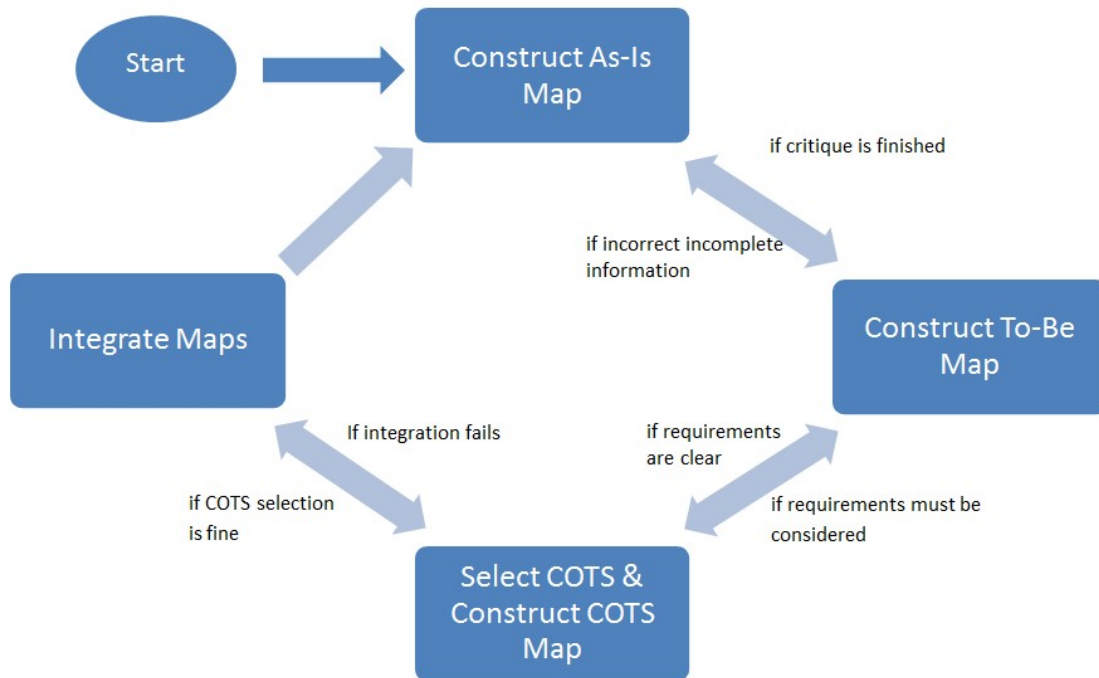
**Figure 9 The COTS requirements-driven process (Alves and Castro 2001)**

Figure 9 above is a graphic depiction of the process detailing the four key goals for effective COTS components retrieval and assembly compliant to an organisations business requirement. In order to achieve these goals, four processes are prescribed:

1. Construct as-is map,
2. Construct to-be map,
3. Construct COTS map and
4. Integrate maps.

This approach is guided be the traditional view of handling change. It recognises the role of the As-Is model and the To-Be model, and it introduces the COTS model and the integrated model, which are all represented as maps. The current achieved goals and requirements for the organisations current practice is described in the As-Is map. This As-Is map serves as a critique point on the current situation and for identifying requirements for the future, to be captured in the To-Be map. The To-Be map reflects what the organisation would like to achieve from the COTS based acquisition and the COTS map reflects the goals and requirements that can be

achieved from the COTS components. The integrated map expresses what the future system will be, it reflects which requirements will be fulfilled by the COTS components, which will require in-house development and which functionality will be left out.

**Table 7 Summary of the processes covered by described methods**

|  | Identification of product | Requirements acquisition | Non-functional requirements description | Product evaluation | Decision-making analysis |
|---|---|---|---|---|---|
| **OTSO** | √ | - | - | √ | √ |
| **PORE** | √ | √ | * | √ | √ |
| **CRE** | √ | √ | √ | √ | - |
| **CAP** | √ | √ | - | √ | √ |

(√) addresses issue fully, (*) deals with the issue but not fully, and (-) does not deal with the issue.

In this study we reviewed the COTS methods as summarised in table 7. The OTSO (Off-The-Shelf Option) method makes use of specific techniques for the defining of evaluation criteria. Alternate products are compared considering costs and benefits, and evaluation results are consolidated for the purpose of decision-making. The OTSO method fails to pay attention to requirements specification, the method does little to provide or suggest an effective solution. The PORE (Procurement-Oriented Requirements Engineering) method is a template based approach that supports requirements acquisition. In this method an iterative process of requirements acquisition and product evaluation is undertaken. Although the PORE method uses some requirements acquisition techniques, it is unclear on how these requirements are used in the evaluation and product selection process. The CRE (COTS-based Requirements Engineering) is goal oriented, where each phase has predefined goals, each phase is template based, and includes some technique and guidelines for requirements acquisition/modelling and COTS evaluation. With CRE, the process is process-orientated where non-functional requirements are explicitly considered as goals to be achieved. This method provides a checklist that assists in the acquisition of product information. This checklist provides information about candidate products and suppliers. CRE suggests the use of cost model that

provide parameter definitions, formulations, and rating criteria used in the estimating of associated costs for COTS alternatives. CAP (COTS Acquisition Process) method is a systematic, applicable and useful method of COTS selection. This method consists of three components: The CAP initialisation Component (IC) activities include Tailor and Weight Taxonomy, estimate measurement effort, elaborate Measurement Plan, and IC review. The CAP-Execution Component (EC) includes activities of exploration, collect measures (1), screening, collect measures (2), ranking, collect measures (3), make-or-buy decision and EC review. The single activity in the CAP-Reuse component (RC) is related to packaging for reuse. CAP is primarily concerned with measurement-based decision-making; therefore, the major effort of the CAP method is with regards to performing measurement activities.

# 3. Research Methodology

This chapter aims to detail with the methodological framework employed in this study. It will include how data is collected, analysed, reported and validated. The researcher will also present the design of the questionnaires and interviews as well as qualitative, quantitative and mixed method of data analysis. The ethical manner in which the research was conducted will be presented, and finally the conclusion of the components of the research methodology employed.

## 3.1. Research Objectives

The researcher intends to use the constructs of the COTS frameworks, outlined in the literature chapter, to evaluate the ERP system implementation at the utility in terms of evaluation criteria, processes and frameworks. The researcher intends to understand the insight that informed the ERP implementation, the ERP evaluation criteria used in the selection process, and the processes undertaken in implementation. The researcher aims to get a better understanding on the above specified processes followed by the utility in relation to the framework.

The objective of the study is therefore to understand the processes followed in the implementation of the ERP system. This was achieved by gaining insight on the:

- process the specification,
- process the evaluation,
- Process of selection, and
- processes for implementation.

## 3.2. Research Design

Case study research represents a type of qualitative research. They are considered different from other types of research since their descriptions and intense analysis of a specific phenomena is bound by space and time. In this particular type of research the phenomena in case study research may include events, groups or individuals (Hancock and Algozzine, 2006). Yin (2010) states that for case study research the following principles should be applied; referring to elaborate theories, the ability of avoid hidden bias, the need to present rival explanations, selecting cases where the outcome is known and the ability to assess several outcomes within the same case. According to Gerring (2006) a case study can be understood as an intense study of a single case or phenomena where the intention is bring light on a larger class of cases as this type of research may incorporate several cases.

According to Gerring (2006), researchers should consider single-case analysis also referred to as analytic narrative, Irrespective of whether the technique is quantitative or qualitative, or a mixed method, researchers can test models or theoretical predictions of a general model to shed light on a particular key case. Mills et al. (2009) states that in-depth single-case studies are an attractive method to reconcile the dynamics of a phenomenon with the resource constraints.

The purpose of this case study is to determine the processes following by the utility in implementing the ERP system, we will study the processes of preparation, evaluation, selection and implementation.

## 3.3. Research Approach

It is clear from the literature that the implementation of ERP systems can be challenging, and the desired outcome is not always fully realised. With this research, better insight would be realised with regards to the process followed by the utility and its relation to the theoretical frameworks. The three research questions will be informed by a combination

of qualitative, quantitative and descriptive research approaches in an attempt to bring meaning to the research.

Descriptive research according to Ruane (2005) offers an in-depth account or picture of some setting, group, experience or phenomenon. In this process the researcher attempts to be as accurate as possible. Therefore, in descriptive research the researcher must pay attention to issues of measurement and sampling as in this approach pure facts are gathered. The researcher investigates the phenomena in terms of what is going on and who is involved, and the size of the group and the members of the group, etc. Hence this type of descriptive research will inevitably be quantitative in nature.

Quantitative research is defined as explaining phenomena by the collection of numeric data that can be analysed using mathematical methods, specifically statistics (Muijs, 2010). According to Blaxter et al. (2010) quantitative research is inclined to involve a relatively large-scale and representative set of data on a specific phenomenon, however Muijs (2010) differs from this statement as he comments that data is presented or perceived as being the gathering of 'facts'. He further states that in order to carry out mathematically based methods of data analysis, the data has to be in numeric form.

According to Ruane (2005) exploratory research is conducted when the researcher is interested in "getting to know more" on a new or little researched phenomena, as it is used to gain insight on the topic. With exploratory research, relatively small samples of subjects are utilised to obtain first-hand information. The researcher may engage in focused one-on-one interviews in order to facilitate an in-depth understanding. The result of exploratory research often produces qualitative data that may be presented in words, pictures or a narrative.

Qualitative research according to Blaxter et al. (2010) when compared to quantitative research, is focused with the collating and analysing information in as many forms, mainly non-numeric, as possible. Qualitative research focuses on exploring, in as much details as possible, a much smaller number of examples or instances that seen to be of interest on a phenomenon to add depth to the research. According to Creswell (2012) qualitative research starts with philosophical assumptions that the researcher makes in deciding to proceed with a qualitative study. Further to this, the researcher brings in his own views, sets of beliefs and paradigms into the writing of the qualitative study. In addition, the researcher, when approaching a qualitative study will employ interpretive and theoretical

frameworks to further his research. According to Muijs (2010) qualitative data is not usually or necessarily in numeric form, and therefore cannot be statistically analysed.

According to Yin (2010) qualitative research enables the researcher to conduct in-depth studies about a particular phenomenon in plain everyday terms. Further to this qualitative research offers greater latitude in selecting subjects of interest, as other research methods may be constrained by the failure to establish the required research conditions, the absence of significant or adequate data sets or lack of sufficient variables, the difficulty in obtaining adequate samples of respondents and other limitations associated with studying phenomenon that is in the past as opposed to ongoing events.

In this study the researcher will make use of a combined method of research, generally termed mixed methods research, which will include qualitative and quantitative methods. According to Blaxter et al. (2010); and Somekh and Lewin (2005) a prevailing feature of research is utilising mixed methods, the combining of qualitative features, such as interviewing and observation with quantitative statistical analysis. Blaxter et al. (2010) states that the researcher, by using mixed methods, is not restricted by just one method or technique, thereby allowing for possible changes in direction in the research project. The researcher may find that there is insufficient response from a postal survey or may experience difficulty in accessing people for an interview, or to the sites where observations are carried out, in such cases, using more than one method should allow the researcher to change the approach and direction of the research. According to Muijs (2010), if the researcher wants to look at both breadth and depth, or both causality and meaning then mixed method design should be used. Muijs (2010) further states that mixed method is a flexible approach since the research design is determined by what the researcher wants to find out, rather than any predetermined philosophy position. With mixed method research, quantitative or qualitative aspects can predominate or have equal status. Silverman and Marvasti (2008) states that quantitative and qualitative methodologies should be viewed as complementary aspects of the systematic, empirical search for knowledge.

The purpose of this study is to describe and explore the process of ERP implementation at the water utility. The researcher aims to understand this process by considering the framework adopted by Tarawneh. The framework will facilitate the understanding of the implementation, in this case study, by researching the COTS theories, evaluation criteria and processes.

## 3.4. Population

Singh (2007) defines a population to be a group of individuals, items or objects from which samples are taken for measurement. According to Trochim and Donnelly (2001) and Muijs (2010) population in the study refers to the group that is to be generalised. It is the group that you would like to sample. According to Somekh and Lewin (2005) research can focus on a specific population or a complete set of units that is being studied where time, costs or accessibility prohibit the collection of data from the entire population or about every item, where this is the case when sampling is required.

Due to the nature of this study, a single case study based on the entity, the targeted population will consist of the utility executives, managers, finance managers, and IT staff. This would bring the total number of respondents to ten.

## 3.5. Sampling

According to Singh (2007) a sample can be defined as a finite part of a statistical population where properties are used to make estimations about the population as a whole. When one deals with people selected from a larger population for the purpose of a survey, they are defined as a set of target respondents. Ruane (2005) describes sampling as a glimpse or "taste" of some larger entity. The use of samples takes their cue from the arena of research where researchers are interested in learning something about large group of people or things. Research population is the term used for these aggregated groups.

Essentially there are two main types of sampling: probability or random samples and non-probability or purposive samples. If a researcher wants to assert that the data is statistically representative of a larger population, then a probability sample is required. A reasonable sample is required for quantitative research.  In a qualitative research approach purposive samples are more likely to be appropriate (Harper et al. 2013).

With purposive sampling, in qualitative research, samples are likely to be selected in a deliberate manner, with the goal of selecting the specific study units that will yield the most plentiful and relevant data to the research topic (Yin, 2010). Blaxter et al. (2010) describes purposive sampling as handpicking interesting or typical cases. When the researcher

approaches a sampling problem with a specific idea in mind then the sampling method is purposive in nature. In purposive sampling we have one or more specific predefined groups in mind. When sampling for proportionality is not the primary concern, purposive sampling can be very useful in order to reach a targeted sample quickly. According to  Berg et al. (2004) purposive sampling is sometimes referred to as judgemental sampling. When a researcher develops a purposive sample, the researcher uses their expertise or special knowledge about some group to select subjects that can represent this population. Purposive samples, in some instances, are selected after field investigations on group, in order to ensure certain individuals or persons displaying certain attributes or knowledge are included in the study.

Moreover with this method of sampling you are likely to get the opinions of your target population but the researcher is likely to overweigh subgroups in the population that are more readily accessible (Trochim and Donnelly, 2001). Harper et al. (2013) argues that purposive sampling is acceptable when it enables the researcher to investigate issues about that which little is known of. That is if the researcher can clearly explain how sampling is done and acknowledge any sources of bias so that the reader can judge the weight of the findings for themselves. Harper et al. (2013) further sates that with small purposive samples the researcher's evidence may be construed as merely anecdotal.

Due to the nature of this study the targeted population consisted of the utility executives, managers, finance managers and IT staff. The sampling method of purposive sampling was used as it allows members to be chosen with a specific purpose in mind. Insight was gathered from the executives regarding high level functional and non-functional criteria for the implementation of the ERP system. Data was collected from the utility managers regarding the detailed functional and non-functional criteria for the implementation of the ERP system. Data regarding the implementation process was gathered from the finance managers and finance staff. The data collected was then be used to analyse the process against the COTS framework.

### 3.6. Data Collection

The design of research instruments largely depends on various factors that include the research problem, the type of survey design, and the nature of the information that is required to be collected. Structured questionnaires and schedules are preferred in a quantitative survey, whereas semi-structured questionnaires or discussions are preferred in qualitative research (Singh, 2007). Therefore survey instruments can be classified into two broad categories: questionnaires and interviews (Ruane, 2005).

Somekh and Lewin (2005) states that questionnaires provide the researcher with a way to gather structured or unstructured data from respondents in a standardised manner, either as part of a structured interview, or through self-completion. Often, the data that is collected is numerical (a measurement) or can be represented numerically and can therefore be analysed statistically. According to Harper et al. (2013) questionnaire is a written list of questions either posted, or given to respondents, who respond by filling in the questionnaire. Required information is gathered directly from the respondents through a series of thought out questions, many of which may require responses that are pre-coded, requiring only a tick. According to Ruane (2005) a questionnaire is a self-administered, self-contained instrument for asking questions. A questionnaire may lack the personal touch of an interview. However, it can be an extremely efficient tool for the collection of data. Questionnaires are a popular option because of their self-sufficiency. A decent questionnaire can stand on its own and allow the researcher to collect meaningful data, without requiring any personal interaction between the researcher and respondent. According to Blaxter et al. (2010), there are various ways in which questionnaires can be administered. Questionnaires can be posted to intended respondents, who are expected to complete and return them. Questionnaires can be administered telephonically or face-to-face; in the latter allowing for a highly structured interview. Questionnaires can also be conducted over the internet. Owing to these traits, questionnaires can transcend most barriers of time and space (Ruane, 2005).

Interviews are a widely used method of data collection for conducting a systematic inquiry. They have been commonly defined as "conversations with purpose and direction". Interviews have been described by postmodernists as a dynamic meaning-making occasion that result in a collaborative production of knowledge. Considering this, interviews are a

process of seeking out knowledge, and understanding through conversation (Mills et al., 2009).

With the interview method of data collection, issues are questioned or discussed with respondents. Interviews are a technique that is useful for collecting data that cannot be accessed using such techniques as observation and questionnaires (Blaxter et al., 2010). In qualitative research interviewing is likely to be the method for collecting data. An interview is typically conducted as a face-to-face communication or discussion via some means of technology such as a telephone or computer between a respondent and an interviewer. There are typically three types of interviews: (i) structured, where information that is required from respondents is already decided on, (ii) unstructured, that allows for the free flow of communication during the course of the interview, and (iii) semi-structured, that restricts certain kinds of communication but allows for the manoeuvring of the discussion to highlight specific topics of interest (Singh, 2007). According to Ruane (2005) the interview style, structured or unstructured, depends upon the research goal. Structured interviews may be suitable when the researcher aims to provide an overview of the research population with reference to their attitudes, behaviours, values etc. Structured interviews may also be appropriate where the research has interest in quantifying information relating to the research population. Unstructured interviews are appropriate when the researcher is pursuing an exploratory descriptive research of a specific phenomenon, or when the researcher is attempting to understand a respondent's unique perspective or experience. According to Mills et al. (2009), semi-standardised or semi-structured interviews are located on the continuum between structured and unstructured interviews. This method seeks to address a number of predetermined questions or topic areas. In semi-structured interviews all questions are not necessarily prepared in advance. Instead they evolve as the interview progresses. The researcher uses semi-structured interviews when the goal is to compare the participant's responses whilst simultaneously seeking to understand their unique experiences. Such techniques are effective with large samples, and are used when the researcher has some knowledge of the subject or phenomenon, but would like to expand their understanding.

The intention of the researcher is to adopt a modified naturalistic inquiry by using semi-structured interview techniques to acquire information about the water utility, different departmental role players and other staff members regarding the ERP selection and implementation processes. Semi-structured interviews are appropriate for case study

research (Hancock and Algozzine, 2006). By using this approach, the researcher can ask predetermined questions and the related answers can provide tentative answers to the researchers' questions. Semi-structured interviews also allow for follow-up questions that are designed to probe deeper issues of interest to the researcher. In this way semi-structured interview allows interviewees to express themselves freely and openly and to define the phenomena from their perspective and not from the perspective of the researcher. This case study will therefore involve semi-structured interviews with the utility executives, departmental managers and related stakeholders. This will be further complimented with more intensive semi-structured in-depth interviews with particular departments.

Case study research means identifying a phenomenon that lends itself to an in-depth analysis in a natural context by using multiple sources of information (Hancock and Algozzine, 2006). In this study semi-structured in-depth interviews will be the main source of primary data. An in-depth interview, at its root, is an interest in understanding the experience of other people, and the meaning they derive from their experience. This type of interviewing provides entry to the context of people's behaviour, and provides a way for the researcher to realize the meaning of that behaviour (Shkedi, 2005).

In-depth interviews in this study may include both individual as well as group interviews. The data will be recorded either by audio recording or written notes. The purpose of the interviews will be to probe the ideas regarding the ERP, ERP modules, its selection process, the evaluation thereof and the implementation. The researcher will conduct interviews at the utility subsequent to negotiating, in advance, venues, dates and times. The interviews were conducted in offices that were conducive to collecting the data, namely, the venue was comfortable and quiet.

Questionnaires were developed and electronically circulated to respondents. The COTS framework and ERP implementation processes were tested through the responses from the questionnaires received from executives, senior managers, managers and finance staff.

### 3.7. Data Analysis

The process of data analysis is to bring order, structure and coherence to the mass of data sets collected, and thus arriving at an understanding of its actual meaning in context of the phenomena (Shkedi, 2005). According to Dey (2003) data analysis is a process of resolving data into its constituent components in order to reveal its characteristic structure and elements. In the absence of data analysis, we would have to put reliance on impressions and intuitions relating to the data. Although a place exists for our impressions and intuitions we can enhance benefit from a more logical and rigorous procedure of analysis. As a result of analysing data, we go beyond the initial description and transform it into something is was not. The basis of analysis lies in the description. However, analysis also makes way for further description (Dey, 2003). Therefore, through analysis we gain a fresh view of our data.

Bickman and Rog (1998) states that data analysis consists of examining, tabulating, categorising, testing or recombining both quantitative and qualitative data to understand the propositions of the study.

Data analysis in qualitative research typically consists of preparing and organising the data (i.e. text data from transcripts, or possibly image data from photographs) for analysis, thereafter reducing or categorising the data into themes through a process of coding and condensing codes and then representing the data in tables, figures or a description (Creswell, 2012).

Qualitative data deals with meanings and quantitative data deals with numbers. Therefore, there are implications for analysis. Conceptualisation is used as a method to analyse meanings and statistics and mathematics are used to analyse numbers. Quantitative analysis involves the preparation of data by checking or logging in the data, inspecting the accuracy, entering the data into a computer, transforming the data, and documenting and developing a database structure that integrates the different measures. Basic features of the data in the study are described by using descriptive statistics. With the use of simple graphic analysis, it forms the basis of many quantitative analysis of data (Trochim and Donnelly, 2001).

In this study the use of questionnaires will form the basis of data collection and the researcher will use descriptive statistics for the exploration of inter-relationships between pairs of variables. It will be acceptable to infer that a number of respondents answered

given questions in a particular way and that the answers given to particular questions appear to be related. By using such an analysis, a wide use of proportions and percentages were possible and, dispersion and various measures of central tendency.

A theoretical frame and a conceptual foundation are important elements of analysis. The analysis of case study data is used by researchers to develop theories on phenomena by identifying new observations, pointing out paradoxes, and by identifying correlations in data between the individual cases and their environments (Mills et al., 2009). In this study, data will be collected in a series of themes directly related to the components/modules of an ERP system and the related specification in that regard.

In thematic analysis, the researcher using qualitative data, identifies themes or patterns of cultural meaning, the researcher codes and classifies the data and interprets the results in thematic structures by seeking relationships, commonalities, theoretical constructs, patterns and explanatory principles (Mills et al., 2009).

### 3.8. Validity

Validity refers to whether the researchers' methods, approaches and techniques actually relate to, or measure the phenomenon that is being explored (Blaxter et al., 2010). According to Yin (2010), a valid study is where data is properly collected and interpreted leading to a conclusion that accurately reflects and represents the real world that was studied. Contrariwise, false findings in any field of study are considered worthless. Validity can be broken down into internal and external validity. Harper et al. (2013) states that validity, in relation to research data, is whether the data reflects the truth, reflects reality and covers the crucial matters.  In a broad sense validity means that the data and methods are right. Regarding methods used to obtain data, validity addresses the question of whether the researcher is measuring the suitable indicators of the phenomena and is he obtaining accurate results?  Validity relates to the degree to which the research data and methods of obtaining the data are deemed to be honest, accurate and on target.

Internal validity refers to the approximate truth regarding inferences about cause-effect or casual relationships. Internal validity is therefore only relevant in studies that try to establish a causal relationship (Gerring 2006; Trochim and Donnelly 2001).

External validity refers to or is related to generalising. External validity is, therefore, the approximate truth of conclusions that involve generalisations. It is the degree to which the conclusions of the study would hold true to other persons in other places and at other times (Gerring 2006; Trochim and Donnelly 2001).

In this study the researcher may employ the following strategies identify by Creswell (2012) and Yin (2010) in order to prevent threats to validity:

- Intense engagement and observation in the field that will include building trust with participants, checking for misinformation, creating opportunity to make repeat observations and interviews and obtaining an in-depth understanding of field situations,

- Triangulation, the use of multiple different sources to collect converging evidence,

- Comparison of results across different settings, groups and events are explicitly compared,

- Identifying discrepant evidence and negative cases to text rival or competing explanations,

- Quasi-statistics, actual numbers will be used instead of adjectives,

- Rich data will be collected to completely cover the interviews with detailed and varied data, and

- Clarifying researcher bias from the outset so that the reader understands the position of the researcher and any bias or assumptions that may impact the study.

### 3.9. Reliability

Reliability refers to how well the researcher has carried out the research project. If another researcher were to carry out the same study, essentially the outcome would be the same. If this is true, then the study is judged as reliable (Blaxter et al., 2010). Trochim and Donnelly (2001) state that in research reliable refers to dependability. To be more precise, the term reliability means repeatability or consistency. A measure is considered to be reliable if we get the same result repeatedly. Harper et al. (2013) define reliability as the measure of confidence that the researcher has and that the measurements are not affected by the research instruments. That is, a reliable measure is one that gives the same results if the same respondents are measured on more than one occasion. The research instruments need to be consistent and any variation in results from using the instrument is only due to variations in the thing being measured and not the nature of the instrument itself.

Trochim and Donnelly (2001) states that in the theory of reliability it is not possible to exactly calculate reliability. However, we can estimate reliability, yet this will be an imperfect endeavour. Reliability consists of four general classes:

- Inter-Rater or Inter-Observer Reliability - used to assess the degree to which different observers or raters obtain consistent estimates on the same phenomenon.
- Test-Retest Reliability - used to assess the consistency or accuracy of a measure at different times.
- Parallel-Forms Reliability - used to assess consistency of results of two tests constructs in the same way from the same domain.
- Internal Consistency Reliability - used to assess the consistency of results across items in a test.

### 3.10. Ethical Considerations

A qualitative researcher, regardless of the approach, faces many ethical issues that surface whilst collecting data in the field and in the analysis and dissemination of qualitative reports (Creswell, 2012). In research, ethical practice is a matter of finding a balance between a number of principles and is dependent on specific context.

Approval for this research will be obtained from the ethics committee at the University of KwaZulu-Natal. To maintain a high level of ethics consent will be obtained from the chief executive officer, managers and other stakeholders at the Water Utility. Respondents will be made aware of their rights to privacy, confidentiality and anonymity.

This study was limited to the Water Utility, specifically the organisational ERP requirements, resulting in portions of the ERP being evaluated or studied. These limitations will constitute the different modules within the ERP. This study may be limited to: supply chain management, contract management, accounts payable, accounts receivable, tariffs, fixed assets, project finance, cash management, interfaces, budgeting, and management information.

## 4. Data Analysis

This chapter presents the findings based on the data collected, through questionnaires and semi-structured interviews, from the entity. The findings of this research aim at examining the process of evaluating and selecting the ERP at the entity, based on theoretical framework constructs in Figure 4. Data was collected by considering processes, evaluation, general and COTS frameworks. Data, in terms of questionnaires and semi-structured interviews was collected from executives, senior managers and managers.

The candidates were as follows:
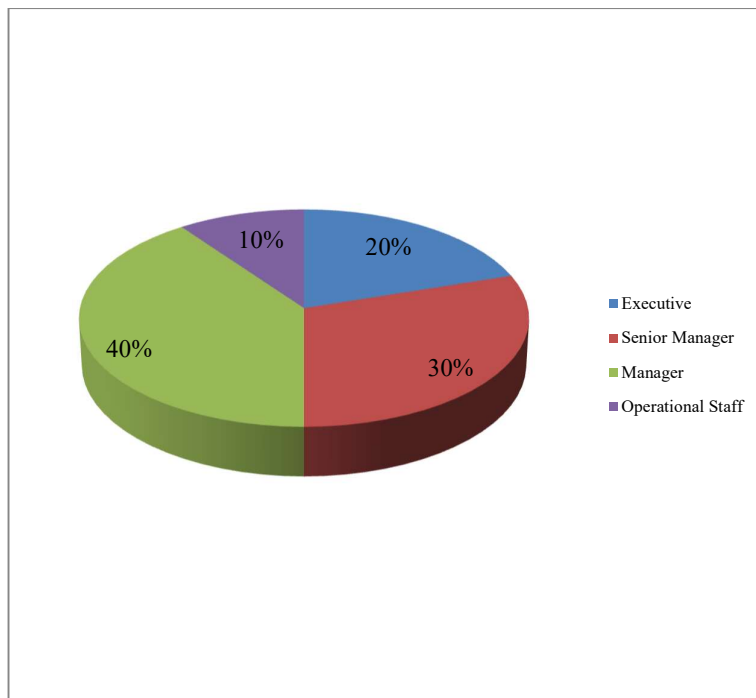


**Figure 10 Questionnaire respondents**

Managing Director - The managing director/chief executive is responsible for the performance of the company, as dictated by the board's overall strategy. He reports to the chair or board of directors. His responsibilities include formulating and successfully implementing company policy.

Director of Operations - Operational management of the entities water supply function, the supply of safe bulk potable water to water service authorities and customers. The maintenance of assets, scientific services, and customer /stakeholder relations in a manner that supports the delivery of a sustainable, cost effective, efficient and responsive bulk water supply service in line with the organisations strategy, vision, policies and legal requirements.

Engineering Manager - Plans, directs and coordinates activities involved in planning, designing, construction, modification, refurbishment and repair of water and sewage treatment structures and related equipment and components, implementation and commissioning of

projects on water and sewage treatment plants and distribution system (civil, mechanical and electromechanical).

Human Resource Manager - Manages, plans, directs and coordinates human resource management activities of the entity to maximize the strategic use of human resources. To maintain functions such as employee compensation, recruitment, industrial relations policies and procedures, personnel policies, and regulatory compliance to ensure the proper application of human resource policies and procedures. To comply with all relevant legislation and that all human resource efforts, through policies are directed to ensuring that the organisational strategy, vision and mission are attained.

Maintenance Manager - Manages and controls the maintenance activities regarding availability of equipment to allow for the production and transfer of products from water purification plants and bulk sewer purification plants and pump stations to achieve the volume demands and quality. To manage subordinates to maintain high quality workmanship and to develop a productive and motivated workforce.

Chief Financial Officer – Ensure that the entire accounting and financial management is in order, to ensure proper records for all transactions, and that the company is always in a solvent position.

Budget Manager - Manages, controls and directs the budget of the entity, by managing organisational budget within the framework and policies, presenting an accurate budget to the board.

Asset Manager -Manages and controls all assets to ensure that the entity's requirements can be met, and that all assets are viable for the needs of the entity and accounted for by the generally recognised accounting principle standards.

IT Systems Engineer - Formulates the strategy and direction for leadership and governance of information, communications and telecommunications (ICT) management within the entity to enable trusted, effective and efficient systems, processes and technologies which are aligned to the entity's business strategy and which deliver benefits to the business.

The respondents mentioned above represent the following departments within the entity: Strategy and Leadership, Operations, Finance, Human Resources, Information Technology, and Engineering.

## 4.1. Questionnaire Findings

Due to the relatively small size of the entity the researcher was able to achieve a 100% response rate, as all questionnaires were completed and returned. The researcher was present with each respondent during the completion of each questionnaire in order to provide assistance, in terms of question clarification and understanding, should the respondent have required it.
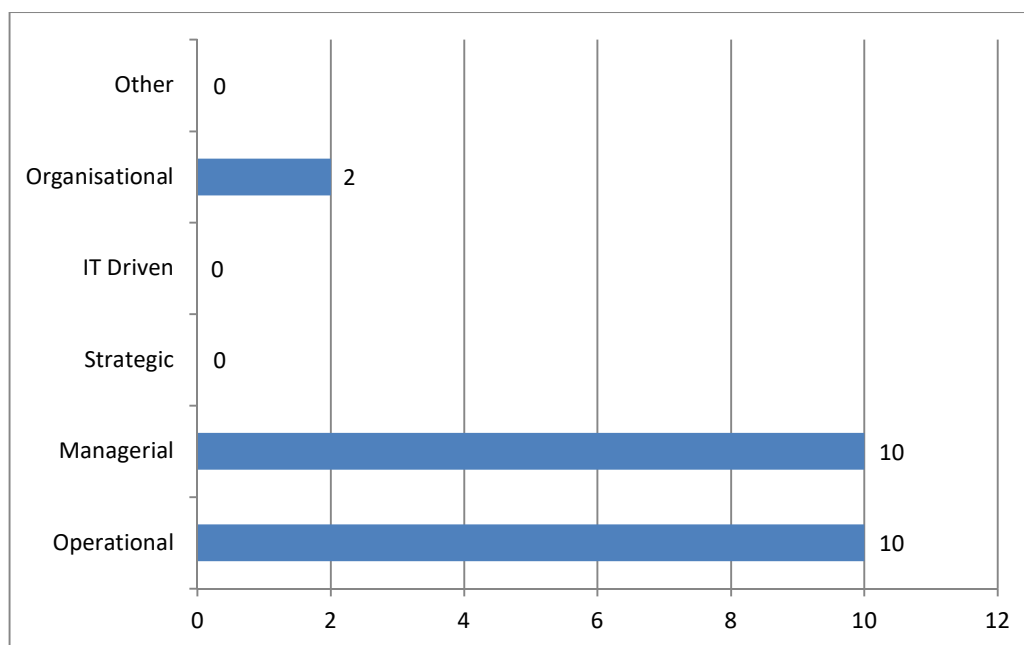


**Figure 11 Motivation for the implementation**

Figure 11 details the responses regarding the motivation for the ERP implementation. The implementation could have been based on a combination of motivational factors i.e. operational, managerial, strategic, IT driven, organisational or other.

Operational reasons were further expanded to the reduction of costs, improvement of production cycle times, improvement of productivity, improvement of quality, and the improvement of customer service. Managerial factors consist of improvement of resource management, the improvement of decision-making and planning, and performance improvement. Strategic motivational aspects would include the support of business growth,

building business innovation and cost leadership, the building of external business linkages and e-commerce, the generation of product differentiation, and creating sustainable competitiveness. IT aspects would include the improvement of business flexibility, the reduction of IT costs, and the increase of IT infrastructure capacity. Organisational motivational reasons would include the change of work patterns, the facilitation of organisational learning, empowerment of staff, the building of common vision, the shift of work focus, and the increase of employee morale and satisfaction.

All 10 respondents (100%) indicated that the motivation for the ERP implementation was based on operational and managerial reasons whilst of the ten, twenty percent (20%) further indicated that organisational motivational reasons existed. It was clear that strategic, IT or any other reason, outside these criteria, played no role in the implementation. The details regarding these responses will be further explained from the analysis of the in-depth interviews in section 4.2.

Non-functional requirements can be a significant part of an ERP specification process, and is important to the decision in implementing a COTS product, in that, non-functional requirements include characteristics or attributes such as: security, maintainability, reliability, scalability, efficiency and performance, portability, flexibility, and usability. These requirements are clearly discussed in section 2.9.

In the responses to the questionnaire these requirements, majority of the respondents either agreed or strongly agreed on the Likert scale that consideration was given to these aspects of non-functional specifications.
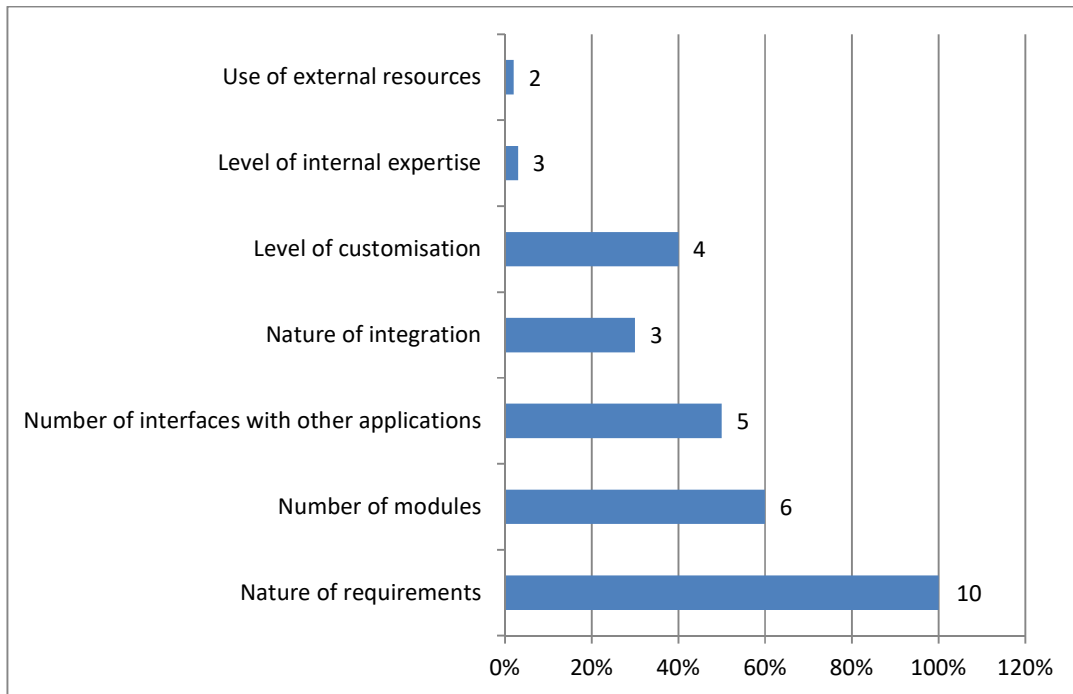
**Figure 12 Functional parameters that influenced the choice of the ERP implementation strategy**

The respondents were asked to indicate which functional parameters influenced the ERP implementation strategy. Figure 12 illustrates the responses; a respondent was free to choose one or more parameters as desired. The decision to engage external resources during ERP implementation is significant. The role of an external consultant is a long-term commitment to the consultant's culture, methodology and implementation philosophy. This relationship can span from 5 years or longer and may have a significant finance bearing. Two of the respondents indicated that this parameter was influential to the implementation whilst three indicated that the level of internal expertise played a role. Internal expertise refers level of knowledge of the shared staff members that implement and use the ERP system. Adequate internal skills have the potential to add tremendous value during the implementation; conversely, the lack of internal skills increases the potential risk to a successful implementation. Developing additional functionality that is specific to the business and outside the standard application functionality is referred to as customisation. Four respondents (40%) indicated that this parameter influenced the implementation strategy. Many ERPs claim to allow for seamless integration of all information that flows throughout the company, more specifically the integration between different elements of the business. Three respondents indicated that this

parameter influenced the implementation strategy. Fifty percent of respondents (5) indicated that the number of interfaces with other applications played a role in the implementation strategy. Interfaces allow for ERP systems to run alongside existing systems or legacy systems. Interfaces exist to allow for bidirectional data flow between systems, both inbound and outbound. Sixty percent (6) of the respondents indicated that the number of ERP modules played a role in the implementation strategy. It is significant to note that one hundred percent of respondents indicated that the nature of requirements influenced the implementation strategy. Further discussion regarding the role of the requirements specification will be detailed from the interview process.
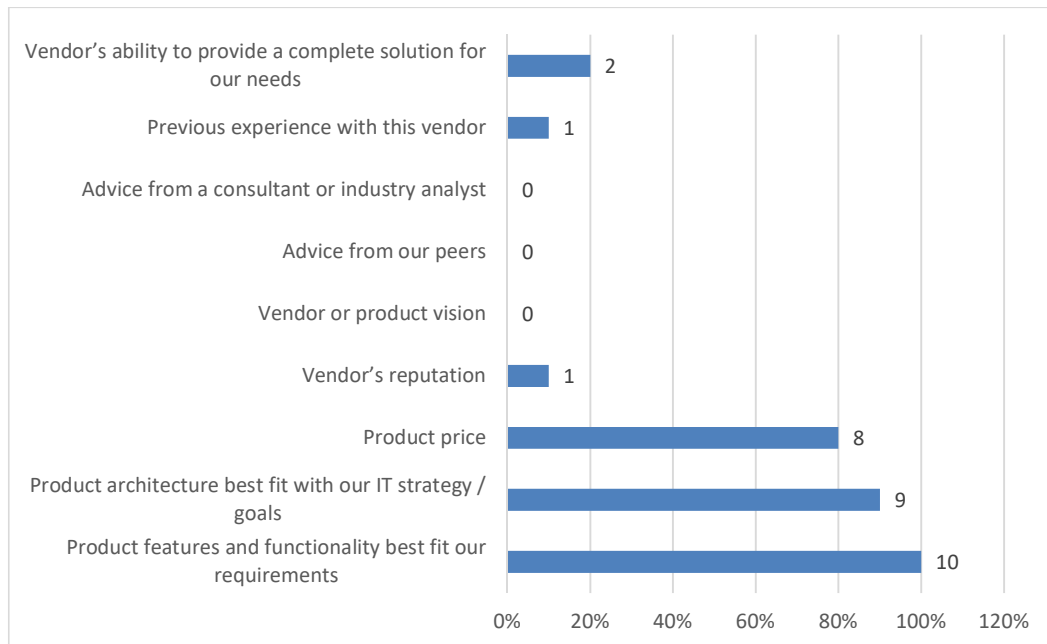


**Figure 13 Major reasons for choosing the vendor**

Figure 13 illustrates the major reasons for the organisation choosing the vendor. The reasons expressed in the survey included: Vendor's ability to provide a complete solution for our needs, previous experience with this vendor, advice from a consultant or industry analyst, advice from our peers, vendor or product vision, vendor's reputation, product price, product architecture best fit with our IT strategy / goals, and product features and functionality best fit our requirements. The respondents rated the highest scores to product price, product architecture

best fit with our it strategy/goals and product features and functionality best fit our requirements. Product price related to the total cost of ownership (TCO). TCO is a method used to evaluate the costs related to the implementation of a system. This would include, costs associated with the software purchase, licencing costs, and all other direct or indirect costs. Product architecture relates to the design philosophy of the software and its fit into the IT strategy in terms of hardware and software platforms, and finally the products features and functionality and its ability to fit the organisation. Obviously, the greater the fit, the more successful the implementation, and vice-versa.
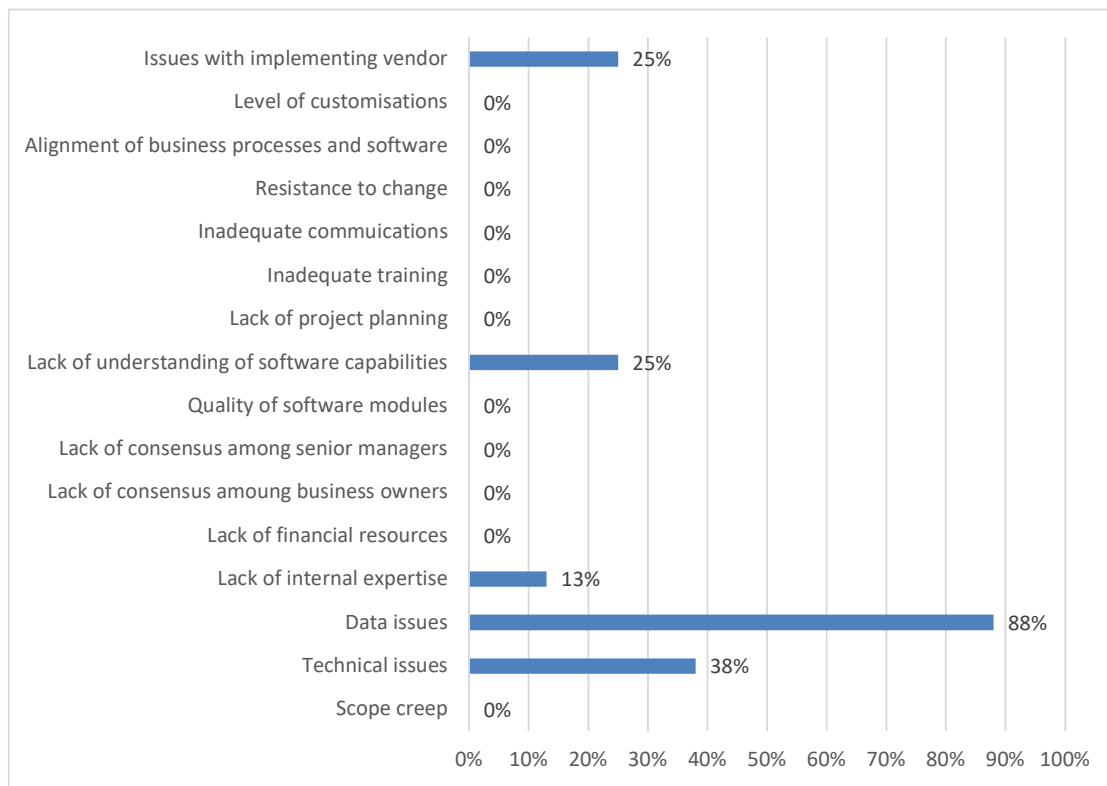


**Figure 14 Significant obstacles experienced in the implementation.**

Figure 14 identifies the obstacles experienced in the implementation process. Of the items listed above, five obstacles were significant: data issues, technical issues, issues with implementing vendor, lack of understanding of software capabilities and the lack of internal expertise. Eighty eight percent (7) of the respondents indicated that data issues were a significant obstacle. This data refers to data sets from legacy systems that are required as inputs

into the new ERP. Technical issues refer to aspects of the implementation relating to the ERP functionality, processes and methodology. Technical issues also include aspects of IT infrastructure and software platforms and associated limitations. Thirty eight percent of respondents believed this aspect was an obstacle. Issues with implementing vendor refers to implementation experience and willingness to commit to IT architecture and applications. Twenty five percent concluded that the vendor was an obstacle. Lack of understanding of software capabilities, to which twenty five percent responded, refers to the lack of understanding of the ERP capabilities by the implementing vendor. Thirteen percent indicated that there was a lack of internal expertise.
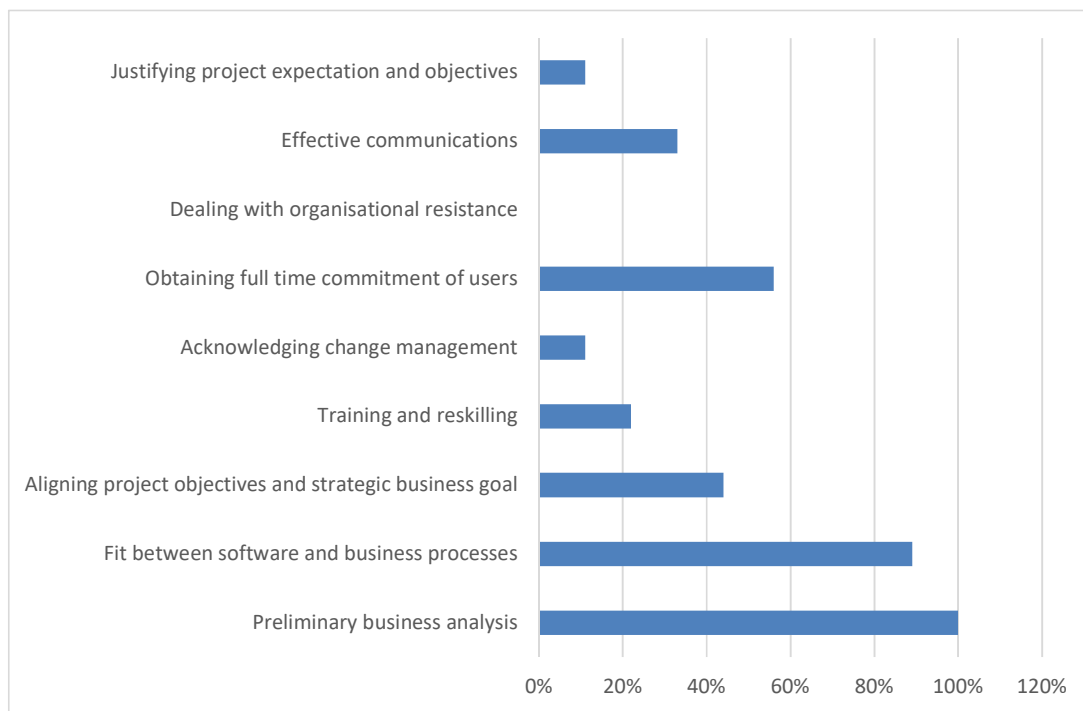


**Figure 15 Functional critical success factors of the ERP implementation.**

When asked to consider the critical success factors of the implementation the respondents indicated the following: Justifying project expectation and objectives 11%, effective communications 33%, dealing with organisational resistance 0%, obtaining full time commitment of users 56%, acknowledging change management 11%, training and reskilling

22%, aligning project objectives and strategic business goal 44%, fit between software and business processes 89%, and preliminary business analysis 100%.

It is evident from the responses that preliminary business analysis and fit between software and business processes played a significant role in the success of the implementation.
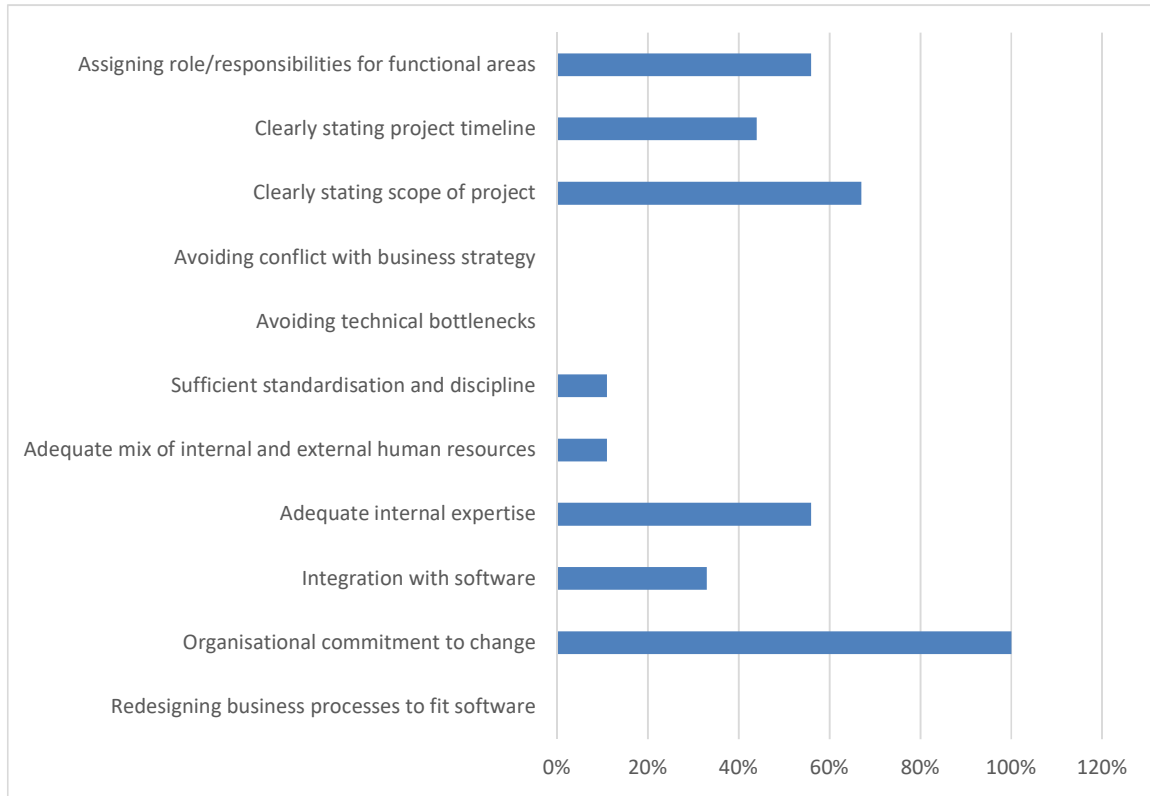


**Figure 16 Organisational critical success factors of the ERP implementation.**

Figure 16, illustrates those aspects that the respondents believed played a significant role in the implementation. The following critical success factors scored significantly: organisational commitment to change at 100% (9 respondents), clearly stating scope of project at 67% (6 respondents), assigning role/responsibilities for functional at 56%(5 respondents), and adequate internal expertise at 56% (5 respondents).

**Table 8 Opinions on the ERP implementation**

| | Strongly disagree | Disagree | Neutral | Agree | Strongly agree |
|---|---|---|---|---|---|
| Did project have an excellent strategy? | 0% | 0% | 20% | 60% | 20% |
| Was the scope of the project well defined? | 0% | 0% | 0% | 80% | 20% |
| Project communication was good? | 0% | 0% | 0% | 70% | 30% |
| Data conversion was well managed? | 0% | 10% | 30% | 40% | 20% |
| Project had executive engagement? | 0% | 0% | 0% | 50% | 50% |
| Project had good budgeting and financial management? | 0% | 0% | 0% | 70% | 30% |
| Excellent software roll-out strategy? | 0% | 0% | 0% | 70% | 30% |
| Project outcomes were well identified? | 0% | 0% | 0% | 30% | 70% |
| Training was well provided? | 0% | 0% | 20% | 40% | 40% |
| Senior managers supported the process? | 0% | 0% | 0% | 30% | 70% |
| Managers supported the process? | 0% | 0% | 0% | 40% | 60% |
| At conclusion of the project, confidence in the CTO and credibility of the IT office had been strengthened? | 0% | 0% | 0% | 40% | 60% |
| If an implementation was to be carried out again, we would approach it in the same way? | 0% | 0% | 10% | 50% | 40% |
| Did you achieve the outcomes that you expected? | 0% | 10% | 0% | 70% | 20% |
| The new system reduced business risk? | 0% | 10% | 0% | 40% | 50% |
| The new system improved the organisations regulatory compliance? | 0% | 10% | 0% | 30% | 60% |
| The new system made management information more accurate and accessible? | 0% | 10% | 0% | 30% | 60% |
| The new system has increased accountability? | 0% | 10% | 0% | 20% | 70% |
| The new system has increased business performance? | 0% | 10% | 0% | 40% | 50% |

Table 8 above illustrates the different opinions of the respondents regarding the ERP implementation. The opinions were gathered on the aspects of project strategy, scope, communication, executive engagement, financial management, software roll-out, project outcomes, training, management support, IT credibility, expected outcomes, risk, compliance, accuracy of information, accountability and business performance.

## 4.2. Interview Findings

**Table 9 Interview themes**

|  | Evaluation Criteria | Preparation | Evaluation | Selection | Implementation |
|---|---|---|---|---|---|
| **Managing Director** | √ |  |  |  |  |
| **Chief Financial Officer** | √ | √ | √ | √ | √ |
| **Procurement Manager** | √ | √ | √ | √ |  |
| **Asset/Budget Manager** | √ | √ |  | √ | √ |
| **Systems Engineer** | √ | √ |  |  | √ |

Table 9 above illustrates the interview outcomes based on the COTS framework. From the interviews each of the respondents input related back to the COTS evaluation criteria and processes.

Managing Director

According to the managing director the reason for changing the ERP included the following; the ERP that was in place was outdated, not all company requirements were being satisfied in terms of financial data and reporting, many of the subledger functions were being carried out off the system. Due to these factors the organisational risk was identified as follows; the organisation was 6 years behind on regulatory audited financial statements, management was unable to provide the board of directors and shareholders live, updated and reliable information, there was a lack of accountability and transparency, management was unable to determine the financial position of the organisation in terms of cash flows, they could not determine the cash reflected in the bank accounts as well as the investment accounts and there were also issues regarding the reconciliation of debtors and creditors. These system shortfalls cascaded into the operational environment. The finance department was unable to provide the operational managers with reliable and accurate budgeting and expenditure reports making operational decision-making extremely difficult.

The managing director further stated that in order to manage these risks, an analysis was carried out to determine the detailed system requirements and specifications. This includes the ledger, all subledgers and management financial reporting.

Once the specifications were drawn up, the organisational procurement process was followed, to acquire a system that would best meet the organisation's requirements. This process is outlined in the interview conducted with the procurement manager. The managing director further stated that, as a result of the procurement process, the organisation gathered information on other ERPs on the market including the system that was currently implemented. The system specification that was drawn up formed the basis of the selection process. In the questionnaire process the managing director indicated that the new ERP that was implemented resulted in an 81 to 90 percent organisational fit, the reason for this was that the assets module was not completely implemented, due to complexity of the requirement, as well as the associated burden of not having submitted 6 years of financial statements and the time constraints at that time. He, however stated, that if these constraints where absent, this module could have been successfully implemented.

An interesting outcome of the selection and evaluation process was that the old system that the organisation had in place, was the very same system that was identified as the best fit to the organisation, and re-implemented; a new system was not implemented. It became clear through

the procurement process that the old system could provide the required functionality, and its failure could be attributed to incorrect configuration. The major contributing factor that led to this realisation emanated from the specifications process, which played a key role in the process. Other contributing factors was the ease of change management, minimal training requirements, and reduced implementation cost.

Owing to the re-implementation of the ERP, all the above risks, with the exception of the asset module, have been mitigated. The organisation was able to, after seven years, produce accurate management financial reports, produce real-time operational reports, and, most importantly audited financial statements.

Chief Financial Officer

In the interview with the chief financial officer (CFO), two areas of concern with the ERP were identified that led to the process of a new ERP acquisition. One area was compliance, and the other was operational. From a compliance perceptive, the ERP was unable to produce financial statements, which is a statuary requirement. The CFO further stated that this was due to subledgers not reconciling with the main ledger and some modules not being correctly implemented, or relevant modules being excluded from the implementation. From an operational perspective the CFO identified expenditure information as being problematic. The management reports of actual expenditure versus budgets was inaccurate, resulting in operational staff not being able to monitor and manage their budgets. The CFO partially attributes this to the initial ERP setup, where financial distribution postings to ledgers and subledgers was not configured correctly, as well as inadequate training to finance staff during the ERP implementation process. It was for these reasons that the organisation decided to implement a new ERP. The organisation followed a procurement process hinged around ERP specifications that were compiled by the different finance managers.

The CFO was asked to comment on the fact that the procurement process resulted in the very same problematic ERP being recommended for implementation, the CFO stated that the implementing vendor, being engineers with little or no finance experience, had no understanding of the organisations requirements. This led to only certain modules being implemented, and incorrectly at that. The CFO believes that the failure of the ERP is due to implementing vendors inability to delivery on the requirements specified by the organisation.

The CFO stated that, whilst re-implementing the ERP, the specifications that were drawn up played a significant role in meeting the organisations requirements. When asked about the assets module on the re-implemented system not functioning, the CFO commented that the required data sets for system import was unavailable at the time. This contributed to the module not being implemented. Coupled with this was the vendor's inability to understand the asset module specifications. According to the CFO, much of the associated risks have been mitigated with the re-implementation of the system, with financial statements can be produced, the fact that and management reports are accurate.

Procurement Manager

The procurement manager stated that many of their processes, in the old ERP, were conducted outside the ERP, generating copious amounts of paper documentation, leading to poor paper trails. This resulted in audit findings, as the department was unable to report on the procurement process as well as on reportable deviations. The procurement manager outlined the process followed in acquiring a new ERP. Key role players were identified based on their field of expertise and functional responsibilities in the utility. These participants included the chief financial officer (CFO), income accountant, expenditure account, procurement officer, asset officer, and budget officer of the utility. Information sessions were conducted to determine what modules and scope were essential to the water utility. Further information sessions were conducted with finance departmental heads and key staff. The purpose was to collect data on the actual business processes of the utility. Specific functions and processes associated the modules applicable to their job functions were identified. The modules identified as essential modules in any ERP system included; supply chain management (SCM), contract management, accounts payable, accounts receivable, fixed assets, project finance, cash management, interfaces, budgeting, management information, and information technology.

The scope of each of these eleven modules are presented in Table 10, below. The scope of the module refers to the functional business processes within the module. For example, within the SCM module one of the business processes would be procurement. Procurement is the business process that facilitates the acquisitioning of goods and services. Thus, the scope of the SCM module would include procurement as one its functional business processes.

**Table 10 Modules and scope required in an ERP system**

| Modules | Scope |
|---|---|
| Supply Chain Management | Procurement<br>Purchase requisition<br>Request for quotation (RFP)<br>Purchase order<br>Emergency orders<br>Receiving<br>Goods returns note<br>Vendor master file<br>Inventory<br>Inventory master file<br>Inventory reorder<br>Dispatch<br>Stock takes<br>Reporting requirements |
| Contract Management | New contracts<br>Existing contracts<br>Deletion of contracts<br>Call-offs<br>Reports<br>Escalation on contracts |
| Accounts Payable | Invoice matching<br>Debit invoicing (no purchase order)<br>Debit & credit notes<br>Accruals journals<br>Prepayments<br>Reporting requirements<br>Views |

| | Reporting requirements<br>Views |
|---|---|
| Accounts Receivable | Debtors master file<br>Invoicing<br>Lab debtors<br>Water debtors<br>Effluent debtors<br>Sundry<br>Staff<br>Invoice print out<br>Receipts<br>Late payments<br>Statements<br>Credit notes<br>Journals<br>Key reports used |
| Fixed Assets | Asset Masterfile<br>Depreciation<br>Disposal<br>Repairs and maintenance<br>WIP and forecasting<br>Revaluation<br>Impairment<br>Wear and tear<br>Journals<br>Reporting requirements<br>General |

| Project Finance | General requirements<br>Project details capture<br>Project management - approval routing<br>Budget capture<br>Cashflow<br>Purchase requisitions and orders<br>Invoicing<br>Payment - internally funded projects<br>Externally funded projects<br>Credit notes<br>Reporting requirements<br>Summary views |
|---|---|
| Cash Management | General requirements<br>Borrowings - loan schedule & interest accrual<br>Interest accrual schedule<br>Reporting requirements<br>Investments |
| Interfaces | GIS, Payroll, HR |

| Budgeting | Operational costs |
| | Income |
| | Forecasting |
| | Dashboards |
| | General |
| Management Information | General ledger codes |
| | Journals |
| | Accounting standards |
| | Financial calendar |
| | Period closure procedures e.g. Month-end requirements |
| | Data take-on |
| | Cost and management accounting |
| | Financial statements |
| | General reporting requirements |
| Information Technology | User profile management |
| | Login procedures |
| | Environments |
| | Archiving |
| | Paper types |
| | Menu allocation |
| | General |
| | Technical |

Once the modules and the scope were identified, it was necessary to get specific detail on the actual business rules and procedures that are followed in each module. These would constitute the actual evaluation specification. For example, service providers to the utility must be managed and maintained in a master file in the module scope. This would form a specification in the of supply chain management, procurement module. The summary of the specification in each module is presented in Table 11, below. It provides an overview of what needs to be evaluated in each module, prior to the ERP purchase decision.

**Table 11 Specification of requirements for the ERP system**

| A | SUPPLY CHAIN MANAGEMENT |
|---|---|
| A1 | **PROCUREMENT** |
| A1.1 | **General Requirements** |
| | The general requirements for the Procurement function of the SCM identified 10 criteria. These criteria covered aspects of web-based requisition creation, routing, delegation of authorities and requisition querying. |
| A2 | **PURCHASE REQUISITION (PR)** |
| A2.1 | **Non-Stock Items (Directs)** |
| | Requisitioning, 17 criteria, for non-stock capital project items. These criteria all for the requisitioning process, capturing thereof, approvals and notifications. |
| A2.2 | **Request for Quotation (RFQ)** |
| | 12 Criteria for the creation of request for quotations from purchase requisitions, capturing thereof, checking budgets and approvals. |
| A3.1 | **Purchase Order** |
| | Creating of purchase orders from request for quotation. 11 criteria from generating purchase orders, approving and communicating via fax/e-mail. |
| A3.2 | **Emergency Orders** |
| | 5 criteria for the creation of emergency orders for vendor not on vendor master file. |
| A4.1 | **Receiving** |
| | Receiving as a result of purchase order process. 13 criteria on the receiving process including full and partial orders. Processing the purchase order and the associated financial postings. |
| A4.2 | **Goods Returns Note** |
| | 4 Criteria for the process of returning ordered goods and associated financial postings. |
| A5 | **Vendor Master File** |
| | Management of vendor master information. 15 criteria with rules and required information for vendor maintenance. |

| A6 | INVENTORY |
|---|---|
| A6.1 | **Inventory Master File** |
| | Management of inventory master information. 10 criteria with rules and required information for inventory maintenance. |
| A6.2 | **Inventory Reorder** |
| | 3 criteria for the reorder (requisitioning) for inventory items that have reached minimum stock levels. |
| A6.3 | **Dispatch** |
| | 9 criteria for the requisitioning of goods from stock items. |
| A6.4 | **Stock Takes** |
| | 4 criteria for the management of stock takes, scheduling and stock information. |
| A7 | **Reporting Requirements** |
| | 22 criteria on the reporting requirements. |
| B | **CONTRACT MANAGEMENT** |
| B1 | **New Contracts** |
| | 30 Criteria for the management and capturing of new contracts |
| B2 | **Existing contracts** |
| | 2 criteria for the viewing and queries of existing contracts. |
| B3 | **Deletion of contracts** |
| | 3 criteria for the deletion of contracts. |
| B4 | **Call-offs** |
| | 4 Criteria for the termination of contracts. |
| B5 | **Reports** |
| | 6 criteria on reporting requirements. |
| B6 | **Escalation on contracts** |
| | 2 criteria for the change in price of contracts. |
| B7 | **Contract extension** |
| | 1 criterion for the extension of contracts. |

| C | ACCOUNTS PAYABLE |
|---|---|
| C1.1 | **Invoice Matching** |
| | Matching invoices to the goods received note. 20 criteria to manage in process and associated financial postings. |
| C1.2 | **Debit Invoicing (No Purchase order)** |
| | 4 criteria for the processing of invoices with no goods received note. |
| C2 | **Debit & Credit Notes** |
| | 3 criteria for processing of debit and credit notes and associated financial postings. |
| C3 | **Accruals Journals** |
| | 4 criteria the performing accruals on outstanding orders, outstanding goods received note, unposted invoices and invoices without orders. |
| C4 | **Prepayments** |
| | 2 criteria for the payment of outstanding invoices. |
| C5 | Payments |
| | 16 criteria for the payment of invoices, approvals, bank uploads and associated financial postings. |
| C6 | **Reporting Requirements** |
| | 17 criteria on the reporting requirements. |
| C7 | **Views** |
| | 7 criteria on application views of transactions, purchase orders, general ledger codes etc. |

| D | ACCOUNTS RECIEVABLE |
|---|---|
| D1 | **Debtors Master File** |
| | Management of debtor master information. 9 criteria with rules and required information for debtor maintenance. |
| D2 | **Tariffs Computation** |
| | 13 criteria to facilitate computation of various tariffs charged to customers based on the budgeted figures i.e. operational costs and budgeted volumes. |
| D3 | **Tariffs Maintenance Table** |
| | 6 criteria to maintain applicable tariffs. |
| D4 | **Water and Waste Water Volumes Table** |
| | 10 criteria for the capture and maintenance of water volumes, licenses and budgeted volumes. |

| D5 | Invoicing |
|---|---|
| D5.1 | General |
| | 11 criteria for the invoicing/billing of debtors. |
| D5.2 | (1) Lab Debtors |
| | 7 criteria for the invoicing of laboratory debtors. |
| D5.3 | 2) Water |
| | 16 criteria for the invoicing of water debtors. |
| D5.4 | (3) Effluent |
| | 7 criteria for the invoicing of effluent debtors. |
| D5.5 | (4) Sundry |
| | 2 criteria for the invoicing of sundry debtors. |
| D5.6 | (5) Staff |
| | 4 criteria for the invoicing of staff debtors. |
| D5.7 | 6)Invoice Print Out |
| | 3 criteria for the generation of a pre-numbered tax invoice with all the details of applicable debtor. |

| D6 | Receipts |
|---|---|
| | 5 criteria for the capturing of receipts against the respective debtors account into the system and associated financial postings. |
| D7 | Late Payments |
| | 5 criteria for the automatic generation of reminder letters for overdue payments. |
| D8 | Statements |
| | 3 criteria for the process of generating consumer statements. |
| D9 | Credit Notes |
| | 5 criteria for the generation of credit notes and associated financial postings. |
| D10 | Journals |
| | 5 criteria for the creation and posting of journals. |
| D11 | Reporting Requirements |
| | 12 criteria on the reporting requirements. |

| E | FIXED ASSETS |
|---|---|
| E1 | General |
| | 10 general criteria for the management of fixed assets. |
| E2 | Asset Masterfile |
| | Management of asset master information. 16 criteria with rules and required information for asset maintenance. |
| E3 | Depreciation |
| | 5 criteria for the rules on the calculation of depreciation. |
| E4 | Disposal |
| | 3 criteria for the disposal of assets. |
| E5 | Repairs & Maintenance |
| | 1 criterion for the updating of assets based on repairs and maintenance. |
| E6 | WIP & Forecasting |
| | 5 criteria for the updating of asset information based on work-in-progress. |
| E7 | Revaluation |
| | Accommodate for revaluation of assets as and when required. |
| E8 | Impairment |
| | Cater for impairments of assets. |
| E9 | Wear And Tear |
| | Cater for wear and tear. |
| E10 | Journals |
| | 6 criteria to create journals on additions, depreciation, disposals and transfers of assets. |
| E11 | Reporting Requirements |
| | 11 criteria on the reporting requirements. |

| F | PROJECT FINANCE |
|---|---|
| F1 | General |
| | 3 criteria for general project finance requirements. |
| F2 | Project Details Capture |
| | 7 criteria detailing the capture of project details. |
| F3 | Project Management - Approval Routing |
| | User to define approval routings, authorisers & delegated authority values on the project. |
| F4 | Budget Capture |
| | 8 criteria on the capturing of project budgets. |
| F5 | Cash flow |
| | Generation of straight-line cash flow for each set of budget values. |
| F6 | Purchase Requisitions & Orders |
| | 10 criteria on the capture purchase order against project allocated budget. |
| F7 | Invoicing |
| | 15 criteria on the project invoicing. |
| F8 | Payment - Internally Funded Projects |
| | Payment process as accounts payable. |
| F9 | Payment For - Externally Funded Projects |
| | 3 criteria for payments of externally funded projects. |
| F10 | Credit Notes |
| | Ability to process credit notes |
| F11 | Reporting Requirements (For Both Internally and Externally Funded Projects) |
| | 15 criteria for reports printed according to pre-defined parameters. |
| F12 | Reporting Requirements |
| | 25 criteria on the reporting requirements. |
| F13 | Summary Views |
| | Views on Budgets vs. PO's, PO's vs. Invoices and Invoices vs. Payments |

| G | CASH MANAGEMENT |
|---|---|
| G1 | General |
| | 7 criteria for the processing of cash receipts, payments, EFT transfers, standing orders, the integration with bank account and associated financial postings. |
| G2 | Borrowings - Loan Schedule & Interest Accrual |
| | Criteria for a loans maintenance function. |
| G3 | Interest Accrual Schedule |
| | System should calculate on a monthly basis the interest on loans and associated financial postings. |
| G4 | Reporting Requirements |
| | 2 criteria on the reporting requirements. |
| G5 | Investments |
| | The system should automatically allocate net interest to the various schemes. |

| H | INTERFACES |
|---|---|
| H1 | General |
| | A list of systems that the ERP is required to interface with. |
| I | BUDGETING |
| I1 | Operational Costs |
| | 6 criteria for operational budgeting. |
| I2 | Income |
| | Interface with other systems and allow for information to be downloaded and uploaded from the ERP system. |
| I3 | Forecasting |
| | Facility to allow preparation of business forecast/plan up to 5 years. |
| I4 | Dashboards |
| | Allows management to view budgets based on real time information from the financial system. |
| I5 | General |
| | 8 criteria listing general budgeting requirements. |

| J | MANAGEMENT INFORMATION |
|---|---|
| J1 | General Ledger Codes |
| | 5 criteria on the management and setup of the chart of accounts. |
| J2 | Journals |
| | Criteria for accounting journals. |
| J3 | Accounting Standards |
| | The system must be in compliance with GRAP, PFMA, MFMA and Water Services Act. |
| J4 | Financial Calendar |
| | Criteria for management of financial calendar. |
| J5 | Period Closure Procedures |
| | Criteria for month end financial closures. |
| J6 | Data Take-On |
| | Data take on should be for the prior and current year, actuals, as well as the current year budget. |
| J7 | Cost and Management Accounting |
| | Criteria for the allocation of costs. |
| J8 | Financial Statements |
| | 6 criteria for the generation of financial statements. |
| J9 | General Reporting Requirements |
| | 16 criteria on the reporting requirements. |

| K | INFORMATION TECHNOLOGY |
|---|---|
| K1 | User Profile Management |
| | 16 criteria on the management of user profiles in terms of security access and functionality. |
| K2 | Login Procedures |
| | Criteria for architecture related login. |
| K3 | Environments |
| | Criteria for demo, test and live environments. |
| K4 | Archiving |
| | Capability to archive event logs and audit trails. |
| K5 | Paper Types |
| | Criteria for printing and paper types. |
| K6 | Menu Allocation |
| | Criteria for configuration of menu allocation. |
| K7 | General |
| | Audit trail on changes to all master file information. |
| K8 | Technical |
| | Criteria detailing organisational IT infrastructure architecture. |

As presented in table 11, supply chain management forms part of the procurement process. This module allows the user to create process, manage and report on requisitions, purchase request processing, purchase order processing, receiving and inventory control. Contract management manages all types of contracts related to supply and delivery of operations, instalments, rentals and leasing. Accounts payable records and manages vendor accounting data while accounts receivable records and manages customer accounting data. The fixed assets module allows the user to track, analyse, manipulate and report on fixed assets. The project finance module is used to manage project definitions, costing, accounting, portfolio management, resource management and billing. Cash management is the bank control system that is used to reflect all transactions that affect the cashbook that is linked to the organisations bank accounts. This module is used for the generation of payments that are generated by sub-modules. The interfaces module refers to standard interfaces to send and accept data from a number of external systems. The budgeting module is a process within the ERP that allows the user to capture, amend, track revisions and approvals of budgets. The management information module provides comprehensive financial information that would include: financial and management reporting, financial planning, budgeting, forecasting, profitability management, overhead costs, working capital, and cash flow management. Finally, the

information technology module relates to the associated technology requirements in terms of setup and management.

As part of the procurement process, vendors were then required to respond to requirements specification in terms of the criteria. Vendors in response indicated whether the specification requirement fell into one of four categories of criterion: standard functionality, 3rd party, customisation and no functionality. An indication of standard functionality means the software can satisfy the required functionality as it is, whereas a 3rd party indication means that the requirement can be satisfied only by the implementation of a 3rd party application outside the original ERP being presented by the vendor. Customisation would indicate that software would have to be specifically written or coded to meet the specified requirement, and finally no functionality would indicate that the ERP would not be able to meet the specified requirement.

**Table 12 Procurement Results**

| Vendor | Solution | Timeline (weeks) | Price | Annual Maint. | IT Platform | COTS Score |
|--------|----------|-------------------|--------|----------------|--------------|-------------|
| 1 | A | 72 | R11.8 m | Not Specified | In spec | 83 |
| 2 | B | 19 | R10.5m | R282 | Out of spec | 86 |
| 3 | B | 20 | R4.3m | Not Specified | Not specified | 86 |
| 4 | D | None | R3.1m | R102 | Out of spec | 82 |
| 5 | E | 22 | R1.9m | R101 | In spec | 96 |
| 6 | F | 112 | R7.5m | R414 | Out of spec | 75 |
| 7 | E | None | R2.4m | R177 | In spec | 96 |
| 8 | B | 36 | R7.9m | Not Specified | In spec | 86 |
| 9 | I | 63 | R1.5m | R45 | In spec | 60 |
| 10 | B | None | R8.3m | R198 | Not specified | 86 |
|  |  |  |  |  |  |  |

Table 12 details the aspects that were considered when evaluating the different ERP solutions. The table lists the vendors and the solution that they are proposing, based on the specifications and criteria listed by the organisation. The timeline indicates the proposed duration of the project implementation plan. It must be noted that vendors D, G and J excluded a project plan in their proposal and this would count negatively against the vendor during the evaluation process. Along with the project plan that would detail processes and timelines. The project costs are also specified. The costs are essential on determining, in this case, the total cost of ownership, which would also include the software annual maintenance fees as shown in the table. The column in the table titled IT platform indicates whether the proposed solution is compliant with the organisation's IT infrastructure strategy. As shown in Table 12, four of the proposed solutions were outside the IT infrastructure plan. This would exclude the proposed solution from the list of possible solutions. Finally, the score column is related to the fit of the proposed solution to the specifications. The higher the score, the better the fit between the organisations requirements and the proposed solution.

Asset/Budget Manager

According to the asset and budget manager, who identified two issues with the ERP with regards to the functions that he is responsible for. The first issue he mentioned was a non-existent asset register on the ERP system. The second issue was weekly and monthly budget reporting to managers, these reports were incorrect and created a significant risk to the organisation. These issues added to the reasons for a change in the ERP system.

The manager further stated that the asset module was not implemented due to complications with the take-on data, as a result the asset functions were run outside the system. He further stated that if the take-on information were correct, the system would have been able to carry out the asset module functions, as stipulated in the requirements specifications. He further explained the issues regarding the budget management reports. The reports were inaccurate, as it did not correctly reflect the departmental budgets, the actual expenditure, and the committed expenditure. The associated risk is that the managers could possibly overspend their operational budgets, making it difficult for managers to run their departments.

With the implementation of the new system, the issue of budget management reports was resolved in its entirety, thereby eliminating the risk to the organisation. The manager stated that it was his opinion that the success of the ERP implementation could be attributed to the following: adequate training on the system, adequate project management, buy-in and involvement of staff, and the creation of proper system specifications.

Information Technology Systems Engineer

According to the Systems Engineer (SE) IT played a role in the setup and collection of information in the specifications process. The SE stated that the development of the specifications was to assist in ascertaining the best fit ERP for the organisation. It was necessary that the ERP remain as vanilla (with the least modification or change) as possible. A standard implementation would reduce the costs of implementation and maintenance. The SE further explained the evaluation criteria, as stated by the procurement manager, in terms of standard functionality, 3rd party software, customisation and no available functionality.

The IT requirements were clearly specified in the procurement process. These non-functional specifications detailed the IT infrastructure in terms of servers, PCs, computer networks, and application software. Other IT requirements included security and reporting.

Other evaluation considerations included the total cost of ownership over a period of five years. These considerations included the software cost, implementation cost, licensing cost, and post-implementation support. The vendor would also have to provide a detailed project plan that would include planning, design, testing, go-live and support.

# 5. Discussion of Findings

This chapter will illustrate the literature presented earlier in relation to the main findings discussed in chapter four. The empirical study provided the appropriate data that would respond to the research questions posed at the outset of the study. The presentation of the findings is based on the theoretical framework that was reviewed in Chapter Three. The data extracted in Chapter Five produced significant findings to respond to the processes followed in implementing the ERP at the entity. It is the aim of the researcher to highlight interesting and unique data collected in Chapter Four. This chapter, at the very end, will form the basis of the discussions and final recommendations.

It consists of three main constructs that will outline the findings of this study. These constructs will include evaluation criteria, processes, and COTS frameworks.

## A. Evaluation criteria

### 1. Functional

The functional requirements are specific in terms of what the COTS product must do. These requirements relate directly to the actions or functions that the COTS product must perform in order to satisfy the business requirements of the organisation. The functional requirements should thus fully describe the actions that the intended COTS product must perform.

According to the results of the questionnaire, in Figure 11 of Chapter Four, functional aspects of the ERP evaluation criteria included operational, managerial and organisational. It was evident from the statements of the managing director and the chief financial officer that functional evaluation criteria included being able to have current, updated and reliable information, that would improve accountability and transparency.

Operationally, they required a fully functional and reconcilable ERP, where sub-ledgers and ledgers reconciled. Managerial functionality included reliable and accurate budgeting and expenditure reports to assist in decision-making, and

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organisational aspects included good governance, and compliance in terms of audited financial statements.

It is evident from the information provided from the managing director and the chief financial officer that the functional project specific evaluation criteria influenced the ERP implementation process. It is also interesting to note from figure 12, titled functional parameter that influenced the choice of the ERP implementation, all respondents indicated that the nature of the requirements played a significant role in the ERP selection. It is also important to note that the number of modules and application interfaces featured highly.

2. Non-functional

Non-functional requirements can refer to security, maintainability, reliability, scalability, efficiency and performance, portability, flexibility, and usability. Non-functional evaluation criteria also include IT infrastructure in terms of hardware, software and networks. These played a significant part in the implementation process. A large majority of the respondents either agreed or strongly agreed with the aspects of non-functional evaluation criteria. It is important to note the detail given in specifying the IT requirements. The organisation gave much consideration to the influence of the IT infrastructure. According to the Information Technology Systems Engineer, the non-functional IT criteria included infrastructure details such as: the server configuration, operating systems and database metadata, the specifications of end-user computers, computer networks, and application software, which included web capabilities and active directories.

These non-functional criteria can have a significant impact on the ERP selection and evaluation processes. It is clear that an ERP can be illuminated from the selection process based on the non-conformance to the IT infrastructure. The IT infrastructure clearly influenced the processes as is evident in table 13 titled Evaluation Criteria. The table clearly illustrates that ERPs can obtain high functional scores. However, these are eliminated from the selection process, based on non-compliance to the organisation's IT infrastructure. From table 12, Solution B and Solution F scored high on the functionality, but failed to meet the IT

requirements and were therefore illuminated from the process. A question can arise from this scenario, that is, can the IT infrastructure limit the potential for success of the ERP implementation? It is also evident from table 12 that all respondents strongly agreed that non-functional aspects such as security, maintainability, reliability, scalability, efficiency and performance, portability, flexibility, and usability played a role in the COTS evaluation process.

## B. Processes

There are several processes in the selecting and evaluating of ERP or COTS software. These processes can be iteratively, overlapping or sequential, however the most common processes for evaluating and selection can be ordered in terms of preparation, evaluation, selection, and implementation.

### 1. Preparation Process

The objective of the preparation process is to acquire information for a further detailed evaluation. This involves the establishing of evaluation criteria, which may include both functional and non-functional aspects to identify the best-fit COTS software candidates. According to the SCM manager part of the preparation process was to establish three distinct committees that would assist with the COTS procurement process. These committees are the specifications committee, the evaluation committee, and the adjudication committee.

The responsibility of the specifications committee was to compile detailed specifications for the COTS requirement. The specifications are meant to be compiled by committee members who are experts in their field, in addition specifications should be unbiased and facilitate all potential vendors a fair opportunity to offer their product and services. The evaluation committee was responsible for the evaluation of the COTS alternatives. Once the evaluation committee completed the evaluation process, a report of recommendations on the COTS alternatives was submitted to the adjudication committee. This committee is responsible for deciding on the final award of the COTS

system, and makes recommendations to the accounting officer, in this case, the managing director.
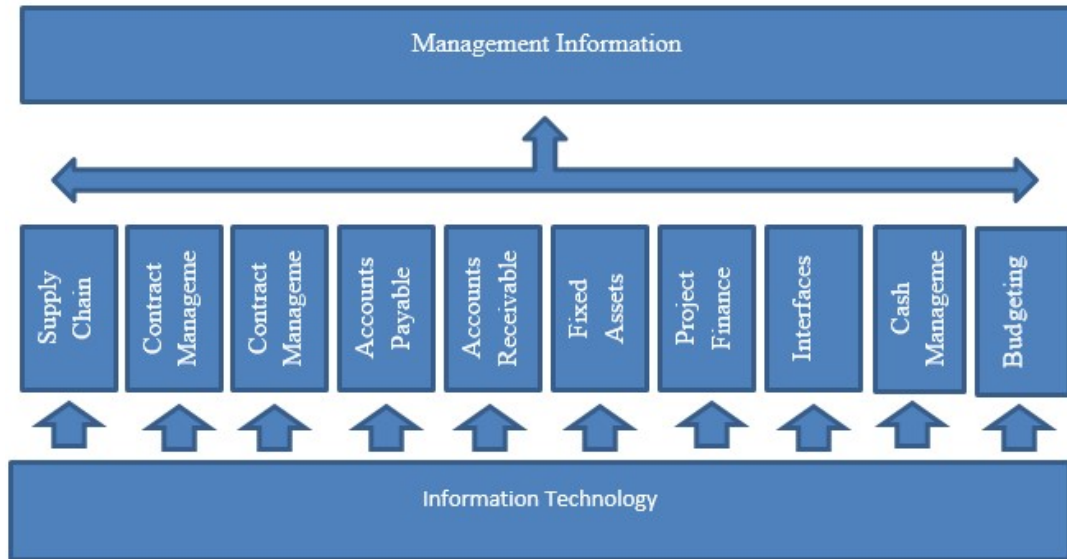


**Figure 17 Module selection.**

Figure 17 illustrates the modules for the evaluation criteria related to the COTS functions that were identified by the organisations specifications committee. The Information Technology aspect forms the bases of the COTS selection. As a non-functional criterion the COTS modules would have to conform to the IT infrastructure, as discussed above. It is important to note that the organisation had an existing IT infrastructure that informed the evaluation criteria. Further the organisation was able to clearly identify the COTS modules required. This was achieved with the assistance from the necessary organisational role players. Supply chain management (SCM), contract management, accounts payable, accounts receivable, fixed assets, project finance, cash management, interfaces, and budgeting were identified as the required modules. The implementation of these modules would inform the final module, management information.

According to the SCM manager, the identified modules related to the functional business processes. Further, the scope of each module was identified. This refers to the actual specific requirement which is translated to the requirements criteria listing, against which the COTS vendors will respond.

The distribution on of the specifications was carried out via advertising the COTS requirements, and in this way prospective COTS vendors could respond to the organisations request. The process was carried out in a fair and transparent manner, in order to achieve the greatest response from vendors.

## 2. Evaluation Process

An important part of the evaluation process is identifying COTS software alternatives based on evaluation criteria definition. This process is critical in determining how well each of the COTS alternatives satisfy the evaluation criteria. Therefore, in this process the main objective is to determine to what degree each COTS software alternative meets the evaluation criteria in explicit detail, and to sort these alternatives based in the level of importance. There are different techniques that can be used to consolidate the evaluation data such as Weighted Scoring Method (WSM) and Analytic Hierarchy Process (AHP) for the decision-making during the selection process.

The organisation did not use, and should have considered applying the Weighted Sum Method (WSM) in the process of the COTS selection. This method users an aggregated value by summing attribute weights multiplied by their respective values. The scoring method used is illustrated in the formula below.

$$score_a = \sum_{j=1}^{n} \left( weight_j * score_{aj} \right)$$

Each criterion is assigned a weight or score. In this case weights were used. They were normalised so that the total weighted score was one hundred. If scoring is used this is done by assigning a weigh score to each criterion. Each alternative is given a score on each criterion. The score for each alternative is counted by the formula above, where subscript $a$ represents an alternative and $n$ represents the number of criteria.

The use of WSM can be criticised as it includes the summing up of differing types of data, there may be a lack in process for determining attribute weights and the results problem of losing dependency information between attributes. On the other hand, the application on WSM is straight-forward, and presents results that intuitively make sense.

The Analytic Hierarchy Process (AHP) is another decision tool that can be used in the process of selecting COTS alternatives. It allows for complex decisions to be reduced to a series of one-on-one comparisons. This process involves the development of a hierarchical model that represents the problem, in this case it would be the selection of the COTS alternative $(A = (A_1, A_2, A_3, A_4))$. The problem is divided into sub-problems that are referred to as alternative evaluation criteria, these criteria are recursively divided to obtain the leaf criteria $(C = (C_1, C_2, \ldots\ldots, C_k))$ of the decision hierarchy. Once the hierarchy is developed, the leaf criteria are organised in a matrix and each pair of criteria are cross compared in the order of importance. Once completed the geometric mean of received grades for each criterion is calculated and final weights $(W_1, W_2, \ldots\ldots, W_k)$ are obtained by normalising the means of a sum of one. Consideration should also be given to the strength $(a_{j1}, a_{j2}, \ldots\ldots, a_{jk})$ of the alternative COTS product $j$. Regarding the evaluation criteria $(1, 2, \ldots\ldots, k)$ is determined by cross comparing each pair of COTS alternatives that can satisfy the associated requirement with the required criterion. Just as the criteria weights are created, each criterion $a_{ji}$ values are generated. At the end, the ability for the alternative $j$ to meet the requirements is represented by $Score_j$ by using the formula below.

$$Score = \begin{pmatrix} a_{j1} & a_{j2} & \ldots. & a_{jk} \end{pmatrix} \begin{pmatrix} W1 \\ W2 \\ :: \\ W3 \end{pmatrix}$$

The specifications committee expected one of four responses to the requirements specification, as indicated by the SCM manager. These were: standard functionality, 3rd party, customisation, and no functionality.

Although the organisation did not use the WSM or AHP approach in terms of actual weights being applied to each module, they scored the modules as explained below.

**Table 13 Evaluation Criteria**

| | A. SUPPLY CHAIN MANAGEMENT | | | | | |
|---|---|---|---|---|---|---|
| | | **S** | **P** | **C** | **N** | **Comments** |
| **1** | **1 SUPPLY CHAIN MANAGEMENT** | | | | | |
| **A1** | **PROCUREMENT** | | | | | |
| **A1.1** | **General Requirements** | | | | | |
| A1.1.1 | Workflow functionality required and the routing should not be hard coded. Administrator and buyer should be able to change the workflow routing (e.g. when key approvers are absent) | | | | | |
| A1.1.2 | Routing is based on the delegation of authority i.e. staff seniority and value of PR | | | | | |
| A1.1.3 | Allow for alternative manager to route to for approval. E.g. user 1 can either route to manager X or manager Y for cases where user 1 reports to more than one manager | | | | | |
| A1.1.4 | Escalate/route to second approver if no action has been taken by the first approver after a specified period e.g. 3 days | | | | | |
| A1.1.5 | Cater for various purchase orders (capital and projects): | | | | | |
| a) | Direct Items & Stock Items (RFQ if value > R1000) | | | | | |
| b) | Emergency orders | | | | | |
| A1.1.6 | Requisitions must be web Based | | | | | |
| A1.1.7 | System should allow for queries and user reports | | | | | |
| A1.1.8 | Allow for comments to be inserted on requisition | | | | | |
| A1.1.9 | Ability to assign different roles to the same user | | | | | |
| A1.1.10 | Must have an approval hierarchy | | | | | |
| **A2** | **PURCHASE REQUISITION (PR)** | | | | | |
| **A2.1** | **Non-Stock Items (Directs)** | | | | | |
| A2 1.1 | Allow creation of purchase requisitions | | | | | |
| A2 1.2 | One purchase requisition to cater for multiple line items | | | | | |
| A2 1.3 | Automatic generation of purchase requisition numbers | | | | | |
| A2 1.4 | The originator of the purchase requisitions should not be able to input the price | | | | | |
| A2 1.5 | Input fields should cater for input of item description, quantity, date. These are required fields | | | | | |
| A2 1.6 | Unit of measure to be selected (kg, boxes etc) | | | | | |
| A2 1.7 | The project name and number should be captured ( mandatory) | | | | | |
| A2 1.8 | A suggested vendor should be selected (information retrieved from the vendor master file) – only in a comment box | | | | | |
| A2 1.9 | Date originated should default to system date | | | | | |
| A2 1.10 | The description field should be of adequate size and allow for additional lines to be added | | | | | |
| A2 1.11 | Allow input of delivery period and expiry period on the requisition | | | | | |
| A2 1.12 | Workflow functionality required for approval of PR (as per administrator-defined routing) | | | | | |
| A2 1.13 | Send email alert to person required to take action | | | | | |

The organisation created a requirements specification and evaluation template as illustrated in table 13. The table above would be for the COTS module supply chain management. This module, like others, was identified by the specifications committee as a functional requirement (titled "A"). The scope of the module included functional aspects such as procurement and purchase requisitions (titled A1 and A2). Next to each of these functional requirements, the criteria "S"," P", "C" and "N" are included. As explained above, these denoted standard functionality, 3rd party, customisation, and no functionality. The organisation also allowed for comments should it be required by the vendor. An iterative process was followed in creating a requirements specification and evaluation template for each of the modules, including the non-functional aspect of Information Technology. The collection of all these module templates formed a completed requirements specification and evaluation template for the organisation.

In order to score the COTS functionality, values were assigned to "S"," P", "C" and "N" as illustrated in the table below.

**Table 14 Criteria Scoring**

| Criteria | Score |
|---|---|
| **Standard Functionality (S)** | 3 |
| **3rd Party Solution (P)** | 2 |
| **Custom Solution (C)** | 1 |
| **No Functionality (N)** | 0 |

Table 13 indicates the scoring system applied to the evaluation process with the highest score of 3 for standard functionality, 2 for 3rd party solution, 1 for custom solution and 0 for no functionality. This will appear to be an equitable approach to scoring the COTS alternatives. It would appear from this approach that for standard functionality is preferred by the organisation.

## 3. Selection Process

The COTS selection process involves identifying criteria and evaluating the alternatives by using a selection methodology decided upon by the organisation.

Several types of data result from the evaluation process. These include facts, checklists, weights, and opinions. These datasets should be interpreted and consolidated into usable information. It is imperative that decision makers identify mismatches between COTS features and customer requirements in order to select the most appropriate COTS solution. The recommendations to the organisation would include which COTS alternative should be procured by the organisation.

The methodology applied by the organisation was not restricted to software selection. From the data collected it is noteworthy to mention the following selection criteria that seemed to have played a role in the final selection process. The organisation seemed to have placed priority on standard functionality, limiting the possible need for 3rd party add-ons, or customisation. This was evident from the criterion that was setup as in table 13. Customisation may cause difficulties in updating to future COTS software releases. The level of customisation was also scored in figure 12 as an important selection criterion. In figure 14 customisation is identified as a non-obstacle to the implementation process.

The degree of implementation of the ERP was considered as indicated in table 11. The organisations infrastructural environment was not disregarded, as this could possibly lead to increased implementation costs or difficulties in implementation. Maintenance of the system is associated with upgrades and patch management. No mention of this aspect was discussed. It can be assumed that this is due to the IT infrastructure requirements specified that maintenance was not a major concern.

Cost is an important factor when implementing an ERP. Due to this one of the other organisational considerations in the selection process was the COTS Total Cost of Ownership (TCO). TCO includes a wide range of factors. In this regard, they had to collect information related to software licensing costs, maintenance costs, hardware costs and other direct and indirect costs (i.e. training). It is worth noting that the organisation benefitted substantially from re-implementing their original ERP. As a

result, minimum change management was required. No additional re-skilling or training was required. User buy-in required minimal effort and ease of use was of little concern to the organisation.

Another important consideration was the reporting and analysis features that were specified by the organisation. This is evident from tables 10 and 11, where reporting requirements are specified for each module. These reporting requirements extend from standard reports, to users creating custom reports and analysis tools for data dumping and analysing.

ERP systems never function in isolation, therefore integration with other software application is required. The ERP modules must integrate and provide accurate and seamless data flow between modules. In the event of a third-party application being needed, the ERP must be able to exchange data with the application in some form or the other. The organisation did take cognisance of this as indicated in table 12. The specific third-party application is specified allowing the vendor to respond to this requirement.

The organisation also considered the timeline for the project implementation, as indicated in table 12. This detail was acquired from the proposals collected from prospective COTS solution providers. The objective of the project timeline or the project plan was to determine the efficacy of the implementation process. The project plan is to provide a framework for the overall implementation.  A project plan focuses on the discipline required to ensure that the client expectations are clearly defined at the onset of the project and remain visible throughout the implementation process. The project plan should also formalise control processes to assist the project team to share project information and co-ordinate with all stakeholders. The overall project management methodology was expressed by each vendor in the submitted proposals. As discussed earlier in the literature, this would include the processes: control and reporting, work management, resource management, quality management, and configuration management. The major project management categories would include: project planning, phase planning, phase control, phase completion, and project completion. The organisation, through the procurement process, ascertained the project implementation methodology adopted by the vendors.

Vendor reputation, market share, experience in terms of successful implementations and support infrastructure are critical to the success of COTS implementations. Selecting the correct vendor is important in the process of implementation, it is evident that there are a number of vendors in the industry, as can be seen in table 12. As a result of the request for proposals ten vendors responded. This complicates the selection process and therefore consideration needs to be given to the vendor. It must also be noted from table 12 that various COTS solutions were proposed and that some vendors proposed the same COTS software. From figure 13 that the three major reasons for choosing the specific vendor were the product features and functionality that best-fit the organisation, the COTS product best-fit, the IT strategy, and finally, the price of the product. These aspects were rated as one hundred percent, ninety percent, and eighty percent respectively in terms of major reasons for choosing the vendor. The vendor's ability to provide a complete solution scored twenty percent, the vendors previous experience scored ten percent and the vendors reputation scored ten percent.

Due to the considerations above, the organisation, selected as shown in table 12, Vendor 5 Solution E. This is an interesting choice, as the outgoing COTS product was now going to be replaced by the very same product. This point will be further analysed in the discussion and recommendation section.

## 4. Implementation Process

COTS implementations are both an art and a science in that they consist of planning, implementation, ongoing support, and maintenance. The implementation process results from the selection of the appropriate COTS being identified. These basic steps would include planning, design, build, test, go-live and support. These steps are essential in understanding structured methodologies in the implementation of ERP systems.

As discussed in the literature, ERP implementations sometimes fail to satisfy the organisational requirements, this is due to the rather high degree of complexity for implementation success or from changes required by the organisation. Some of the identified risks associated with ERP implementations are: poor senior management

commitment, poor communication strategies, insufficient training, lack of user support, poor project management, gaps in legacy systems, departmental conflicts, ineffective project team members, and misunderstanding change requirements. It is evident that the risks are not limited to the aforementioned.

ERP implementations inevitably result in organisational changes, it therefore requires the involvement of senior management. In the absence of such commitment from senior managers, the ERP implementation success will have a high risk of failure. It is evident from table 8 that respondents were of the opinion that the project had executive engagement and all respondents either agreed or strongly agreed that the senior managers as well as managers supported the implementation process. It would seem that overall management support was strong during the implementation of the ERP. It was also evident in the interviews with the managers that the process, activities and motivation for the implementation were clearly understood and supported.

An effective communication strategy within the organisation is essential during the implementation process and can increase the success of the implementation. Effective communication can facilitate understanding the end goal clearly as well as the expected benefits of the overall project. In this implementation 70% of the respondents agreed and 30% strongly agreed to an effective communication strategy.

The lack of end-user training increases the risk of implementation failure. This is due to confusion related to work processes and inaccuracy in the way processes are executed, thereby creating user dissatisfaction and credibility of the system. End-user training is a critical factor in the implementation process, as it enables the user with an essential understanding of the system, how it works and how to use it. Sufficient end-user training increases productivity and improves user satisfaction. According to the figures in table 8 regarding the level of training provided, 40 % strongly agreed, 40% agreed and 20% were neutral. From figure 15, functional critical success factors of the implementation, we see that training and re-skilling were identified as a success point as well as the commitment of the users. This is interesting, but it must be noted that if the organisation had decided to re-implement the old ERP, this would significantly affect the degree to which training would be required, when compared to a totally new implementation.

Project management is a key factor in the successful implementation of an ERP. Proper well-thought out resource allocation plans, project objectives, and work plans are required. Without proper project management, ERP implementation plans are sure to fail. It is also crucial that the project team is composed adequately with the key stakeholders who have a clear understanding of the organisational structures, processes and strategies. When managing projects, it is important to understand the relationship between cost, scope and time. It is difficult to control these three aspects and it may be necessary to compromise on one of them. We learn from table 8 that all the managers indicated that the project had good budgeting and financial management, 70% strongly agreed with this and 30% agreed. From the same table we see, in terms of scope, 80% of the managers agreed and 20% strongly agreed that the project scope was well identified.

One of the significant obstacles in the implementation was data issues. This received a rating of 88% as illustrated in figure 14. The asset manager in his interview identified this as an area of concern. Issues with the take-on data prevented the organisation from implementing the asset module and, as a result, this business process was performed outside the ERP.

COTS implementations are considered successful when:

1. There is a match between the IT infrastructure or systems and the specific planned objective, in table 8, 70% agreed, 20% strongly agreed and 10% disagreed to this.
2. The project is completed within the specified time and budget.
3. Attitudes towards IT is improved. This is evident in table 8 where 40% of respondents agreed and 60% strongly agreed to this.
4. The COTS system matches the organisational expectations. This is evident as the implementation improved the organisations regulatory compliance, it made management information more accurate and accessible, it improved accountability, and it increased business performance.

It would seem as if the implementation at the organisation can be considered as successful, although the asset module was not implemented.

## C. Theoretical Framework

The COTS theoretical frameworks have been discussed at great length in the literature review. In this study we looked at the Procurement-Oriented Requirements Engineering (PORE) method, the Off-The-Shelf-Option framework (OTSO), the COTS Acquisition Process and the COTS-Based Requirements Engineering (CRE). Considering the process followed by the organisation, it would be fair to state that the OTSO approach was followed. This method allows for search, evaluation, and selection, of COTS software.

OTSO allows for the specific techniques for defining the evaluation criteria, evaluating the associated costs and benefits, as well as, consolidating the evaluation results for decision-making. OTSO has four main characteristics that can be aligned to the organisational process that was adopted. These characteristics are:

1. There is a well-defined process that encapsulates the entire reusable component selection process.

   The process followed by the organisation is clearly stated by the procurement manager, in that the reusable components were identified (supply chain management (SCM), contract management, accounts payable, accounts receivable, fixed assets, project finance, cash management, interfaces, budgeting, management information, and information technology) and the requirements related to each component were specified.

2. There is a systematic approach to determining the detailed evaluation criteria from reuse goals.

   The evaluation criteria detailed by the organisation is explained by the procurement manager. The organisation identified four categories of criterion: standard functionality, 3rd party, customisation, and no functionality. These criteria assisted the organisation in identifying the COTS goal that could be achieved from the reusable components.

3. A method of estimating the costs or cost benefits of COTS alternates.

   As discussed earlier, the organisation considered the total cost of ownership over a period of five years for each COTS alternative. This includes the software cost, implementation cost, licensing cost, and post-implementation support.

4. A method for comparing or considering non-functional aspects of the COTS alternatives.

   In this regard, the organisation considered non-functional requirements such as security, maintainability, reliability, scalability, efficiency and performance, portability, flexibility and usability. Non-functional evaluation criteria also included IT infrastructure in terms of hardware, software, and networks.

It would seem from the process that the organisation followed that the OTSO method of evaluation was followed although it may not have been intentional. This method seems to be efficient and consistent and can allow for an increase in the decision makers confidence in the evaluation of results.

# 6. Conclusion

## 6.1. Research Overview

In this chapter, the researcher will discuss the closing arguments of the research and demonstrate how this study contributes to the body of knowledge and thus motivate academic discussion. The research questions will be re-visited in order to draw conclusions from this research. Research limitations encountered will be mentioned. Further this chapter will outline future research recommendations.

Research Question 1: What processes was followed in the ERP implementation?

Once the utility had realised the need for an ERP implementation, it followed the following steps or processes:

1. *Identify functional requirements* in terms of specific operational, managerial and organisational requirements.

2. *Identify non-functional requirements* in terms of security, maintainability, reliability, scalability, efficiency and performance, portability, flexibility, and usability. This will also include IT infrastructure in terms of hardware, software and networks.

3. *Preparation process*, the utility established three committees i.e. specifications committee, the evaluation committee, and the adjudication committee, for the procurement of the ERP. The organisation gathered information for further detailed evaluation. They achieved this by identifying functional and non-functional specification criteria. Evaluation criterion was also identified in terms of standard functionality, 3rd party, customisation, and no functionality.

4. *Selection process,* the COTS *selection process* involves identifying criteria and evaluating the alternatives by using the selection methodology decided upon by the organisation and selecting the appropriate COTS alternative.

5. *Implementations process,* the organisation followed the steps of implementation that included planning, design, build, test, go-live, and support.

Research Question 2: What process was followed in the ERP evaluation criterion setup?

The organisation followed the following process for the creating of the specification and evaluation criteria:

1. Information sessions were conducted with finance departmental heads and key staff for the purpose of collecting data on the business processes of the organisation. From this data ERP modules were identified. The modules identified as essential modules in any ERP system included: supply chain management (SCM), contract management, accounts payable, accounts receivable, fixed assets, project finance, cash management, interfaces, budgeting, management information, and information technology.

2. The scope of each of these eleven modules was determined. The scope of the module refers to the functional business processes within the module.

3. Once the modules and the scope were identified, detailed business rules and procedures were identified for each module. These would constitute the actual specification per ERP module.

4. The organisation determined evaluation criterion. They identified four criteria relevant to each of the specifications, in this case: standard functionality, 3rd party, customisation, and no functionality.

Research Question 3: What frameworks gave insight that informed the implementation?

The process that was followed would appear to be in line with the OTSO method, although it would seem to be unintentional. The OTSO method allows for the specific techniques for defining the specifications and evaluation criteria, evaluating the associated costs and benefits, as well as, consolidating the evaluation results for decision-making.

It is clear that the process followed in selecting the ERP included the aspects outlined in the COTS framework illustrated in figure 4. The researcher found from the interviews, with the participants, and the resultant findings from the questionnaires that the process of evaluating and selecting the ERP is significant. It is essential to understand the ERP modules and the process of defining the required scope of each module as discussed in Chapter 5.  This assists in configuring a specification and an evaluation framework for the implementation of an ERP. The ERP selection process is thereby improved and becomes creditable if the aforementioned processes are followed.  Appendix A, ERP evaluation tool, is a collection of specifications based on these processes. This pilot evaluation tool includes supply chain management, contract management, accounts payable, accounts receivable, fixed assets, project finance, cash management, interfaces, budgeting, management information and information technology.

## 6.2. Study Limitations

As can be expected in a study of this nature, there are certain weaknesses or limitations. It is the intention of the researcher to acknowledge these limitations by clearly identifying these aspects that are outside the control of the researcher, and the effects that it may have on the validity of the results.

It must be noted that this study was limited to the water utility and their specific requirements, resulting in portions of the ERP implementation being evaluated or studied.

It must also be noted that possible limitations of the study could include researcher bias, as the researcher, is directly involved in the ERP implementation and holds the position as IT manager.

The researcher made a concerted effort to mitigate any bias that may exist, by employing the technique of triangulating and verifying data that was collected from different data sources. The information was gathered using semi-structured interviews where respondents could explain, in detail, their rationale to their responses. The researcher attempted to mitigate hindsight bias by interviewing a variety of respondents so that facts can be determined. The researcher further constructed research questionnaires with the intention to increase the face validity of the data collected.

## 6.3. Future Work

The research covered in this study has primarily focused on the ERP implementation processes. These processes were critically evaluated against the theoretical framework adapted from Tarawneh. The processes are clearly outlined in the framework and the utility seemed to have complied with the theory in terms of their practice in evaluating, selecting and implementing the ERP system.

When implementing a new ERP, organisations typically replace the old ERP with the new. However, it is interesting to note that this was not the case in this study. The organisation took a strategic decision to re-implement the ERP that was already in place, but not meeting organisational requirements. As a result of the organisation creating an evaluation process, it became clear that the current ERP could meet the organisational requirements if properly configured against a set of well thought-out specifications.

Based on the results of this study, future research can be conducted to create ERP scopes based on business requirements, specifications based on the scope and evaluation criterion. The pilot evaluation tool mentioned above requires further development to allow for easy configurability in terms of setting up module scopes and specifications. It would also be necessary, as discussed in Chapter 5, to allow for criteria weighting and scoring. The evaluation tool should be further computerised in an online configurable web-based system.

There seems to be no study in this area of knowledge and it is the opinion of the researcher that the study and creation of an ERP evaluation tool can assist both organisations and ERP vendors in achieving successful ERP implementations.

# References

Adam, R. (2010) Exploring the acceptance of enterprise resource planning systems by small manufacturing enterprises.

Al Rashid, W. (2013) Managing stakeholders in enterprise resource planning (ERP) context-a proposed model of effective implementation.

Al-Sabaawi, M.Y.M. (2015) Critical success factors for enterprise resource planning implementation success. *International Journal of Advances in Engineering \&Technology*, IAET Publishing Company, 8(4), 496.

Alanbay, O. (2005) ERP selection using expert choice software. *Proceding ISAHP, Honolulu, Hawaii*.

Alves, C. and Castro, J. (2001) CRE: A systematic method for COTS components selection. In: *XV Brazilian Symposium on Software Engineering (SBES)*.

Amid, A., Moalagh, M. and Ravasan, A.Z. (2012) Identification and classification of ERP critical failure factors in Iranian industries. *Information Systems*, Elsevier, 37(3), 227–237.

Berg, B.L., Lune, H. and Lune, H. (2004) *Qualitative research methods for the social sciences*. Pearson Boston, MA.

Bickman, L. and Rog, D.J. 1998. *Handbook of applied social research methods*. Sage.

Bitsini, N. 2015. Investigating ERP Misalignment between ERP Systems and Implementing Organizations in Developing Countries. *Journal of Enterprise Resource Planning Studies* 2015, p. 1.

Blaxter, L., Hughes, C. and Tight, M. 2010. *How to research*. McGraw-Hill International.

Brown, W. 2004. Enterprise resource planning (ERP) implementation planning and structure: a recipe for ERP success. In: *Proceedings of the 32nd annual ACM SIGUCCS conference on User services*. pp. 82–86.

Burns, M. 2005. How to select and implement an ERP System.

Cechich, A. and Taryano, K. 2003. Selecting COTS components: a comparative study on E-Payment systems. In: *IX Congreso Argentino de Ciencias de la Computación*.

Chofreh, A.G., Goni, F.A., Shaharoun, A.M. and Ismail, S. 2014. Review on Enterprise Resource Planning Implementation Roadmap: Project Management Perspective. *Sains Humanika* 2(2).

Chou, S.W. and Chang, Y.C. 2008. The implementation factors that influence the ERP (enterprise resource planning) benefits. *Decision Support Systems* 46(1), pp. 149–157.

Creswell, J.W. 2012. *Qualitative inquiry and research design: Choosing among five approaches*. Sage.

Das Neves, D., Fenn, D. and Sulcas, P. (2004) Selection of enterprise resource planning (ERP) systems. *South African Journal for Business Management*, 35.

De Carvalho, R.A. and Johansson, B. (2009) Enterprise Resource Planning Systems for Small and Medium-Sized Enterprises. *Handbook of Research on Software Engineering and Productivity Technologies: Implications of Globalization: Implications of Globalization*, IGI Global, 373.

Dey, I. 2003. *Qualitative data analysis: A user friendly guide for social scientists*. Routledge.

Edwards, C.A. 2013. Business process integrity and enterprise resource planning systems: an analysis of workaround practices in a large public sector organisation.

Esteves, J. and Pastor, J. 1999. An ERP lifecycle-based research agenda. In: *1st International Workshop in Enterprise Management \& Resource Planning*.

G.rufael, T. 2007. Design of Enterprise Resource Planning (ERP) Frame work and its implementation.

Ganesh, K., Mohapatra, S., Anbuudayasankar, S. and Sivakumar, P. 2014. *Enterprise Resource Planning: Fundamentals of Design and Implementation*. Springer.

Gerring, J. 2006. *Case study research: principles and practices*. Cambridge University Press.

Haddara, M. and Elragal, A. 2011. ERP lifecycle: When to retire your ERP system? In: *International Conference on ENTERprise Information Systems*. pp. 168–177.

Haddara, M. and Zach, O. 2012. ERP systems in SMEs: An extended literature review. *International Journal of Information Science* 2(6), pp. 106–116.

Hancock, D.R. and Algozzine, B. 2006. *Doing case study research: A practical guide for beginning researchers*. Teachers College Press.

Harper, C., Jones, N. and Marcus, R. 2013. *Research for development: a practical guide*. Sage.

Hart, C.A. 2010. The organisational performance impact of ERP systems on selected manufacturing companies within South Africa.

Hawari, A. and Heeks, R. 2010. Explaining ERP failure in developing countries: A Jordanian case study. *Development Informatics Working Paper* 45.

Koch, C., Slater, D. and Baatz, E. 1999. The ABCs of ERP. *CIO magazine* 22.

Kontio, J. 1995. OTSO: a systematic process for reusable software component selection.

Kontio, J., Chen, S.-F., Limperos, K., Tesoriero, R., Caldiera, G. and Deutsch, M. 1995. A COTS selection method and experiences of its use. In: *Proceedings of the 20th annual software engineering workshop, Maryland*.

Kralji'c, A., Delismajlovi'c, D. and Kralji'c, T. 2011. ERP Implementation's Risk Factors in State Owned Company in Post-Socialist Transitioning Country. In: *Digital Enterprise and Information Systems*. Springer, pp. 187–196.

Kurbel, K.E. 2013. Enterprise Resource Planning and Supply Chain Management.

Leyh, C. 2016. Critical success factors for ERP projects in small and medium-sized enterprises—the perspective of selected ERP system vendors. In: *Multidimensional Views on Enterprise Information Systems*. Springer, pp. 7–22.

Liu, G.H., Wang, E.T. and Tai, J.C. 2011. ERP Misfit: A Multidimensional Concept And Misfit Resolution. In: *PACIS*. p. 118.

Loonam, J.A. and McDonagh, J. 2005. Exploring top management support for the introduction of enterprise information systems: a literature review. *Irish Journal of Management* 26(1), p. 163.

M. Beheshti, H., K. Blaylock, B., A. Henderson, D. and G. Lollar, J. 2014. Selection and critical success factors in successful ERP implementation. *Competitiveness Review* 24(4), pp. 357–375.

Markus, M.L. and Tanis, C. 2000. The enterprise systems experience-from adoption to success. *Framing the domains of IT research: Glimpsing the future through the past* 173, pp. 207–173.

Miller, J. and Yeoh, H.C. 2006. COTS acquisition process: incorporating business factors into COTS vendor evaluation taxonomies. *Software Process: Improvement and Practice* 11(6), pp. 601–626.

Mills, A.J., Durepos, G. and Wiebe, E. 2009. *Encyclopedia of case study research*. Sage Publications.

Momoh, A., Roy, R. and Shehab, E. 2010. Challenges in enterprise resource planning implementation: state-of-the-art. *Business Process Management Journal* 16(4), pp. 537–565.

Muijs, D. 2010. *Doing quantitative research in education with SPSS*. Sage.

Mukwasi, C.M. 2013. Enterprise resource planning business case considerations: an analysis of Small to Medium-Sized Enterprises in developing countries.

Murray, M. 2009. *Discover logistics with SAP ERP*. SAP PRESS.

Nah, F.H. and Delgado, S. 2006. Critical success factors for enterprise resource planning implementation and upgrade. *Journal of Computer Information Systems* 46(5), p. 99.

Nah, F.F.H. 2002. *Enterprise resource planning solutions and management*. IRM Press Hershey, PA.

Nakato, R. 2008. A Multi criteria decision making support to software selection.

Ncube, C. and Maiden, N. 2000. COTS software selection: The need to make tradeoffs between system requirements, architectures and COTS components. In: *COTS workshop. Continuing Collaborations for Successful COTS Development*.

Ncube, C. and Maiden, N.A. 1999. PORE: Procurement-oriented requirements engineering method for the component-based systems engineering development paradigm. In: *International Workshop on Component-Based Software Engineering*. pp. 130–140.

Ochs, M., Pfahl, D., Chrobok-Diening, G. and Nothhelfer-Kolb, B. 2000. A COTS acquisition process: Definition and application experience. *ISERN Report*.

Palanisamy, R. 2012. Tacit Knowledge Sharing During ERP Acquisition: An Exploratory Multi-Site Case Study. *Journal of Information & Knowledge Management* 11(02), pp. 1250010–1–1250010–14.

Panorama Consulting Solutions (2014) 2014 ERP Report.

Plant, R. and Willcocks, L. 2007. Critical success factors in international ERP implementations: a case research approach. *Journal of Computer Information Systems* 47(3), pp. 60–70.

Raymond, L. and Uwizeyemungu, S. 2007. A profile of ERP adoption in manufacturing SMEs. *Journal of Enterprise Information Management* 20(4), pp. 487–502.

Restemis, A. and Okpor, L. 2013. ENTERPRISE RESOURCE PLANNING SYSTEMS, BUSINESS PERFORMANCE AND USERS COMPLAINTS.

Rolland, C. 1999. Requirements engineering for COTS based systems. *Information and Software Technology* 41(14), pp. 985–990.

Roman, K. 2009. Benefits of Implementing an ERP.

Ruane, J.M. 2005. *Essentials of research methods: A guide to social science research*. Blackwell Malden, MA.

Seo, G. 2013. Challenges in implementing enterprise resource planning (ERP) system in large organizations: similarities and differences between corporate and university environment.

Shang, S. and Seddon, P.B. 2000. A comprehensive framework for classifying the benefits of ERP systems. *AMCIS 2000 Proceedings*, p. 39.

Shanks, G., Seddon, P.B. and Willcocks, L. 2003. *Second-wave enterprise resource planning systems: Implementing for effectiveness*. Cambridge University Press.

Shatat, A.S. 2015. Critical Success Factors in Enterprise Resource Planning (ERP) System Implementation: An Exploratory Study in Oman. *Electronic Journal of Information Systems Evaluation* 18(1).

Shaul, L. and Tauber, D. 2013. Critical success factors in enterprise resource planning systems: Review of the last decade. *ACM Computing Surveys (CSUR)* 45(4), p. 55.

Shkedi, A. 2005. *Multiple case narrative: A qualitative approach to studying multiple populations*. John Benjamins Publishing.

Sia, S.K. and Soh, C. 2007. An assessment of package-organisation misalignment: institutional and ontological structures. *European Journal of Information Systems* 16(5), pp. 568–583.

Silverman, D. and Marvasti, A. 2008. *Doing qualitative research: A comprehensive guide*. Sage.

Singh, K. 2007. *Quantitative social research methods*. Sage.

Singh, O. and Singh, U. 2015. Introducing FERPS: A framework for Enterprise Resource Planning selection. In: *Computing, Communication and Security (ICCCS), 2015 International Conference on*. pp. 1–8.

Singla, A.R. 2008. Impact of ERP systems on small and mid sized public sector enterprises. *Journal of Theoretical and Applied Information Technology* 4(2), pp. 119–131.

Skok, W. and Legge, M. 2002. Evaluating enterprise resource planning (ERP) systems using an interpretive approach. *Knowledge and Process Management* 9(2), pp. 72–82.

Soh, C., Kien, S.S. and Tay-Yap, J. 2000. Enterprise resource planning: cultural fits and misfits: is ERP a universal solution? *Communications of the ACM* 43(4), pp. 47–51.

Soh, C. and Sia, S.K. 2004. An institutional perspective on sources of ERP package-organisation misalignments. *The Journal of Strategic Information Systems* 13(4), pp. 375–397.

Solutions PC (2014) *2014 ERP Report*.

Somekh, B. and Lewin, C. 2005. *Research methods in the social sciences*. Sage.

Somers, T.M. and Nelson, K.G. 2004. A taxonomy of players and activities across the ERP project life cycle. *Information \& Management* 41(3), pp. 257–278.

Sonnichsen, K. 2009. THE FUTURE OF ERP-SYSTEMS.

Stefanou, C.J. 2000. The selection process of enterprise resource planning (ERP) systems. *AMCIS 2000 Proceedings*, p. 418.

Strong, D.M. and Volkoff, O. 2010. Understanding Organization—Enterprise System Fit: A Path to Theorizing the Information Technology Artifact. *MIS quarterly*, pp. 731–756.

Swartz, D. and Orgill, K. 2001. Higher education ERP: Lessons learned. *Educause Quarterly* 24(2), pp. 20–27.

Tarawneh, F., Baharom, F., Yahaya, J.H. and Ahmad, F. 2011. Evaluation and Selection COTS Software Process: The State of the Art. *International Journal of New Computer Architectures and their Applications (IJNCAA)* 1(2), pp. 344–357.

Tazyeen, F. 2012. Modeling government ERP acquisition methods using system dynamics.

Trochim, W.M. and Donnelly, J.P. 2001. Research methods knowledge base.

Turton, J.W. 2010. A managers view of critical success factors necessary for the successful implementation of ERP.

Umble, E.J., Haft, R.R. and Umble, M.M. 2003. Enterprise resource planning: Implementation procedures and critical success factors. *European journal of operational research* 146(2), pp. 241–257.

Van Beijsterveld, J. (2006) Misfits in ERP System Implementation.

Velcu, O. and others (2008) Drivers of ERP Systems' Business Value. *Helsinki: Swedish school of economics and business administration*.

Wang, E.T., Klein, G. and Jiang, J.J. 2006. ERP misfit: country of origin and organizational factors. *Journal of Management Information Systems* 23(1), pp. 263–292.

Wanyama, T. 2006. *Decision support for COTS selection*. University of Calgary.

Wei, C.-C. and Wang, M.-J.J. 2004. A comprehensive framework for selecting an ERP system. *International journal of project management* 22(2), pp. 161–169.

Wu, J.-H., Hsieh, C., Shin, S.-S. and Wu, C.-C. 2005. A methodology for evaluating data and output misfits in commercial off-the-shelf ERP systems. *Journal of International Technology and Information Management* 14(4), p. 3.

Yen, T.S., Idrus, R. and Yusof, U. 2011. A Framework for classifying misfits between enterprise resource planning (ERP) systems and business strategies. *Asian Academy of Management Journal* 16(2), pp. 53–75.

Yin, R.K. 2010. *Qualitative research from start to finish*. Guilford Press.

# Appendix A: ERP Evaluation Tool

| A. SUPPLY CHAIN MANAGEMENT | | S | P | C | N | Comments |
|---|---|---|---|---|---|---|
| 1 | **1 SUPPLY CHAIN MANAGEMENT** | | | | | |
| A1 | **PROCUREMENT** | | | | | |
| A1.1 | **General Requirements** | | | | | |
| A1.1.1 | Workflow functionality required and the routing should not be hard coded. Administrator and buyer should be able to change the workflow routing (e.g. when key approvers are absent) | | | | | |
| A1.1.2 | Routing is based on the delegation of authority i.e. staff seniority and value of PR | | | | | |
| A1.1.3 | Allow for alternative manager to route to for approval. E.g. user 1 can either route to manager X or manager Y for cases where user 1 reports to more than one manager | | | | | |
| A1.1.4 | Escalate/route to second approver if no action has been taken by the first approver after a specified period e.g. 3 days | | | | | |
| A1.1.5 | Cater for various purchase orders (capital and projects): | | | | | |
| a) | Direct Items & Stock Items (RFQ if value > R1000) | | | | | |
| b) | Emergency orders | | | | | |
| A1.1.6 | Requisitions must be web Based | | | | | |
| A1.1.7 | System should allow for queries and user reports | | | | | |
| A1.1.8 | Allow for comments to be inserted on requisition | | | | | |
| A1.1.9 | Ability to assign different roles to the same user | | | | | |
| A1.1.10 | Must have an approval hierarchy | | | | | |
| A2 | **PURCHASE REQUISITION (PR)** | | | | | |
| A2.1 | **Non-Stock Items (Directs)** | | | | | |
| A2 1.1 | Allow creation of purchase requisitions | | | | | |
| A2 1.2 | One purchase requisition to cater for multiple line items | | | | | |
| A2 1.3 | Automatic generation of purchase requisition numbers | | | | | |
| A2 1.4 | The originator of the purchase requisitions should not be able to input the price | | | | | |
| A2 1.5 | Input fields should cater for input of item description, quantity, date. These are required fields | | | | | |
| A2 1.6 | Unit of measure to be selected (kg, boxes etc) | | | | | |
| A2 1.7 | The project name and number should be captured ( mandatory) | | | | | |
| A2 1.8 | A suggested vendor should be selected (information retrieved from the vendor master file) – only in a comment box | | | | | |
| A2 1.9 | Date originated should default to system date | | | | | |
| A2 1.10 | The description field should be of adequate size and allow for additional lines to be added | | | | | |
| A2 1.11 | Allow input of delivery period and expiry period on the requisition | | | | | |
| A2 1.12 | Workflow functionality required for approval of PR (as per administrator-defined routing) | | | | | |
| A2 1.13 | Send email alert to person required to take action | | | | | |
| A2 1.14 | Send email alert to the requestor to inform them at what stage (or with who) the requisition is | | | | | |
| A2 1.15 | User should select the department code that the purchase requisition is for | | | | | |
| A2 1.16 | Limit selection of GL Codes/ cost centre codes at requisition stage based on the department user belongs to. | | | | | |
| A2.1.17 | Notifications / alerts at each stage of the processing. Including when budget is exceeded or requisition is not approved | | | | | |
| A2.2 | **Request for Quotation (RFQ)** | | | | | |
| A2 2.1 | Ability to generate multiple RFQs from purchase requisition. Up to 3 RFQs normally used | | | | | |
| A2 2.2 | Include all details on Purchase requisitions on the RFQ including delivery person, expiry period and utilities' invoice address and Delivery address, letterhead, required by date and comment | | | | | |
| A2 2.3 | Buyer's signature image should be incorporated on the RFQ with necessary security authentication. | | | | | |
| A2 2.4 | If no signature has been incorporated "INVALID" to be printed on document | | | | | |
| A2 2.5 | Insert the utilities' terms and conditions on the RFQ | | | | | |
| A2 2.6 | Interface with DBFax or Faxination for faxing RFQs and email to vendors | | | | | |
| A2 2.7 | Ability to capture prices, delivery dates and volumes vendor is able to supply based on response from vendors | | | | | |
| A2 2.8 | Workflow functionality required for approval of vendor & item price (based on RFQ responses) | | | | | |
| A2 2.9 | Automatic budget check once quotes/ item price is captured on purchase requisitions | | | | | |
| A2 2.10 | Workflow functionality required for approval of the completed purchase requisition (with details of the selected vendor & item price) within the ERP system | | | | | |
| A2 2.11 | Ability for user to approve/release purchase requisition via email system (Ms Outlook)  - optional | | | | | |
| A2 2.12 | Send email alert to the buyer and the requestor when the requisition approval process is complete | | | | | |
| A3.1 | **Purchase Order** | | | | | |
| A3 1.1 | Generate purchase order from approved purchase requisition. | | | | | |
| A3 1.2 | Automatically generate a purchase order number. | | | | | |
| A3 1.3 | Date should default to system date | | | | | |
| A3 1.4 | Purchase order details (from the approved requisition) must not allow for alterations for predetermined fields. Should require approval | | | | | |

| ID | Description | | | | | |
|---|---|---|---|---|---|---|
| A3 1.5 | Specifically identified user can open up approved purchase requisitions or purchase orders to enable changes to the quantity (reduction of quantity) | | | | | |
| A3 1.6 | Line items should include: - product type, description, units, quantity, price and total per line item; and - Vendor details, buyer name, requestor name and requisition number, delivery address | | | | | |
| A3 1.7 | Track and monitor status of purchase requisitions and orders at any given time | | | | | |
| A3 1.8 | Print purchase order with following details included: Purchase order #, Items ordered, Quantity, Price per item, Delivery Period, Order expiry period, Supplier details etc. | | | | | |
| A3 1.9 | Buyer's signature image should be incorporated on the Purchase Order with necessary security authentication. | | | | | |
| A3 1.10 | If no signature has been incorporated "INVALID" to be printed on document | | | | | |
| A3 1.11 | Interface with DBFax or Faxination for faxing of, and email for emailing of, Purchase orders to vendors | | | | | |
| **A3.2** | **Emergency Orders** | | | | | |
| A3 2.1 | Cater for creation of a purchase order without existence of vendor in vendor master file. Alert and approval required | | | | | |
| A3 2.2 | Purchase order must be workflowed for approval by requestor's manager once price has been captured | | | | | |
| A3 2.3 | All fields captured in normal purchase requisition and order should also apply | | | | | |
| A3 2.4 | Input field for emergency order number required | | | | | |
| A3.2.5 | Direct input of emergency purchase orders into the system with no requisition. Approval required | | | | | |
| **A4.1** | **Receiving** | | | | | |
| A4.1.1 | Cannot receive if there is no Purchase order | | | | | |
| A4.1.2 | Cannot receive if purchase order delivery period and expiry period has lapsed. Requires authorisation, alert and ability to amend date with approval | | | | | |
| A4.1.3 | Generate a uniquely numbered Goods Received Note (GRN) which links to the respective purchase order | | | | | |
| A4.1.4 | One purchase order may have many GRN's (partially-filled orders) | | | | | |
| A4.1.5 | Capture quantity per line item received against purchase order number and generate a goods received note. | | | | | |
| A4.1.6 | Cannot receive more than quantity on Purchase order | | | | | |
| A4.1.7 | Capture vendor's delivery note/ invoice number | | | | | |
| A4.1.8 | Automatically compute and show value of each item received and the total value of the GRN based on the purchase order price. | | | | | |
| A4.1.9 | Value field to cater up to 6 decimal places | | | | | |
| A4.1.10 | Once processed, automatically post to the general ledger and update stock sub ledger | | | | | |
| A4.1.11 | Close purchase order once all deliveries has been made | | | | | |
| A4.1.12 | Show the GRV clerk's name on the GRN | | | | | |
| A4.1.13 | Cater for conversion of chemicals upon receipt. This may require receiving in a different unit of measure from the measure used at order stage. E.g. for conversion used for Sodium Hypochloride = (Quantity in Litres * Specific gravity * MV) / 100 = Quantity | | | | | |
| **A4.2** | **Goods Returns Note** | | | | | |
| A4.2.1 | Generate a uniquely numbered Goods Returns Note which links to the respective purchase order and Goods received Note. Purchase orders must remain open for future use when replacement goods are received. | | | | | |
| A4.2.2 | Capture quantity per line item that needs to be returned | | | | | |
| A4.2.3 | Once processed, automatically post to the respective general ledger and stock sub ledger | | | | | |
| A4.2.4 | Able to view and print GRN and Goods Returns notes and indicate: - the vendor number, name, vendor's delivery number, purchase order number and originator of purchase order with cost centre code, Item ordered (description), quantity ordered, quantity received | | | | | |
| **A5** | **Vendor Master File** | | | | | |
| A5.1 | Allow input of new vendors | | | | | |
| A5.2 | Automatically generate vendor number | | | | | |
| A5.3 | Input fields to include: Name of vendor, Addresses (all including email), Postal code, Contact details, Banking details, vendor category, items/services provided (classified per commodity, per type, per area), payment terms, delivery terms, active/disabled, BEE status, performance rating, VAT registration, company registration number, tax clearance certificate and expiry date. Must flag to indicate imminent expiration | | | | | |
| A5.4 | Skipping of the VAT registration and Tax clearance certificate field should create a warning/alert | | | | | |
| A5.5 | Field for item/service provided must cater for input of several items/services per vendor | | | | | |
| A5.6 | Restrict access to input/modify banking details. System should maintain this control. | | | | | |
| A5.7 | Workflow is required from the buyer to SCM for completion of vendor details i.e. banking details | | | | | |
| A5.8 | Vendor should be activated (for use) only after approval from SCM (ie completion of 5.7 above) | | | | | |
| A5.9 | Maintain discounts negotiated with vendor | | | | | |
| A5.10 | Automatic check for duplicate bank details on vendor master file and have a system warning | | | | | |
| A5.11 | Allow users to do inquiry on vendor number, vendor name, items/services provided etc | | | | | |
| A5.12 | Block usage of disabled/blacklisted vendors i.e. no orders can be made from these vendors | | | | | |
| A5.13 | Allow users to perform supplier assessment online and input ratings | | | | | |
| A5.14 | Workflow required to the owner of vendor master file to approve ratings prior to updating the master file | | | | | |
| A5.15 | System must allow for rotation of suppliers listed on the vendors list | | | | | |
| **A6** | **INVENTORY** | | | | | |
| **A6.1** | **Inventory Master File** | | | | | |
| A6.1.1 | Allow for creation of new inventory items | | | | | |
| A6.1.2 | Generate item numbers based with 2 characters using the following naming convention: Stock type(XXXX) - Short Description (YYYY) - Sequence Number (system generated) (ZZZZ) | | | | | |
| A6.1.3 | Input fields to include: bin location, item description, unit of measure, unit of issue, stock type, plant name, minimum and maximum re-order levels, useful life | | | | | |

| | | | | | | |
|---|---|---|---|---|---|---|
| A6.1.4 | Information for these fields should be selected from a pre-set list:<br>Stock Type: e.g. Strategic etc | | | | | |
| A6.1.5 | The description field should be of adequate size and allow for additional lines to be added | | | | | |
| A6.1.6 | Tags for bin location and item # should be generated by the system. | | | | | |
| A6.1.7 | Inventory items should be linked to the vendor file. One item can be linked to 1 or many vendors. | | | | | |
| A6.1.8 | Maintain an audit trail for all changes | | | | | |
| A6.1.9 | The system should be able to accommodate a weighted average costing, FIFO, LIFO system. | | | | | |
| A6.1.10 | Should be able to amend unit cost (weighted average cost, FIFO, LIFO) for impairments/obsolescence | | | | | |
| a) | Able to revalue stock items where applicable | | | | | |
| b) | Changes on unit cost to be workflowed for authorisation prior to affecting change | | | | | |
| **A6.2** | **Inventory Reorder** | | | | | |
| A6.2.1 | System should automatically generate purchase requisition for items that have reached their minimum re-order levels | | | | | |
| A6.2.2 | Allow for automatic budget checks for the items on system generated purchase requisition | | | | | |
| A6.2.3 | Allow for review and confirmation of system generated purchase requisition | | | | | |
| **A6.3** | **Dispatch** | | | | | |
| A6.3.1 | Allow online/ web inquiry of stock items and quantity in stock | | | | | |
| A6.3.2 | Allow users to create stores issue requisition online/ web | | | | | |
| A6.3.3 | Automatically generate stores issue requisition number | | | | | |
| A6.3.4 | Pre-populated fields include GL codes and department name, user name, date defaulted to system date | | | | | |
| A6.3.5 | Selection of inventory item required and allow capture of quantity required | | | | | |
| A6.3.6 | Job order number field is optional | | | | | |
| A6.3.7 | Workflow is required for approval of issue requisition | | | | | |
| A6.3.8 | Send email alert to person required to take action | | | | | |
| A6.3.9 | Should automatically update quantity in stock once stores issue requisition is processed | | | | | |
| **A6.4** | **Stock Takes** | | | | | |
| A6.4.1 | Allow user to define when to perform stock takes in addition to the quarterly and annual stock takes | | | | | |
| A6.4.2 | Generate stock count samples | | | | | |
| A6.4.3 | The system should have a diary system to allow the input of dates for stock take | | | | | |
| A6.4.4 | Be able to input stock adjustments which should workflow for approval | | | | | |
| **A7** | **Reporting Requirements** | | | | | |
| A7.1 | Report showing all requisitions that have not been approved in a specified period | | | | | |
| A7.2 | Report listing all requisitions for a specified period | | | | | |
| A7.3 | Report showing all vendors used for a specified period | | | | | |
| A7.4 | Report on stock/inventory quantities and value based on type of stock. | | | | | |
| A7.5 | Report to monitor movement of stock in a specified period per stock type (Strategic Spares. Chemicals and Consumables) | | | | | |
| A7.6 | Report detailing all items in stock, quantities, opening balance, closing balance, receipts and value. | | | | | |
| A7.7 | Report showing stock levels of all items in a specified period | | | | | |
| A7.8 | Report showing last order price per item against current price (in a give period) and the percentage variance between the two | | | | | |
| A7.9 | Report on slow moving items (stock) | | | | | |
| A7.10 | Report on supplier least used/not used (i.e. having no purchase orders/invoices) | | | | | |
| A7.11 | Variance/discrepancy report after stock take | | | | | |
| A7.12 | Report on the time taken to complete purchase requisition authorisation | | | | | |
| A7.13 | Monthly purchase by Supplier ( BEE and Other Expenditure Spend including %) | | | | | |
| A7.14 | Monthly BEE and Other suppliers Paid to date including % | | | | | |
| A7.15 | Cost allocations of all issues and receipts for every cost centre, analysed in the category value R0 to R1000, greater than R1000 less than R10 000<br>and everything greater than R10 000. Parameters should be changeable and specified by user. | | | | | |
| A7.16 | Re-order level reports after daily issues | | | | | |
| A7.17 | Outstanding orders report | | | | | |
| A7.18 | Invoices received and not paid | | | | | |
| A7.19 | Status of purchase orders | | | | | |
| A7.20 | Suppliers delivery pattern | | | | | |
| A7.21 | Reportable Deviations – process not followed | | | | | |
| A7.22 | Report on expenditure on specified sites and votes | | | | | |

| | **B. CONTRACT MANAGEMENT** | S | P | C | N | Comments |
|---|---|---|---|---|---|---|
| **B1** | **New Contracts** | | | | | |
| B1.1 | Allow the input of contracts only by authorised users | | | | | |
| B1.2 | Automatically generate contract number | | | | | |
| B1.3 | Workflow authorisation is required for every contract | | | | | |
| B1.4 | Workflow routing is based on the delegation of authority i.e. staff seniority and value of the contract | | | | | |
| B1.5 | Those with authority are allowed to suspend a contract | | | | | |
| B1.6 | Requesters manager should be able to unsuspended contracts based on his approval limits | | | | | |
| B1.7 | Should the contract total value be increased the contract status should be placed on suspense and workflowed for approval | | | | | |
| B1.8 | Contracted vendor must be on the vendor master file | | | | | |
| B1.9 | One vendor could have many contracts | | | | | |
| B1.10 | Contract delivery terms should be selected. No free text | | | | | |
| B1.11 | Contract delivery terms will be automatically populated on the called-off purchase orders | | | | | |
| B1.12 | Contract payment terms can be defined per contract | | | | | |
| B1.13 | Contract payment terms would override default payment terms in vendor master | | | | | |
| B1.14 | Ability to input a link to location of scanned contract stored in the document management system OR | | | | | |
| B1.15 | Allow for attachment of scanned copy of contract | | | | | |
| B1.16 | Allow input of terms of contract (per item where relevant) | | | | | |
| B1.17 | Input description of contracted items. Description field should be of adequate size and allow for additional lines to be added | | | | | |
| B1.18 | Allow input of start and end dates | | | | | |
| B1.19 | A warning message will be displayed if the contract start date is before today's date. This could be ignored. | | | | | |
| B1.20 | Cater for an expiry date for a contract. An alert will be sent to the contract owner one month before expiry date of the contract | | | | | |
| B1.21 | The cost centre code/ GL code is mandatory. The GL selection will populate the department field | | | | | |
| B1.22 | A field to denote whether or not the contract is active is required | | | | | |
| B1.23 | A field to specify type of contract, select from service or product contracts | | | | | |
| B1.24 | Based on selection of contract type, allow user to select type of service e.g. Engineering, IT etc | | | | | |
| B1.25 | System should indicate and maintain the user id of the person creating the contract | | | | | |
| B1.26 | Enter the total value of the contract | | | | | |
| B1.27 | Able to capture line items per contract and the maximum quantity per item | | | | | |
| B1.28 | During processing of goods receipts and supplier invoices, the total value of goods received or supplier invoices should not exceed the total value of the contract | | | | | |
| B1.29 | If contract total value or maximum value of line items is not set, workflow is required for approval of call-offs (purchase orders) | | | | | |
| B1.30 | Maintain quantity and value of contract already used | | | | | |
| **B2** | **Existing contracts** | | | | | |
| B2.1 | A browsing facility to view existing contracts | | | | | |
| B2.2 | Allow for inquiry on vendor number, contract number, expiry date | | | | | |
| **B3** | **Deletion of contracts** | | | | | |
| B3.1 | Functionality to allow a contract to be deleted | | | | | |
| B3.2 | Deletion will not be allowed if any outstanding call-offs from the contract have been made | | | | | |
| B3.3 | System check to be made to verify that there are no outstanding purchase orders awaiting invoicing | | | | | |
| **B4** | **Call-offs** | | | | | |
| B4.1 | Ability to create a purchase order from contract details | | | | | |
| B4.2 | Call off should be within the valid/active period (date period) of the contract | | | | | |
| B4.3 | Purchase order number should be automatically generated | | | | | |
| B4.4 | Call-off cannot exceed the maximum quantity or maximum total value of contract | | | | | |
| **B5** | **Reports** | | | | | |
| B5.1 | Monthly reports showing all contracts and their contract status (active, inactive, suspended) | | | | | |
| B5.2 | Report detailing vendor BEE status, value of contract, amount spend, duration of contract and vendor equity status on contract | | | | | |
| B5.3 | Report detailing total amount for active contracts | | | | | |
| B5.4 | Monthly report for all contractors whose contracts are active | | | | | |
| B5.5 | Statistical reports on how much was paid on a contractor in comparison to all contractors | | | | | |
| B5.6 | Report of contractors per BEE rating in percentage | | | | | |
| **B6** | **Escalation on contracts** | | | | | |
| B6.1 | Ability to change contract prices where escalation is permitted | | | | | |
| B6.2 | Workflow authorisation/approval required for any price change on the contracts prior to effecting the price change | | | | | |
| **B7** | **Contract extension** | | | | | |
| B7.1 | Should cater for extension of existing contract with same or different pricing conditions | | | | | |

| | **C. ACCOUNTS PAYABLE** | S | P | C | N | Comments |
|---|---|---|---|---|---|---|
| C1 | **ACCOUNTS PAYABLE** | | | | | |
| C1.1 | **Invoice Matching** | | | | | |
| C1.1.1 | Enquiry facility on GRN/Invoice number, vendor number, vendor name, GL account number, Date | | | | | |
| C1.1.2 | Allow invoice matching against GRN details. Matching should be per GRN/invoice line item | | | | | |
| C1.1.3 | Allow for tolerances between invoice value , receipt value and order value. Tolerances to be set up by value or percentage of invoice amt | | | | | |
| C1.1.4 | Capture amount to pay per GRN/invoice line item | | | | | |
| C1.1.5 | Capture the vendor's invoice number | | | | | |
| C1.1.6 | Ability to input a link to location of scanned invoice stored in the document management system OR | | | | | |
| C1.1.7 | Allow for attachment of scanned copy of invoices | | | | | |
| C1.1.8 | Cannot process Qty/Price exceeding that of GRN | | | | | |
| C1.1.9 | System to automatically generate invoice no | | | | | |
| C1.1.10 | Link to vendor master file to retrieve banking details for payment | | | | | |
| C1.1.11 | Automatically compute and show value of each item matched and the total value of the invoice based on the GRN | | | | | |
| C1.1.12 | Should reflect discount per vendor if applicable from vendor master - payment terms | | | | | |
| C1.1.13 | Automatically compute VAT on payments method | | | | | |
| C1.1.14 | Cater for partial payments for open purchase orders (i.e. Item quantity still outstanding) | | | | | |
| C1.1.15 | Close GRN for matching once all items have been matched to invoice | | | | | |
| C1.1.16 | The same supplier invoice (#) cannot be processed twice | | | | | |
| C1.1.17 | Workflow for approval of processed invoice is required | | | | | |
| C1.1.18 | Alerts are required for the person required to approve | | | | | |
| C1.1.19 | Post invoice after approval and update the respective general ledger codes. Invoice should be open/ready for payment | | | | | |
| C1.1.20 | Facility to delete invoice at any time as long as it had not been posted Allow for miscellaneous charge and interest capture | | | | | |
| C1.2 | **Debit Invoicing (No Purchase order)** | | | | | |
| C1.2.1 | Allow for processing of invoices that have no GRNs | | | | | |
| C1.2.2 | Allow users to select the general ledger codes to be used to process invoice | | | | | |
| C1.2.3 | Capture amount to pay per invoice line item | | | | | |
| **C1.2.4** | Other requirements similar to 3-way matching above | | | | | |
| C2 | **Debit & Credit Notes** | | | | | |
| C2.1 | Allow processing of credit notes by input of negative amount | | | | | |
| C2.2 | Generate a credit note number | | | | | |
| C2.3 | Invoice posting will update the sub-ledger (debit expenses and credit creditors control) and updates respective general ledger codes | | | | | |
| C3 | **Accruals Journals** | | | | | |
| C3.1 | Ability to perform accruals on three types of reserved accounts: | | | | | |
| a) | Outstanding orders | | | | | |
| b) | Outstanding GRNs | | | | | |
| c) | Unposted Invoices | | | | | |
| d) | Invoices without orders where invoice is not received e.g. rental, electricity.. | | | | | |
| C3.2 | Restrict access/Password protection to process accruals | | | | | |
| C3.3 | Automatically generates journal number | | | | | |
| C3.4 | An input field for description of accrual is required for the journal | | | | | |
| C4 | **Prepayments** | | | | | |
| C4.1 | Cater for payment of outstanding invoices (i.e. those outside the current payment period/list) | | | | | |
| C4.2 | Allow user to specify (outstanding) vendors or invoices for payment | | | | | |
| C5 | Payments | | | | | |
| C5.1 | Be able to calculate settlement discounts automatically based on discount rates in supplier masterfile and update vat calculation | | | | | |
| C5.2 | Generate a payment listing i.e. invoices ready for payment based on the payment terms and the prepayment list | | | | | |
| C5.3 | Split the payment listing (i.e. invoices ready for payment) by value ranges (R1- R10000 and > R10000 | | | | | |
| C5.4 | Approval of payment listing via workflow is required based on the value range above | | | | | |
| C5.5 | Email alerts are required for the person required to approve | | | | | |
| C5.6 | Create a remittance advice for every vendor in the approved payment list | | | | | |
| C5.7 | Remittance slip faxed through DBFax or Faxination | | | | | |
| C5.8 | Create EFT File for upload to ABSA Cash focus | | | | | |
| C5.9 | Once paid, CR: cashbook and DR: creditors ledger and control account | | | | | |
| C5.10 | Once paid; automatically allocate payment to respective invoices paid. User should be able to view this information on screen | | | | | |
| C5.11 | Able to reverse entries that have been rejected in the EFT system and automatically update the supplier ledger and the control account | | | | | |
| C5.12 | Able to reverse rejected cheque payments and automatically update the supplier ledger and the control account | | | | | |
| C5.13 | Electronic reconciliation | | | | | |
| C5.14 | Vendor EFT Bank maintenance | | | | | |
| C5.15 | Transaction/Vendor hold | | | | | |
| C5.16 | Generate electronic file of authorised cheques to bank to enable bank to confirm the authenticity of the cheque before payment | | | | | |

| C6 | **Reporting Requirements** | | | | | |
|------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------|---|---|---|---|---|
| C6.1 | Prepayment report showing per vendor all invoices that require payment and vendor totals | | | | | |
| C6.2 | Automated accrual journal- showing unposted invoices for that month | | | | | |
| C6.3 | Accrual report sorted by vendor, invoice number and GL code | | | | | |
| C6.4 | Creditors age analysis showing amount for the current period, 30 days, 60 and 90 days and over | | | | | |
| C6.5 | Payments listing for the current period | | | | | |
| C6.6 | Reports of settlement discounts that can be taken | | | | | |
| C6.7 | Monthly report showing VAT paid out to suppliers | | | | | |
| C6.8 | Report of all invoices per specified period sorted by supplier. Report should show total value of invoices and total number of invoices | | | | | |
| C6.9 | Report of all payments made per specified period sorted by supplier. Report should show total value of payments and total number of payment transactions made | | | | | |
| C6.10 | System should have in-built controls and generate error messages when entries between the creditors ledger and general ledger control accounts are not in synch | | | | | |
| C6.11 | Distribution breakdown reports | | | | | |
| C6.12 | Audit trail reports | | | | | |
| C6.13 | Posting Reports | | | | | |
| C6.14 | Vendor address list | | | | | |
| C6.15 | Transaction edit lists | | | | | |
| C6.16 | Export reports to Excel | | | | | |
| C6.17 | Period-End closing reports | | | | | |
| C7 | **Views** | | | | | |
| C7.1 | Able to view all transactions (eg orders, invoices) by supplier/document number | | | | | |
| C7.2 | Able to view general ledger codes used by invoice | | | | | |
| C7.3 | Able to view payments made per given period and the invoices paid out under that payment | | | | | |
| C7.4 | List of purchase orders per given period | | | | | |
| C7.5 | Year to date and Month to date value of purchase orders per supplier | | | | | |
| C7.6 | Purchase Requisitions by requestor | | | | | |
| C7.7 | Historical transactions-closed years | | | | | |

| | D. ACCOUNTS RECIEVABLE | S | P | C | N | Comments |
|---|---|---|---|---|---|---|
| D1 | **DEBTORS MASTER FILE** | | | | | |
| D1.1 | Maintain customer details in a master file. Some of the data to be captured includes: -Customer name, box no, tel no, vat registration no, type of debtor, general ledger codes. Contact person, Phone # work, home and cell. Date of birth. Service type. ID number. Lot number. Meter number. Route number. Tariff type. Equipment number. Landlord/Owners details (same as all the latter fields) | | | | | |
| D1.2 | Automatically allocate a debtor's account number that will maintain transactions posted to this account. Apply unique debtors ID to all new customers and reconnected customers | | | | | |
| | Field available to distinguish between government, business, municipal and individual debtors. | | | | | |
| D1.3 | Select tariffs applicable to customer (based on debtor type). This should be through a menu selection reading from the Tariffs maintenance table | | | | | |
| | Ability to disconnect and reconnect customers per location. | | | | | |
| | Ability to perform meter switches on a customer's account. | | | | | |
| D1.4 | Other input fields required: customer short name, payment details, company details, meter number, payment method, postal address, physical address, date opened. | | | | | |
| D1.5 | Able to specify if customer is active or on hold | | | | | |
| D1.6 | Allow users to specify how the surcharge (for water and effluent) should be applied per respective customer. Options should be on daily, monthly or yearly basis | | | | | |
| D1.7 | Ability to restrict access to the master file | | | | | |
| | Ability to link debtor system to the customer query management to identify debtors with outstanding queries on their accounts | | | | | |
| | Ability to produce an audit trail. | | | | | |
| D1.8 | Cater for discounts applicable on certain tariffs (e.g. customer A - 35% basic tariff) | | | | | |
| D1.9 | Ability to handle large (retail) volumes of customers should a need arise –account consolidations | | | | | |
| D2 | **TARIFFS COMPUTATION** | | | | | |
| | Facilitate computation of various tariffs charged to customers based on the budgeted figures i.e. operational costs and budgeted volumes. Refer to separate worksheet for details - Tariffs Computation | | | | | |
| | Basic Tariff | | | | | |
| D2.1.1 | (i) Able to retrieve and calculate the sum total of the budgeted operational costs relating to the A factor per scheme | | | | | |
| D2.1.2 | (ii) Able to retrieve and calculate the sum total of the budgeted operational costs relating to the C factor per scheme | | | | | |
| D2.1.3 | (iii) Retrieve information stored in the water volumes and compute the adjusted consumption and adjusted demand volume | | | | | |
| D2.1.4 | (iv) Able to compute the "tariff factor" based on the budgeted operational costs (figures in (i) and (ii) above) and the "adjusted demand volume" ((iii) above) | | | | | |
| D2.1.5 | (v) Able to compute the (iii) and (iv) above for each customer. | | | | | |
| D2.2 | Consumption Tariff | | | | | |
| D2.2.1 | (i) Able to retrieve and calculate the sum total of the budgeted operational costs relating to the Tc factor per scheme | | | | | |
| D2.2.2 | (ii) Able to compute the "tariff factor" based on the budgeted operational costs (figures in (i) above) and the "tariff factor" ((i) above) | | | | | |
| D2.3 | Connection Fee | | | | | |
| D2.3.1 | (i) Able to generate projected cashflow for new projects. The project cost information will be available from 'Project Finance" | | | | | |
| D2.3.2 | (ii) Calculation of interest that will be charged for the project implementation period | | | | | |
| D2.3.3 | (iii) Depreciation during the project implementation period | | | | | |
| D2.3.4 | (iv) Allow computation of the connection fee based on the costs (i), (ii) and (iii) above over the depreciation period (20 years) | | | | | |
| D2.4 | Allow users to use "what if" scenarios during the computation of tariffs above | | | | | |
| D2.5 | Maintain workings of the final tariff computed and update the tariffs masterfile | | | | | |
| D3 | **TARIFFS MAINTENANCE TABLE** | | | | | |
| D3.1 | Maintain all applicable tariffs (mainly for water and effluent customers) in this table. Refer to the separate worksheet for list of tariffs | | | | | |
| D3.2 | Maintain the formulas used to apply the various tariffs during the billing/invoicing process | | | | | |
| D3.3 | Ability for designated users to add, modify tariffs as and when required | | | | | |
| D3.4 | Ability for designated users to change these formulas as and when required | | | | | |
| D3.5 | Restricted access to the tariffs maintenance table | | | | | |
| D3.6 | Maintain an audit trail and history of all changes made | | | | | |
| D4 | **WATER AND WASTE WATER VOLUMES TABLE** | | | | | |
| D4.1 | Capture and maintain contracted volumes. These are fixed annually | | | | | |
| D4.2 | Capture and maintain licensed volumes. These are fixed annually | | | | | |
| D4.3 | Capture and maintain budgeted volumes. These are fixed annually | | | | | |
| D4.4 | Capture and maintain a field for 'loading factor'. Cater for up to 10 decimal places | | | | | |
| D4.5 | Capture and maintain "free allocation" volumes | | | | | |
| D4.6 | Able to capture and maintain water consumption/volumes on a daily basis per customer. Two sets of volumes applicable: (i) Purified/Clarified Water and (ii) Waste water /Effluent | | | | | |
| | Able to electronically import and maintain water consumption/volumes on a monthly basis per customer. Two sets of volumes applicable: (i) Purified/Clarified Water and (ii) Waste water /Effluent | | | | | |
| D4.7 | Able to compute and maintain the total monthly consumption based on the daily readings captured above | | | | | |
| | Ability to search for customers using various criteria selected from the masterfile. | | | | | |
| | Produce meter reading exception reports e.g high low consumption, set consumption parameters, meter reading types, estimated and auto estimated meter reading exceeding the set paramenters. | | | | | |
| | Able to restrict the number of estimated and auto estimated meter readings per customer | | | | | |
| D4.8 | Able to compute and maintain the surcharge volumes (ie where actual volume is greater than the contracted volume) based on the daily readings captured above. Applicable for (i) Purified/Clarified Water and (ii) Waste water /Effluent | | | | | |
| | Able to highlight each meter reading type e.g. Actual, estimate, auto estimate, customer supplied etc | | | | | |
| | Allow users to alter meter readings manually. | | | | | |
| | Export meter reading details i.e meter #, equipment number, date of meter reading, current meter reading, route, etc | | | | | |
| D4.9 | Customer selection should be a drop down menu reading from the Debtors master file | | | | | |
| D4.10 | Restricted access to this table | | | | | |
| | Ability to produce an audit trail | | | | | |
| D5 | **INVOICING** | | | | | |
| D5.1 | **General** | | | | | |
| D5.1.1 | Automatic invoice/billing using the water volumes table, the debtors master file and the tariffs table described above | | | | | |

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|---|---|---|---|---|---|---|
| D5.1.2 | Allow for capturing of amounts to be invoiced - e.g. staff debtors etc | | | | | |
| D5.1.3 | Monthly invoicing based on consumption (volumes) | | | | | |
| D5.1.4 | Regular invoicing of lab & staff debtors e.g. twice a week, weekly etc | | | | | |
| D5.1.5 | Automatically and uniquely number the invoice (transaction) made for easy referencing | | | | | |
| D5.1.6 | Allow users to type in the description of the items invoiced | | | | | |
| D5.1.7 | Generate proforma invoice for manual approval | | | | | |
| D5.1.8 | Allow for changes to be made on the proforma invoice in the system without requiring adjustments to GL codes | | | | | |
| D5.1.9 | Invoices to be posted into the system from the "proforma stage" following approval | | | | | |
| D5.1.10 | System should allow posting of invoice line items to several GL codes | | | | | |
| D5.1.11 | User to be able to define the GL codes to which these charges are posted to (i.e. the accounts to be DR and CR) | | | | | |
| **D5.2** | **(1) Lab debtors** | | | | | |
| D5.2.1 | Invoices are created from the Lab using LIMS system. Interface required to upload invoices into this system for invoicing purpose | | | | | |
| D5.2.2 | Upload and view invoice details in the respective module/menu used for invoicing purpose | | | | | |
| D5.2.3 | Calculate VAT on the total value and indicate separately | | | | | |
| D5.2.4 | Generate proforma invoice print out and show: <br> - line items of transactions as per details from LIMS; <br> - Quantity of item and cost; <br> - discounts (where applicable); <br> - the sub-total (before VAT) <br> - VAT Amount <br> - Total including VAT | | | | | |
| D5.2.5 | Invoices to be posted into the system from the "proforma stage" following approval. | | | | | |
| D5.2.6 | Post invoice details in the respective debtors account. Debtor should already exist in the debtor master file. | | | | | |
| D5.2.7 | Once posted; DR: the debtor CR: Lab account and CR: VAT. | | | | | |
| **D5.3** | **(2) Water** | | | | | |
| D5.3.1 | Using the debtors master file, tariffs maintenance table and the water volumes table; compute the charges applicable at month-end or in terms of the billing cycle <br> Refer to the Tariffs worksheet for the description and application of each of these charges | | | | | |
| D5.3.2 | (i) Basic tariff: | | | | | |
| D5.3.3 | (ii) Consumption tariff (Tc) | | | | | |
| D5.3.4 | (iii) Surcharge: | | | | | |
| D5.3.5 | (iv) Research - No VAT | | | | | |
| D5.3.6 | (v) Catchment | | | | | |
| D5.3.7 | (vi) Abstraction | | | | | |
| D5.3.8 | (vi) Fixed connection charge: | | | | | |
| | Calculate VAT on the total value and indicate separately | | | | | |
| D5.3.9 | Generate proforma invoice print out and show: <br> - Actual Consumption <br> - the amount charged per each charge on the invoice; <br> - the sub-total (before VAT) <br> - VAT Amount <br> - Total including VAT | | | | | |
| D5.3.10 | Generate proforma invoice print out and show: <br> - Actual Consumption <br> - the amount charged per each charge on the invoice; <br> - the sub-total (before VAT) <br> - VAT Amount <br> - Total including VAT | | | | | |
| | Ability to produce bill per route. | | | | | |
| | Be able to select invoice and billing period. | | | | | |
| | Able to perform a pre bill run and delete this run after producing exception reports. | | | | | |
| | Tax invoice/statement must reflect the following details. Customer name, postal address, vat registration number, route #, meter number, opening meter reading, closing meter reading, consumption for the month, meter reading dates, balance b/f, current charges per tariff step, sanitation charges, vat, balance due, due date billing date , invoice date, banking details, easy pay details, applications for debit orders, etc | | | | | |
| | Ability to update maintain and reconcile vat on a receipt basis. | | | | | |
| | Allow for manual approval of proforma prior to posting entry into the GL | | | | | |
| D5.3.11 | Allow for changes to be made on the proforma invoice in the system without requiring adjustments to GL codes | | | | | |
| D5.3.12 | Invoices to be posted into the system from the "proforma stage" following approval. | | | | | |
| D5.3.13 | System should allow posting of charges to several GL codes. Refer to the separate worksheet for the DR and CRs that apply on the "Basic Tariff" | | | | | |
| D5.3.14 | User to be able to define the GL codes to which these charges are posted to (i.e. the accounts to be DR and CR) | | | | | |
| D5.3.15 | Post the amounts calculated to the respective GL accounts | | | | | |
| D5.3.16 | | | | | | |
| **D5.4** | **(3) Effluent** | | | | | |
| D5.4.1 | Monthly invoicing based on consumption (volumes) | | | | | |
| D5.4.2 | Using the debtors master file, tariffs maintenance table and the water volumes table; customer compute the charges applicable at month-end or in terms of the billing cycle <br> Refer to the Tariffs worksheet for the application of these charges. | | | | | |
| D5.4.3 | (i) Fixed connection charge: | | | | | |
| D5.4.4 | (ii) Surcharge: | | | | | |
| D5.4.5 | Calculate VAT on the total value and indicate separately | | | | | |
| D5.4.6 | Generate proforma invoice print out and show: <br> - Actual Consumption <br> - the amount charged per each charge on the invoice; <br> - the sub-total (before VAT) <br> - VAT Amount <br> - Total including VAT | | | | | |
| D5.4.7 | Once approved, automatically post invoice and charged to respective GL codes | | | | | |
| **D5.5** | **(4) Sundry** | | | | | |
| D5.5.1 | Allow for capturing of the amount to be billed and a description. Debtor should already exist in debtor master file | | | | | |
| D5.5.2 | Once approved, automatically post invoice and charged to respective GL codes, DR: debtor sundry control account | | | | | |
| **D5.6** | **(5) Staff** | | | | | |
| D5.6.1 | Allow for capturing of the amount to be billed and a description. Debtor should already exist in debtor master file | | | | | |
| D5.6.2 | Can state payments/deductions to be once-off or over a specific period and the invoice amount will be based on this breakdown. | | | | | |
| D5.6.3 | Automatically compute the repayment instalments based on the payment period specified above | | | | | |
| D5.6.4 | Once approved, automatically post invoice and charged to respective GL codes. | | | | | |

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| | DR Staff debtor CR respective GL account e.g. Telephone, Uniform etc | | | | | |
| D5.7 | **(6)Invoice print out** | | | | | |
| | Generate a pre-numbered tax invoice with all the details shown as per the proforma above. Tax invoice/statement must reflect the following details. Customer name, postal address, vat registration number, route #, meter number, opening meter reading, closing meter reading, consumption for the month, meter reading dates, balance b/f, current charges per tariff step, sanitation charges, vat, balance due, due date billing date , invoice date, banking details, easy pay details, applications for debit orders, etc | | | | | |
| | Be web based | | | | | |
| | Have the function to add a note onto the invoice | | | | | |
| D5.7.1 | Be able to print previous and random invoices. | | | | | |
| D5.7.2 | Print 3 copies of invoices, 1 original and 2 copies | | | | | |
| D5.7.3 | Insert signature image of the person approving the invoices | | | | | |
| D6 | **RECEIPTS** | | | | | |
| | Allow for capturing of receipts against the respective debtors account into the system. | | | | | |
| | Electronically import receipt batches and post batches ( segregation of duties) | | | | | |
| | Electronic reconciliation between the GI and the debtors system ( invoicing, receipting, miscellaneous charges, credit notes) | | | | | |
| D6.1 | Electronically import and maintain a consumer deposit register reflecting all movement for a specified period per customer, per town, per WSA, per business, individual, raw water, industrial. | | | | | |
| D6.2 | Allow for upload of receipts made through the banking cash management system (Absa CashFocus) into the ERP system | | | | | |
| | Once receipts are posted, CR: debtor account DR: Bank and credit vat | | | | | |
| | Ability to update maintain and reconcile vat on a receipt basis. | | | | | |
| | Maintenance and control of all unallocated and suspense accounts. | | | | | |
| | Balance transfer from one account to another. | | | | | |
| D6.3 | Processing of credit notes | | | | | |
| D6.4 | Staff debtors | | | | | |
| | System to automatically post journals based on deductions processed and uploaded from VIP to the staff debtors accounts in the financial system | | | | | |
| D6.5 | Ability to produce an audit trail | | | | | |
| D7 | **Late Payments** | | | | | |
| | Automatically generate reminder letters for overdue payments (over 30 days) | | | | | |
| | Generate reminder letters for overdue payments (over a selected amount of days) as and when required | | | | | |
| | Ability to tag and maintain debtors who made payment arrangements. | | | | | |
| | Ability to tag and maintain debtors whom have been handed over for collections. | | | | | |
| D7.1 | Ability to tag and maintain debtors whom have been handed over for restrictions. | | | | | |
| D7.2 | Maintain Interest rates applicable to customers for late payments. Different rates apply to different debtor categories e.g. water customers charged prime +2.5%, staff debtors charged prime etc | | | | | |
| | Ability to automatically charge interest on late payments (over 30 days) for Trade, Sundry & Staff | | | | | |
| | Ability to automatically charge interest on late payments (over 30 days) for Trade, Sundry & Staff | | | | | |
| | Automatically increase in deposits for late and non payment | | | | | |
| | Electronically update and maintain legal fee charged to customer accounts. | | | | | |
| | Produce a list of customers to be restricted and reconnected after payment received | | | | | |
| D7.3 | Automatically post to the relevant GL accounts once applied. DR: Debtor; CR:- Interest account | | | | | |
| D7.4 | The interest charged is shown on the customer statements | | | | | |
| | | | | | | |
| D7.5 | Ability to produce an audit trail | | | | | |
| D8 | **Statements** | | | | | |
| D8.1 | Generate monthly customer statements (Trade, sundry and RDP debtors) and show all invoices, receipts and interest charged during the month | | | | | |
| D8.2 | The following details should appear on the statement:<br>Full name<br>Postal Address<br>Account number<br>Page number<br>Period<br>Terms of transaction<br>Document Reference Number<br>Date of Statement<br>Transactions for the period<br>Amount of each debit/credit and cumulative balance<br>Post-dated cheques not yet credited<br>Comment/Message block<br>Utilities' details<br>Amount due - i.e. current and 30 days<br>Amount overdue - i.e. over 60 days<br>Age Analysis - showing current invoice amount, 30 days, 60, 90 and 120 days and over | | | | | |
| D8.3 | Link to DbFax or Faxination to allow statements to be faxed automatically to the customer once generated | | | | | |
| D9 | **Credit notes** | | | | | |
| D9.1 | Uniquely numbered credit notes created in the system under the respective debtor account | | | | | |
| D9.2 | Generate/print proforma credit note for approval | | | | | |
| D9.3 | Allow for changes on the proforma without adjustments to the GL codes (i.e. prior to posting) | | | | | |
| D9.4 | Post credit note to the respective accounts once proforma has been approved. CR: debtor and DR: respective income account | | | | | |
| | Print 3 copies of posted credit note, 1 original and 2 copies | | | | | |
| D9.5 | Ability to produce an audit trail | | | | | |
| D10 | **Journals** | | | | | |
| D10.1 | Uniquely numbered journals (e.g. reversal) can be created/passed to the GL. | | | | | |
| D10.2 | Input fields to include:<br>Date<br>Period<br>Journal number (sequential, computer generated)<br>Debtors account number<br>Debtor's Name<br>Accounts being debited or credited<br>Amounts<br>Narration | | | | | |
| D10.3 | Workflow required for authorisation of journals prior to updating the GL | | | | | |
| D10.4 | Post to respective accounts once authorised. | | | | | |

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| | Able to print details of the journals posted. | | | | | |
| D10.5 | Ability to produce an audit trail | | | | | |
| **D11** | **Key Reports used** | | | | | |
| D11.1 | Debtors Age analysis, showing current invoice amount, 30 days, 60, 90 and 120 days and over per customer, per town, per WSA, per business, individual, raw water, vacant, current/ former customer, industrial including and excluding vat Ability to specify a period for the report.Including all voids | | | | | |
| D11.2 | Cash audit trails imported receipts (income schedule) - showing all receipts for the respective period per customer, per town, per WSA, per business, individual, raw water, industrial including and excluding vat Ability to specify a period for the report. Including voided receipts. | | | | | |
| D11.3 | Invoice audit trail - list of all invoices for the respective period per customer, per town, per WSA, per business, individual, raw water, industrial including and excluding vat. Consumption and charges split according to stepped tariff and sanitation as well as fixed charges. Ability to specify a period and criteria for the report. per customer, per town, per WSA, per business, individual, raw water, industrial including and excluding vat. Consumption and charges split according to stepped tariff and sanitation as well as fixed charges. Ability to specify a period and criteria for the report Including voided bills | | | | | |
| | Credit note audit trail - list of all credit notes posted per customer, per town, per WSA, per business, individual, raw water, industrial including and excluding vat. Consumption and charges split according to stepped tariff and sanitation as well as fixed charges Ability to specify a period and criteria for the report Including voided credit notes | | | | | |
| D11.4 | Miscellaneous charges audit trail – list of all miscellaneous charges posted per customer, per town, per WSA, per business, individual, raw water, industrial including and excluding vat. Consumption and charges split according to stepped tariff and sanitation as well as fixed charges. Ability to specify a period and criteria for the report. Including voided miscellaneous charges | | | | | |
| D11.5 | Users should be able to access previous periods to generate or view the reports above | | | | | |
| D11.6 | General Ledger Journals - for adjustments | | | | | |
| D11.7 | General Ledger Journals - for adjustments | | | | | |
| D11.8 | VAT charged for the period against the invoices processed on a receipt basis<br>Water Consumption/volumes report & Surcharge report | | | | | |
| D11.9 | Consumption report split per stepped tariff and sanitation. | | | | | |
| D11.10 | Report listing various water & effluent charges for the period. E.g.; list of all customers charged "surcharge" and the respective amount for the period | | | | | |
| D11.11 | Report on government levies - i.e. listing all invoices/customer charged levies and the respective amount for the period | | | | | |
| D11.12 | Meter readings report showing:<br>account number<br>name of debtor<br>meter number<br>previous reading<br>present reading<br>consumption<br>total | | | | | |
| | Listing of all unbilled customers per customer, per town, per WSA, per business, individual, raw water, industrial. Ability to specify a period and criteria for the report | | | | | |
| | Ability for reports to be drawn on any selected fields from the debtor's masterfiles. | | | | | |

| E. FIXED ASSETS | | S | P | C | N | Comments |
|---|---|---|---|---|---|---|
| **E1** | **General** | | | | | |
| E1.1 | Cater for more than one tax book | | | | | |
| E1.2 | Allow for ad hoc calculations of depreciation, forecasting and 'what if' scenarios | | | | | |
| E1.3 | Able to manage budget expenditure and project based Work-in-progress assets | | | | | |
| E1.4 | Able to differentiate between capital and expense items maintained within the fixed assets register | | | | | |
| **E2** | **ASSET MASTERFILE** | | | | | |
| E2.1 | Allow for additions of assets and capturing of:<br>- the full description of the asset; Serial no (where applicable); Addition Date; Cost , useful life, residual value, depreciation rates,<br>commissioning date, wear and tear, number of units | | | | | |
| E2.2 | Link asset information to accounts payable module (supplier details) to indicate the supplier of the asset and the respective invoice | | | | | |
| E2.3 | Automatically generate asset number | | | | | |
| E2.4 | Cater for asset barcode to be maintained in the system | | | | | |
| E2.5 | Entries for the following fields should be through a drop-down menu. The underlying information should be stored as standing data/masterfiles | | | | | |
| E2.6 | Asset Class eg Plant & Machinery etc | | | | | |
| E2.7 | Location of Asset, into 3 levels:<br>- Location;<br>- Department;<br>- Role of the asset user | | | | | |
| E2.8 | Cater for additions and modification of sub-assets with different depreciation rates. | | | | | |
| E2.9 | Allow for transfer of assets to cost centres, asset class and locations. Cost centres asset class and locations to be selected from a drop-down menu | | | | | |
| E2.10 | Accommodate for replacement cost of asset | | | | | |
| E2.11 | Maintain audit trail of all changes done to the asset masterfile | | | | | |
| E2.12 | Should cater for asset returns (credits) and automatic update of the GL | | | | | |
| E2.13 | Ability to split and allocate asset quantities into smaller quantities. Eg if 10 chairs have been captured under cost centre A, system<br>can facilitate this to be split into 5 to cost centre A and 5 to cost centre B | | | | | |
| E2.14 | Ability to import/update the asset masterfile in batch/bulk with respect to asset additions and transfers | | | | | |
| E2.15 | Ability to view the full fixed asset register detailing the asset code(number), sub assets, full description of asset, purchase date, cost, net book value. | | | | | |
| E2.16 | Ability to view fixed asset register per location | | | | | |
| **E3** | **DEPRECIATION** | | | | | |
| E3.1 | Calculate depreciation using various depreciation methods e.g. straight-line method | | | | | |
| E3.2 | Calculate depreciation on a daily basis, such that shorter months will have a different total depreciation value compared to longer months | | | | | |
| E3.3 | Ability to calculate depreciation for different types/classes of assets | | | | | |
| E3.4 | Able to generate depreciation forecasts on a monthly or yearly basis | | | | | |
| E3.5 | Be able to cater for residual values | | | | | |
| **E4** | **DISPOSAL** | | | | | |
| E4.1 | Allow for disposal of assets and update the respective general ledger codes accordingly. | | | | | |
| E4.2 | System should cater for the following input fields:<br>- Asset number to be disposed,<br>- Disposal date,<br>- Number of units to dispose<br>- Comment field (should be able to add lines for long description/comments) | | | | | |
| E4.3 | Able to calculate profit/loss on disposal | | | | | |
| **E5** | **REPAIRS & MAINTENANCE** | | | | | |
| E5.1 | Must allow update of useful life (i.e. extended life and depreciation) where asset repairs and maintenance have taken place. | | | | | |
| **E6** | **WIP & FORECASTING** | | | | | |
| E6.1 | System should be able to maintain data on project based work-in-progress assets. This should include maintenance of:<br>- Depreciation; and<br>- Interest | | | | | |
| E6.2 | Allow for Interest charges to the project until commissioning date when asset is transferred | | | | | |
| E6.3 | Maintain history of depreciation and interest details in the system after the commissioning date | | | | | |
| E6.4 | Ability to generate cashflow forecast on WIP | | | | | |
| E6.5 | Ability to generate cashflow forecast per asset class | | | | | |
| **E7** | **REVALUATION** | | | | | |
| E7.1 | Accommodate for revaluation of assets as and when required | | | | | |
| **E8** | **IMPAIRMENT** | | | | | |
| E8.1 | Cater for impairments of assets | | | | | |
| **E9** | **WEAR AND TEAR** | | | | | |
| E9.1 | Be able to calculate wear and tear and maintain tax values | | | | | |
| E9.2 | Be able to calculate recoupment/scrapping on disposal of assets | | | | | |
| **E10** | **JOURNALS** | | | | | |
| E10.1 | Able to create journals on additions, depreciation, disposals and transfers. | | | | | |
| E10.2 | Journals should be uniquely numbered | | | | | |
| E10.3 | Input fields to include:<br>Date<br>Period<br>Journal number (sequential, computer generated)<br>Debtors account number | | | | | |

| | | | | | | |
|---|---|---|---|---|---|---|
| | Debtor's Name<br>Accounts being debited or credited<br>Amounts<br>Narration | | | | | |
| E10.4 | Workflow required for authorisation of journals prior to updating the GL | | | | | |
| E10.5 | Post to respective accounts once authorised | | | | | |
| E10.6 | Able to print details of the journals posted | | | | | |
| **E11** | **REPORTING REQUIREMENTS** | | | | | |
| E11.1 | Ability to export information from the system reports into other applications e.g. spreadsheets | | | | | |
| E11.2 | Flexible reporting, allowing users to view and generate own reports based on a selection of fields available on the Fixed assets module | | | | | |
| E11.3 | Summary Movements reports showing the opening balance, additions, disposals, closing balance, depreciation and the net book value. | | | | | |
| E11.4 | Report listing all additions per period specified by user | | | | | |
| E11.5 | Report on depreciation per period specified by user per asset | | | | | |
| E11.6 | Report listing all disposals per period specified by user | | | | | |
| E11.7 | Able to generate Balance sheet | | | | | |
| E11.8 | Report on depreciation forecast for the current period and prior periods | | | | | |
| E11.9 | Report on journals processed per period specified by user | | | | | |
| E11.10 | Able to generate the movement report (above) per asset, asset class and per cost centre. | | | | | |
| E11.11 | Able to view and generate asset register per office (e.g. list of assets in CEO's office) | | | | | |
| **E12** | **GENERAL** | | | | | |
| E12.1 | the system must have a separate asset register module that is linked to the general ledger | | | | | |
| E12.2 | Asset register module must be fully GRAP compliant and comply with all GRAP 17 requirements/disclosures | | | | | |
| E12.3 | Asset register acquisitions and disposals should be updated directly to asset register and general ledger from capital account transactions in general ledger | | | | | |
| E12.4 | Asset register must cater for depreciation of assets and allocation of depreciation according to funding sources | | | | | |
| E12.5 | Asset register must provide any departmental and asset category information to properly compile GRAP compliant annual financial statements | | | | | |
| E12.6 | Asset register must cater for revaluation and impairment provisions as per GRAP 17. | | | | | |

| | F. PROJECT FINANCE | S | P | C | N | Comments |
|---|---|---|---|---|---|---|
| F1 | **General requirements** | | | | | |
| F1.1 | Workflow functionality required for approval of various entries made | | | | | |
| F1.2 | Email alerts to be generated to the person responsible for next action | | | | | |
| F1.3 | Transactions/entries requiring approval cannot be further processed until the approval chain is completed | | | | | |
| F2 | **Project Details Capture** | | | | | |
| F2.1 | Allow for manual input of the following information pertaining to project (Project Data fields) | | | | | |
| a) | Project Number | | | | | |
| b) | Budget Reference Number | | | | | |
| c) | Department File Reference Number | | | | | |
| d) | Project Commission Date | | | | | |
| e) | General Ledger Account Selection | | | | | |
| f) | Baseline Budget Entry | | | | | |
| g) | Project Title | | | | | |
| h) | Funder Reference Number | | | | | |
| i) | Project Start & End Dates | | | | | |
| j) | Department Selection | | | | | |
| k) | Notes & Comments on Progress | | | | | |
| l) | Baseline Budget Cashflow | | | | | |
| F2.2 | Entries for the following fields acquired from drop-down menus (Master File Data) | | | | | |
| F2.3 | Project Type: (i) Internal Funded - VAT excl (ii) External Funded - VAT incl (III) Multiple Funded | | | | | |
| F2.4 | Project type selection automatically updates whether project is vatable or not. | | | | | |
| F2.5 | Client e.g. Municipality | | | | | |
| F2.6 | Project Status: (i) Running - default upon new creation (ii) Closed (iii) Archived | | | | | |
| F2.7 | Funding source - must allow for a drop-down to select | | | | | |
| F3 | **Project Management - Approval routing** | | | | | |
| F3.1 | User to define approval routings, authorisers (employee names) & delegated authority values on the project | | | | | |
| F3.2 | This routing will be used for all entries & transactions that require approval within this project | | | | | |
| F4 | **Budget Capture** | | | | | |
| F4.1 | User to define project phases and tasks under each phase up to **4 levels** eg: A. Phase = Planning A. 1 Sub-phase 1 = Consulting Costs A.1.1 Task = Consulting Engineers A.1.1.1 Sub-task = Engineer X | | | | | |
| F4.2 | Ability to capture budget per item (lowest level of task) defined under each project phase | | | | | |
| F4.3 | Ability to change/revise budgets (except baseline) and maintain details of all revisions made including date | | | | | |
| F4.4 | Ability to review budgets online including details of all revisions made | | | | | |
| F4.5 | Maintain and allow for several budget entries per item per project. Entries currently made for: (i) Baseline(**Original**) budget; - does not change (ii) Approved budget; (iii) Project Expenditure Approval (PEA) | | | | | |
| F4.6 | Availability of funds should be checked against the Approved budget e.g. when processing purchase orders | | | | | |
| F4.7 | Various checks & balances when entering values - PEA cannot exceed Budget or be less than purchase orders already entered | | | | | |
| F4.8 | Once budget figures have been captured, workflow to be used for approval of the budget as per approval routing defined above. | | | | | |
| F5 | **Cashflow** | | | | | |
| F5.1 | Generate a straight-line cashflow for each set of budget values captured (above), for the time span of the project | | | | | |
| F5.2 | Cashflow can be generated as and when required | | | | | |
| F5.3 | Allow for manual adjustment of generated cashflows and recalculate the remainder accordingly | | | | | |
| F6 | **Purchase Requisitions & Orders** | | | | | |
| F6.1 | Capture purchase order against budget allocated to sub-task i.e. at level A.1.1.1 above. | | | | | |
| F6.2 | Generate purchase order number | | | | | |
| F6.3 | Purchase order details to be captured must include: | | | | | |
| a) | Vendor/supplier - selected from master file | | | | | |
| b) | Project Number | | | | | |
| c) | Cost Code - selected from GL Codes assigned to that project | | | | | |
| d) | Selection made against project phases and tasks | | | | | |
| e) | Description of service / product - adequate lines required. User should be able to add lines | | | | | |
| F6.4 | Allow for several line items (PO Items) to be captured per order. Number line items | | | | | |
| F6.5 | Automatically check for money available against PEA from the sub-task | | | | | |
| F6.6 | Purchase order cannot be processed if budget is unavailable | | | | | |
| F6.7 | Show PEA budget per the respective sub-task and the funds already committed and funds available | | | | | |
| F6.8 | Ability to track/report on the value of the PO, PEA and committed funds per sub-task (i.e. level A.1.1.1 above) | | | | | |

| | | | | | | |
|---|---|---|---|---|---|---|
| F6.9 | Generate a straight-line cashflow on purchase order | | | | | |
| F6.10 | Once purchase order has been processed, workflow to be used for approval of the budget as per approval routing defined | | | | | |
| **F8** | **Invoicing** | | | | | |
| F8.1 | Manually capturing of information | | | | | |
| F8.2 | Invoice number | | | | | |
| F8.3 | Date invoice received | | | | | |
| F8.4 | Entries for the following fields acquired from drop-down menus (Master File Data) | | | | | |
| a) | Invoice status; Interim, Provisional or Final | | | | | |
| b) | Supplier name/number | | | | | |
| c) | Supplier type; - consultants; - Contractors and suppliers; | | | | | |
| d) | Project number | | | | | |
| e) | Order No (show outstanding orders on that project for the respective supplier) | | | | | |
| F8.5 | Capture item number to be paid (i.e. line item as per order) | | | | | |
| F8.6 | Capture amount to be paid | | | | | |
| F8.7 | Add comments on a comments field according to supplier type | | | | | |
| F8.8 | Show total value of previous invoices processed against this order | | | | | |
| F8.9 | Indicate due date (i.e. when payment is due) | | | | | |
| F8.10 | Allow to separate amounts that are Vat able and Non-Vat able | | | | | |
| F8.11 | Calculate and show VAT amount if applicable | | | | | |
| F8.12 | Route the GRN for approval as per approval routing defined above | | | | | |
| F8.13 | Once approved, update the GL; DR Expenses and CR Creditors Control A/c | | | | | |
| F8.14 | Allow for capturing/processing of Retention against an invoice | | | | | |
| F8.15 | Allow for payment of retention on duration of project (up to 1 year of final date on project) | | | | | |
| **F9** | **Payment - Internally Funded Projects** | | | | | |
| F9.1 | Normal payment process applied (refer to Accounts Payable). | | | | | |
| F9.2 | All transactions up to payment records maintained in MW's core business general ledger | | | | | |
| **F10** | **For - Externally Funded Projects:** | | | | | |
| F10.1 | Generate separate payment transactions (manual input) | | | | | |
| F10.2 | Payment file sent through for payment in Abs Focus through a separate bank account | | | | | |
| F10.3 | All transactions up to payment records maintained in a separate general ledger | | | | | |
| **F11** | **Credit Notes** | | | | | |
| F11.1 | Ability to process credit notes against processed invoices or purchase orders | | | | | |
| **F12** | **Reporting Requirements (for both Internally and Externally Funded Projects)** | | | | | |
| F12.1 | *Reports printed according to pre-defined parameters* | | | | | |
| F12.2 | Report showing original Budget, PEA Budget, Orders processed, Payments, Orders not Invoiced and Retention | | | | | |
| F12.3 | Report on contingencies budgeted per project | | | | | |
| F12.4 | Report on Escalations per project: Projects status report showing project value of all projects that have been escalated | | | | | |
| F12.5 | Status of Retention Held | | | | | |
| F12.6 | Project Financial Control Sheet: Original budget, Approved and Revised Budgets & PEA and Variances | | | | | |
| F12.7 | Project status reports | | | | | |
| F12.8 | Budget Variations - changes between budgets | | | | | |
| F12.9 | PEA Variations - changes between budgets | | | | | |
| F12.10 | Order Variations - changes between budgets | | | | | |
| F12.11 | Commitments - Invoices awaiting payments (i.e. already matched to purchase orders) | | | | | |
| F12.12 | Purchase Order Requisitions | | | | | |
| F12.13 | Payment Approval report on Invoices | | | | | |
| F12.14 | Payment Progress on Invoices | | | | | |
| F12.15 | Invoice Schedules | | | | | |
| **F13** | **Other Reports** | | | | | |
| F13.1 | Cashflow on Budgets, Expenditure and Payments per project | | | | | |
| F13.2 | Payment Progress Report: Consultants | | | | | |
| F13.3 | Monthly Status of outstanding Payments | | | | | |
| F13.4 | Project Budget Variation Orders | | | | | |
| F13.5 | Project standing data details | | | | | |
| F13.6 | Project Variations (on budgets and orders) to be submitted | | | | | |
| F13.7 | Project Variations subject to approval | | | | | |
| F13.8 | Outstanding payments to creditors per project | | | | | |
| F13.9 | Outstanding payments summary | | | | | |
| F13.10 | Detail orders and invoices per project | | | | | |
| F13.11 | Cheques processed per month (audit trail) | | | | | |
| F13.12 | Detail payments per projects | | | | | |
| F13.13 | Capitalized and Discontinued Project report (All projects - per cost centre) | | | | | |
| F13.14 | Detailed Capitalized and Discontinued Project Report | | | | | |
| F13.15 | Orders by project | | | | | |
| F13.16 | Transaction Audit Trail | | | | | |
| F13.17 | Payments per period | | | | | |
| F13.18 | Payments Project Cashflow | | | | | |

| | | S | P | C | N | Comments |
|---|---|---|---|---|---|---|
| F13.19 | Detail: Capitalised Project Report | | | | | |
| F13.20 | Detail: Orders vs. Invoices | | | | | |
| F13.21 | Detail: Orders vs. Invoicing (Outstanding) | | | | | |
| F13.22 | Detail: Project Report (Capitalised & Discontinued by Project and Cost Centre) | | | | | |
| F13.23 | Reports: Board Project Report (Capitalised & Discontinued by Project and Cost Centre) | | | | | |
| F13.24 | Detail: Completed Projects | | | | | |
| F13.25 | Supplier Detailed reports | | | | | |
| **F14** | **Summary Views** | | | | | |
| F14.1 | Views on Budgets vs. PO's, PO's vs. Invoices and Invoices vs. Payments | | | | | |
| F14.2 | Status of Retention Held | | | | | |
| F14.3 | Order Values for Supplier on Projects | | | | | |
| F14.4 | Progress on Approvals for budgets, purchase orders & invoices | | | | | |

| **G. CASH MANAGEMENT** | | | | | | |
|---|---|---|---|---|---|---|
| | | S | P | C | N | Comments |
| G1 | **General** | | | | | |
| G1.1 | The system should cater for processing of cash receipts, payments, EFT transfers, standing orders etc to the cashbook | | | | | |
| G1.2 | investments etc. | | | | | |
| G1.3 | The ERP system must allow for uploading and downloading of information to and from Absa CashFocus. | | | | | |
| G1.4 | System should cater for automatic posting of payments made through the banking cash management system (CashFocus) to the respective General ledger accounts/codes and cashbook. | | | | | |
| G1.5 | Allow users to download information (statements) from the cashbook for bank reconciliation purposes | | | | | |
| G1.6 | Allow for maintenance of multiple bank accounts | | | | | |
| 11.7 | Electronic bank reconciliation | | | | | |
| G2 | **BORROWINGS - LOAN SCHEDULE & INTEREST ACCRUAL** | | | | | |
| G2.1 | Require a loans maintenance function which will detail date loan was commissioned, loan amount, duration/maturity date, interest rate, movement etc | | | | | |
| G3 | **Interest accrual schedule** | | | | | |
| G3.1 | System should calculate on a monthly basis the interest (accruals) for each loan maintained and post the amount to the respective GL accounts | | | | | |
| G3.2 | The interest accrued should also be automatically allocated to the various schemes funded by these loans based on the capital employed per scheme. | | | | | |
| G3.3 | System should also maintain details of the loan repayments made | | | | | |
| G3.4 | Feature to alert users of loan repayment that are due. | | | | | |
| G4 | **Reporting requirements** | | | | | |
| G4.1 | Need a report detailing all the loans maintained, with their respective standing data i.e. loan amount, interest rate, payments made etc. | | | | | |
| G4.2 | Report showing all the loans maintained, the interest rate applicable and the duration in order to compute the "weighted average (loan pool) interest rate" | | | | | |
| G5 | **INVESTMENTS** | | | | | |
| G15.1 | The system should automatically allocate net interest to the various schemes. | | | | | |

| **H. INTERFACES** | | | | | | |
|---|---|---|---|---|---|---|
| | | S | P | C | N | Comments |
| H1 | **Interfaces** | | | | | |
| H1.1 | project management and project finance | | | | | |
| H1.2 | engineering and finance support products | | | | | |
| H1.3 | banking and cash management systems | | | | | |
| H1.4 | HR and Payroll systems | | | | | |
| H1.5 | GIS software | | | | | |
| H1.6 | Metering, prepaid and billing systems | | | | | |
| H1.7 | LIM | | | | | |
| H1.8 | a list of any additional products should be listed | | | | | |

| | I. BUDGETING | S | P | C | N | Comments |
|---|---|---|---|---|---|---|
| I1 | **Operational Costs** | | | | | |
| I1.1 | Budgeting functionality required | | | | | |
| I1.2 | Facilitate budgeting process by showing users previous budget and Actuals per responsibility (general ledger) code and suggesting estimates based on this information | | | | | |
| I1.3 | The system should allow each manager to capture/prepare their departmental budgets | | | | | |
| I1.4 | Access to budgeted figures (and account codes) should be restricted per department, to the respective manager | | | | | |
| I1.5 | Designated staff in Finance should have access to view/edit all budgeted figures | | | | | |
| I1.6 | The system should also calculate budget variances ie previous vs current and reflect percentages for analysis | | | | | |
| I2 | **Income** | | | | | |
| I2.1 | Interface with other systems and allow for information to be downloaded and uploaded from the ERP system | | | | | |
| I3 | **Forecasting** | | | | | |
| I3.1 | Facility to allow preparation of business forecast/plan up to 5 years | | | | | |
| I3.2 | System should calculate the required output (figures) based on the variables set by the user | | | | | |
| I4 | **Dashboards** | | | | | |
| I4.1 | Allows management to view budgets based on real time information from the financial system | | | | | |
| I5 | **GENERAL** | | | | | |
| I5.1 | System must be capable of compiling Multiyear budgeting in GRAP and National Treasury formats | | | | | |
| I5.2 | have a tariff module linked thereto for the calculation and determination of cost based tariffs | | | | | |
| I5.3 | allow for fixed budget and percentage forecasting calculations | | | | | |
| I5.4 | capital budgeting incorporating all GRAP requirements, e.g. linked funding sources, future operational costs, capital charges and estimated life of asset | | | | | |
| I5.5 | maintain a five year history of all budgets | | | | | |
| I5.6 | allow for annual adjustments budget process in terms of MFMA | | | | | |
| I5.7 | cater for budgets in progress and carry over's to ensuing financial year | | | | | |
| I5.8 | be linked to contract management, finance and loans register modules | | | | | |
| | | | | | | |

| J. MANAGEMENT INFORMATION | S | P | C | N | Comments |
|---|---|---|---|---|---|
| **J1**   **GENERAL LEDGER CODES** | | | | | |
| J1.1   Restricted access to open general ledger account codes required | | | | | |
| J1.2   Must be configurable | | | | | |
| J1.2   Able to assign a responsibility code - i.e. assigned a department (manager) responsible for that account i.e. budget monitoring etc | | | | | |
| J1.4   Allow users to generate various reports per cost centre/scheme. The GL naming convention is important for this purpose as all reporting requirements are cost-centre/scheme based. | | | | | |
| J1.5   Ability to maintain multiple general ledgers or creation multiple companies (e.g. to cater for core business, external projects) | | | | | |
| **J2**   **JOURNALS** | | | | | |
| J2.1   Uniquely numbered journals (e.g. recurring, reversal) can be created/passed to the GL. | | | | | |
| J2.2   Workflow required for authorisation of journals prior to updating the GL. Authorisation is based on value hence the routing will be to different staff depending on the value | | | | | |
| J2.3   Post to respective accounts once authorised. | | | | | |
| J2.4   Able to view and print details of the journals posted. | | | | | |
| **J3**   **Accounting Standards** | | | | | |
| J3.1   The system must be in compliance with GRAP, PFMA,MFMA and Water Services Act | | | | | |
| **J4**   **Financial Calendar** | | | | | |
| J4.1   System must allow for a 13 month cycle where 12 months period are for normal transactions and 13th month is for adjustments | | | | | |
| J4.2   Cater for future time periods for planning/forecasting purposes (e.g. 5 year planning) | | | | | |
| J4.3   Date format should be in dd/mm/yyyy | | | | | |
| **J5**   **Period closure procedures e.g. month-end requirements** | | | | | |
| J5.1   Closure of sub-ledgers after month-end (based on date pre-determined by the user) | | | | | |
| J5.2   Posting to closed (or future) periods should not be allowed. | | | | | |
| J5.3   Override on period closure to be restricted to designated staff in Finance | | | | | |
| **J6**   **Data Take-on** | | | | | |
| J6.1   Data take on should be for the prior and current year, Actuals, as well as the current year budget | | | | | |
| **J7**   **Cost and Management Accounting** | | | | | |
| J7.1   All indirect costs incurred at Head Office, the Laboratory, Stores and the Workshop are allocated to the main schemes served by the core business (by final percentage allocation based on costing) | | | | | |
| J7.2   The system should be able to automatically allocate indirect costs to the core schemes based on a pre-set criteria | | | | | |
| J7.3   The current cost allocation is based on: | | | | | |
| J7.4   (a) Stores - Allocation based on issues and receipts to the respective schemes. Retrieve information from the Inventory Module | | | | | |
| J7.5   b) Workshop - Allocation of labour charge (i.e. time * charge out rate) and vehicle usage (Travel) to the respective schemes Retrieve information from the Job costing module (and/or Service Orders) | | | | | |
| J7.6   © Head Office - Allocation based on budgeted water volumes | | | | | |
| J7.7   (d) Laboratory - Allow for manual capturing of the percentage split to be applied for allocation. | | | | | |
| **J8**   **Financial Statements** | | | | | |
| J8.1   Generate financial statements after indirect cost allocation. The requirements for the financial statements are: | | | | | |
| J8.2   (i) Required for MW's "Core business" schemes and other schemes need to be prepared separately. Refer to the Finance set up flow chart. | | | | | |
| J8.3   (ii) Income statement, balance sheet and cash flow statements on a monthly, quarterly and yearly basis | | | | | |
| J8.4   (iii) Statements are required per scheme or cost centre and in a consolidated format i.e. all schemes | | | | | |
| J8.5   (iv) Financial statements prepared according to Public finance management Act & GAAP | | | | | |
| J8.6   Ability to compute different financial ratios and indicators e.g. liquidity ratio etc | | | | | |
| **J9**   **General reporting requirements** | | | | | |
| J9.1   System should allow users to specify the financial period (year, months, dates) for which to generate a report | | | | | |
| J9.2   Users (particularly Finance) should be able to generate their own reports by selecting the required parameters e.g. reports by cost centres, balance sheet items etc | | | | | |
| J9.3   Users should be able to export information/report details from this system into other applications particularly Ms Excel | | | | | |
| J9.4   Other forms of report output required are: | | | | | |
| a)   · printer | | | | | |
| b)   · screen | | | | | |
| c)   · e-mail or fax | | | | | |
| J9.5   *Some of the basic/standard report requirements include:* | | | | | |
| J9.6   Lead Schedules- i.e. list of all transactions posted to each account in the general ledger | | | | | |
| J9.7   Responsibility/Variance reports - Monthly income statements by responsible department (manager) showing Actuals, estimates and variance e.g. Staff costs Actuals against budget | | | | | |
| J9.8   Salaries Expenditure (actual) against budget for the organisation as a whole and per department. Report required per month or annualy | | | | | |
| J9.9   Cashflow forecast | | | | | |
| J9.10   Loan schedule and Interest Accrual report - Refer to Cash management | | | | | |
| J9.11   Report showing indirect costs allocation per scheme/cost centre in core business | | | | | |
| J9.12   Report on all accounts per month per category | | | | | |
| J9.13   invoices report | | | | | |
| J9.14   Repairs and Maintenance per cost centre and per item | | | | | |
| J9.15   - Statistical (SARS) Returns - Monthly, Quarterly and Annually; | | | | | |
| J9.16   - Annual Report - shows actuals for the previous year and current against the business plan (budget) | | | | | |

| | K. INFORMATION TECHNOLOGY | S | P | C | N | Comments |
|---|---|---|---|---|---|---|
| **K1** | **User Profile Management** | | | | | |
| K1.1 | Automatically prompt user to change password after a certain number of days | | | | | |
| K1.2 | Allow administrator to specify: | | | | | |
| a) | the number of days for which password changes must occur | | | | | |
| b) | password length (e.g. 6 characters) | | | | | |
| c) | number of password attempts before account lockout | | | | | |
| d) | account lockout after period of inactivity (e.g. 15 minutes) | | | | | |
| K1.3 | Ability to lock user sessions | | | | | |
| K1.4 | Allow enforcement of password complexity e.g. use of alphanumeric | | | | | |
| K1.5 | Simultaneous login of user ID/password prohibited | | | | | |
| K1.6 | Passwords not displayed on screen (*******). Encryption of password files/tables | | | | | |
| K1.7 | Facility to view system logs | | | | | |
| K1.8 | Require facility to disable an account | | | | | |
| K1.9 | Search functionality on the system logs | | | | | |
| K1.10 | System log report headers should be meaningful | | | | | |
| K1.11 | Functionality to import user profile from active directory | | | | | |
| K1.12 | Ability to allocate user access by: | | | | | |
| a) | Program/module | | | | | |
| b) | Transaction type | | | | | |
| c) | Specific transactions | | | | | |
| K1.13 | Input fields for user creation should cater for input of: company, employee number, name, surname, user login name, privilege (end-user/administrator), job title, | | | | | |
| K1.14 | Should also cater for input of authorisation level as per delegation authority (required for workflow) | | | | | |
| K1.15 | Administrator ability to change user access levels at any time | | | | | |
| K1.16 | Changes to masterfiles (e.g. vendor, debtors, tariffs etc) should be password protected | | | | | |
| **K2** | **Login Procedures** | | | | | |
| K2.1 | Able to authenticate user login with Windows Active directory. | | | | | |
| **K3** | **Environments** | | | | | |
| K3.1 | Maintain live and demo company environments | | | | | |
| K3.2 | Facility to synchronise live and demo environments | | | | | |
| **K4** | **Archiving** | | | | | |
| K4.1 | Capability to archive event logs and audit trails | | | | | |
| **K5** | **Paper Types** | | | | | |
| K5.1 | Each user should be allocated a paper type | | | | | |
| K5.2 | Paper types are linked to printers | | | | | |
| **K6** | **Menu Allocation** | | | | | |
| K6.1 | Should be meaningful- preferably using job title | | | | | |
| K6.2 | Configuration should be made easy | | | | | |
| K6.3 | Ability to change routing (workflow and alerts) | | | | | |
| **K7** | **General** | | | | | |
| K7.1 | Audit trail on changes to all master file information | | | | | |
| **K8** | **Technical** | | | | | |
| K8.1 | Is your system compatible with the current IT infrastructure in place the utility (CURRENT INFORMATION TECHNOLOGY ENVIRONMENT SECTION OF THIS DOCUMENT). If not, indicate what additional hardware, system software, database, or utilities are required. | | | | | |
| K8.2 | What version of the software is being proposed? When was this version released? When is the next version due? | | | | | |