INTEGRATING ENTERPRISE RESOURCE PLANNING INTO ELECTRONIC CONTENT MANAGEMENT IN A SOUTH AFRICAN WATER UTILITY COMPANY

by

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ABSTRACT

Digital records are either stored in an enterprise resource planning (ERP) system or electronic content management (ECM), or managed without the benefit of either system. In many countries, public and private organisations have implemented ECM systems, some have implemented ERP systems and others generate digital records without the benefit of any controlled system. In most organisations such systems are not integrated resulting in duplication and fragmentation of records. The South African Water Utility company, Rand Water, has implemented both ERP and ECM systems. Investing in these systems as an organisation comes at a cost but it can add value when used optimally to improve the organisation's productivity and efficiency. To achieve high productivity and efficiency, integration of an ERP system into an ECM system is a requirement but remains lacking. This qualitative study utilised the Actor Network Theory to explore the integration of ERP into ECM at the South African Water Utility company, Rand Water, with a view to developing a framework for integration of the systems. The study utilised a system analysis case design with fourteen interviews conducted at different levels in the organisation and diverse business units using ERP and ECM to perform their operational deliverables in line with the organisation's business objectives. The interviews were augmented with data from document analysis of policies, specifications and functionalities of the systems to determine the feasibility of integration. The study established that the water utility company has implemented ERP systems (SAP) since 1994 and ECM system since 1991 (Papertrail and later IBM FileNet) with only information flow module integrated. The study suggested that to integrate ERP into ECM, human and non-human actors need to collaborate to ensure that the actor network being integrated is achieved. The study also presents a strategy discussion for integrating ERP into ECM. A further study on the transfer of digital records in ECM into archival custody is recommended.

Key words: Integration, electronic content management, enterprise resource planning, enterprise content management, Actor network theory, electronic records, digital records, electronic system, information management system, records management, archives, Rand Water, critical success factors

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DEDICATION

This dissertation is dedicated to my wife, Ntuthuko (Moratuwa), my daughters, Sebosarena and Phethego, and my parents. Mr and Mrs Mello.

DECLARATION

Name: Vincent Malesela Mello

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I declare that the above dissertation/thesis is my own work and that all the sources that I have used or quoted are indicated and acknowledged by means of complete references.

09/12/2019

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Mr VM Mello **Date**

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LIST OF ABBREVIATIONS

ANT:	Actor Network Theory
AP:	Accounts Payable
AIIM:	Association for Information and Image Management
AST:	Adaptive Structuration Theory
BLL:	Business Logic Layer
COPICS:	Communication Oriented Production Information System
CIM:	Computer Integrated Manufacturing
CMIS:	Content Management Interoperability Services
CRM:	Customer Relationship Management
CSF:	Critical Success Factor
DAL:	Data Access Layer
EA:	Enterprise Architecture
ECM:	Enterprise Content Management
ECM:	Electronic Content Management
EDMS:	Electronic Document Management System
EDRMS:	Electronic Document and Records Management System
ERMS:	Electronic Records Management System
FTP:	File Transfer Protocol
GIS:	Geographical Information System
GUI:	Graphical User Interface
HTTP:	HyperText Transfer Protocol
IBM:	International Business Machines Corporation
ICT:	Information and Communication Technology
IDMS:	Integrated Document Management System
IDR:	Intelligent Document Recognition
IP:	Internet Protocol
IT:	Information Technology
JIT:	Just-in-Time
JSR:	Java Specification Request
LAN:	Local Area Network
LMS:	Learning Management System
MRP:	Material Resource Planning

NIST:	National Institute of Standards & Technology
SA:	South Africa
SAP:	Systeme, Anwendungen, Produkte in der Datenverarbeitung
SCM:	Supply Chain Management
SQL:	Sequence Query Language
RDBMS:	Relational Database Management System
OCR:	Optical Character Recognition
ODMA:	Open Document Management API
OPP:	Obligatory Passage Point
PDA:	Personal Digital Assistant
PEOU:	Perceived Ease of Use
TAM:	Technology Acceptance Theory
TCP:	Transmission Control Protocol
TPM:	Total Productive Maintenance
UI:	User Interface
US:	United States
VLE:	Virtual Learning Environment
WAN:	Wide Area Network
WebDAV:	Web Distribution Authoring API
Y2K:	Year 2000

CHAPTER ONE
INTRODUCTION: PUTTING THINGS INTO PERSPECTIVE

1.1 Background to the study

ERP is a business management software that allows an organisation to use a system of integrated applications to manage the business (Al-Mashari & Al-Mudimigh 2003). Integration of applications is one of the most debated issues recently. For example, Azevedo, Romão and Rebelo (2012) posit that in an attempt to maximize productivity gain, organisations choose integration of information which tends to also cause several problems mainly because there are many isolated tools in their varied environments. This in most cases leads to the duplication of information in the organisation and different result in its various silos. Furthermore, the main problems of fragmentation due to these silos are the difficulty of obtaining consolidated information and the inconsistency of redundant data stored data on more than one system. Thus in their opinion, they suggest enterprise resource planning (ERP) as the solution to these identified problems by its capability to aggregate in one integrated system, the various business processes and support of organisations. However, the aforementioned authors have identified ERP limitations among others to be its inflexibility, long implementation period in an ever evolving business environment, its hierarchical rigidity and centralization of control and management. With these limitations, ERP needs to be integrated with enterprise content management (ECM) system to be effective.

ECM is a transition from paper to computer in the management of records (Nelen 2009). According to Munkvold, Päivärinta, Kristine and Stangeland (2006), ECM represents an integrated enterprise-wide management of the lifecycle of all forms of recorded information content such as documents, data, reports and web pages, and their metadata that is organised in accordance to corporate taxonomies supported by an appropriate technological and administrative infrastructure. Furthermore, the ECM perspective is found to integrate and extend the research areas of information resource management and document management including the repository model of knowledge management. However, in their study, two research issues were identified and are discussed briefly as follow: firstly, it is the utilization of content metadata and corporate taxonomy representing a big challenge in integrating the logical solutions and their user processes despite the technological solutions for producing the

content. Secondly, there is a need for justifying ECM investments and evaluation of a comprehensive programme impact to legitimise the enterprise-wide approach in general.

Integration of ERP system into ECM system has been an issue of discussion in recent years (Katuu 2016; Maican & Lixandroiu 2016). ECM and ERP are enterprise systems and if they are integrated, the following benefits can be realised: reduced paper handling and reduced labour; reduced misplaced or lost invoices; reduced storage costs; increased processing speed; decreased errors (higher accuracy); fast, reliable, easy access to invoices using the familiar ERP user interface; on-time payments; more early-payment discounts; and auditable business processes with more visibility, improving efficiency and automation and add efficiency to repetitive business processes; cost reduction and rapid decision-making and regulatory compliance (Medina 2014; Motwani, Subramanian & Gopalakrishna 2005).

In some cases, challenges are revealed regarding how to ensure that enterprise systems such as ERP and ECM add value and return on investment (Medina 2014; Van Rooij 2013). It is of value to explore the integration of the two enterprise systems (ECM and ERP) and identify in the related opportunities, challenges and benefits in organisations where these systems are already in place or planned to be in place. This issue is topical as several articles have already been written about ECM integration from different aspects such as customisation and architecture, unstructured information with structured information, electronic information system and integration benefits enveloped with higher costs, more risks and larger changes (Nordheim & Päivärinta 2004; Haug 2012; Svärd 2013; Van Rooij 2013). Munkvold, Päivärinta, Kristine and Stangeland (2006) list ECM integration challenges relating to its integration with other components of IS infrastructure such as portal solutions, various e-collaboration solutions, other enterprise-scope applications and technologies, web services and service-oriented information systems architectures, and business intelligence.

The integration of the ERP into ECM enterprise systems is relevant and worth exploring in the academic and business worlds. This study covered the sub-fields of records management and technology within information science. The technologies at the centre of this study were ERP and ECM. The phenomenon was studied within the context of the South African water utility known as Rand Water. This utility company has invested in two enterprise systems, SAPS (ERP) and IBM FileNet (ECM), which generate records but are not integrated, resulting in a

missed opportunity in optimally deriving value and return on investment. This study sought to propose a framework to integrate the ERP system into the ECM system with the view to achieving operational efficiency and high productivity. This chapter specifically puts things into perspective by providing the background, the contextual setting, theoretical framework, problem statement, justification of the study, the importance of the study, originality of the study, scope and delimitation of the study, research methodology, definition of key concepts, ethical consideration and the outline of the chapters of the study.

Enterprise systems such as ERP and ECM are implemented to add value to the operation of organisations. In the case of ERP, its functionality spreads across all organisational departments (e.g. Human Resources, Procurement, Sales, Finance, etc.). On the other hand, ECM offers the organisation the capability to create, capture, manage, store, secure, preserve, destroy, publish and present digital content (Van Rooij 2013). Leikums (2012) posits that when these systems are integrated, they offer numerous benefits such as the reduction of cost of maintenance and the simplification of workflow among others. The combination of ERP and ECM can ensure creation, processing and storage of all the necessary data.

Although these enterprise systems (ERP and ECM) offer benefits, they also come at a reasonably high cost to the organisation. The return on investment such as cost reduction, improved productivity, improved efficiency, visibility and compliance, is not realised due to a lack of integration of ERP and ECM (Van Rooij 2013). This silo operational approach is common in some countries. InterPARES studies by Team Africa carried out in Zimbabwe (AF03), Botswana (AF04), South Africa (AF02) and Kenya (AF05) revealed that integration of ERP and ECM was very minimal or non-existent (InterPARES 2018). Zimbabwe (AF03) study revealed that some organisations (non-profit and public) running ERP and ECM also have less or no integration between the two enterprise systems. This Zimbabwe (AF03) study concluded that there was an inadequacy of research work that specifically addresses issues of ECMs and ERPs in Zimbabwe's public and private sector. Furthermore, it was lamented that the bulk of the extent of the literature addresses the generality of the electronic records management issues, rather than integration (Chaterera 2016). Based on the InterPARES studies by Team Africa, reveal that integration of these two enterprise systems was inadequate or, in some instances as mentioned earlier, not integrated at all (InterPARES 2018). Therefore, there is a need for a framework to integrate ERP into ECM to realise the strategic benefits of the two systems.

The article by OpenText (2014) emphasises the benefits of integrating ECM and ERP. In the same article, it is further argued that organisations without ECM and ERP integration will find it very difficult to leverage on their functionalities. Both ERP and ECM systems are enterprise systems that add value in an organisation due to their capability to reduce cost, and improve productivity, efficiency, visibility and compliance (Alalwan & Weistroffer 2013; Herbst, Simons, Vom Brocke & Derungs 2014; Kwatsha 2010; Medina 2014; OpenText 2014; Van Rooij 2013; Vom Brocke, Sonnenberg & Buddendick 2014).

In the case of Rand Water as a public water utility company in South Africa, it has acquired both ERP (SAP) and ECM systems (IBM FileNet). However, the two systems are operated separately, and there is a need to integrate them to realise the above-mentioned benefits (Maraba 2017; Medina 2014; Ngoepe 2017; Van Rooij 2013). Lack of integration of these two systems is not unique to Rand Water but its global opportunity and a problem. A company in the name of Statoil had similar problems whereby the main platform for document management workflow (Lotus Notes, including Notes- based virtual project room (Sarepta Arena), and an electronic archive) used other applications for file creation and data storage which included discipline specific applications and databases intra- and extranet applications and file structures in MS office 2000. Though Statoil had ERP solution as SAP which covered a proportion of business processes and related databases across the organisation, their information remained scattered across several different storage media and applications with the total number of databases estimated to exceed 5,500. This caused major challenges related to information retrieval, version control and information quality across the enterprise Munkvold et al (2006).

1.1.1 Contextual setting

In attempting to design a framework for integrating ERP into ECM at a South African Water Utility, the researcher conducted interviews at Rand Water being a water utility with a rich history in document management and electronic document management development. The organisation also runs ERP as its transactional system. As the ERP system and the ECM system were not integrated as was mentioned in section 1.1, the organisation was a suitable candidate to conduct this study.

1.1.2 Brief background of the South African water utility company

The idea to establish Rand Water as a water utility surfaced in 1893. It started with its operations in 1905 and to date, it still provides bulk potable water and related services to Gauteng, Free State, Mpumalanga, and Northwest provinces. The water utility was chosen because it is the largest water utility in Africa and both runs ERP and ECM. It has historical records that are still important and remain an input to the current, existing practices and technology. Since its establishment in 1903, its records management function was centralised at its head office, with satellite records systems feeding into the corporate system. This is still the case today, with the ISO 9001:2008 quality management system and its associated annual audits, ensuring quality control (Ngoepe 2017; Rand Water 2013).

Among the factors that influenced records management compliance with the government regulations and legislation was the water utility's move to a new building outside the city centre of Johannesburg in 1988 during which its archives from the foundation of the utility up to 1975 were transferred to the Johannesburg Records Centre. This action meant a total revamp of the records file system implementation and conformance to the principles and guidelines of the National Archives and Records Service of South Africa (NARSSA). The records file plan was registered with NARSSA, but a longstanding legal issue between NARSSA and the state legal advisors regarding the applicability of the National Archives of South Africa Act (NARS Act) to parastatals such as Rand Water, resulted in some delay in finalising the actual file plan. However, the guidelines and regulations about the implementation of the file plan were followed by Rand Water as good practice in any case (Ngoepe 2017).

In consideration of the records management system introduced in 1991 and the ERP system in 2004, the electronic management system and the ERP remain not integrated. This state of two systems running independently detracts the operations and benefits that could be realised by the organisation. Mohamed (2015) contends that lack of automation, efficiency and cost reduction is because of the non-integration of the electronic management system and ERP system in organisations. In some instances, electronic records are stored in the ERP (SAP) systems as well as in the ECM. Having different versions of the same records and one source of the truth remains a challenge to this day. Electronic records are often duplicated or lost in the process and it is difficult to point to one reliable source where electronic content is fully

managed (Maraba 2017). Rand Water is a suitable candidate for this research based on its rich history in Electronic Content Management and ERP usage (Ngoepe 2017).

Rand Water was established in accordance to the stipulation of the Water Service Act of 1997. However, with the passing of the Water Services Act of 1997 and its subsequent incorporation into the greater family of bulk water suppliers, its records management function became aligned with the provision of the National Archives and Records Services of South Africa Act, (No. 43 of 1996), as amended. Thus, it is in the provisions of the NARSA Act that the integration of the ERP and ECM plays a critical role. Therefore, integrating ERP into ECM makes a business case for water utilities to ensure that accurate and quality records are preserved and archived effectively to ensure ease of retrieval for the productivity and improved service provision to the ultimate benefit of the customers, as monitored and evaluated by the Minister of Water and Sanitation (Republic of South Africa 1997).

1.2 Theoretical framework

Theory is defined as a group of logical, related statements that are presented as an explanation of a phenomenon (Jacobs & Roodt 2007). It is a system that aligns concepts in a way that produces understanding or insight. It is deemed a tool to better understand and interact with reality. As explicated by Cibangu (2013), science exists due to the existence of the theory. This applies to the information science fraternity as the body of knowledge with history, community and organisation, which has a venue for its activities as articulated in the article by Cibangu (2013) referring to articles by Bates (1999), Cornelius (2002), Farkas-Conn (1990), Hjorland (2000; 2002; 2003a; 2003b; 2003c) and Saracev (1999). Furthermore, Haynes and Carroll (2010), from the philosophy of science, define theory as an assembly of domain or aspect-specific knowledge consisting of statements that could be mathematical or not, generalisation that is empirical and theoretical propositions on observable entities or forces.

As mentioned earlier and supported by Jacobs and Roodt (2007), a theory is a group of logical, related statements that are presented as an explanation of a phenomenon. Cibangu (2013) considers the existence of science as the influence of theory. In review of literature in the IS, ERP and ECM integration revealed that there is a range of theoretical perspectives and frameworks that has been widely adopted for the past few decades. Davis, Bagozzi and Warshaw (1989) developed an early framework called the Technology Acceptance Model

(TAM) to examine the degree of satisfaction amongst users of a new system in an organisation. In brief, the TAM assesses the degree of perceived ease of use (PEOU) and the perceived usefulness to users introduced to IS or ERP or ECM systems in an organisation. TAM had been widely adopted by other scholars in the IS and ERP implementation and business integration from critical success factors (Bueno & Salmeron 2008). For their work on this article, they used TAM to identify the factors that influence ERP but are not defined by TAM. Systems integration was included in the critical success factors reviewed. A more recent study relating to ERP where TAM was applied had to do with identifying the impact of usage on the individual panoptic empowerment and individual performance. TAM was also criticised for considering usage as an end (Rajan & Baral 2015). The other aspect that was investigated was the sociotechnical issue that relates to human and non-human actors' (Orlikowski 2009) influence on the integration outcomes, which tends to revolve around power dynamics and political aspects (Sarker, Sarker, Sahaym & Bjørn-andersen 2012). These aspects tend not to be given high importance when adopting TAM as a theoretical framework for research. Researchers believe that to critically analyse these aspects for an ERP and ECM integration project, TAM will fail to give this research the depth needed to rigorously investigate such issues. Concerning the integration of ECM and ERP Medina (2014) introduced an ECM_ERP AP model which focused on integrating the financial management component being the accounts payable module in the SAP system. The ECM-ERP AP model was intended to assist in explaining a complex situation by breaking the process into nine different ECM activities requiring different ECM capabilities. It uses different colours to show which types of ECM systems are best suited of each of the nine different activities offering integration benefits for one component of ERP (ECM_ERP AP module was discussed further in section 2.5).

Some researchers on IS, ERP and ECM implementation brought a range of social organisational theories to explain and critically analyse the issues that are found during the integration of such systems. Theories such as Giddens's structuration theory and the actor network theory (ANT) have been cited particularly in IS and ERP implementation and integration literature (Jones & Karsten 2008; Lyytinen & Newman 2015). Giddens's structuration theory assumes that the structure and individuals are mutually constitutive of social order (Giddens 1984). Dualistic mutual participation of constituting the social norm between the structure and the individual cannot be separated (Jones & Karsten 2008). Giddens's structuration theory affirms that the social structures and the agent are interdependent where social structures invite interactions of agents where at the same time,

social structure is produced and reproduced through the interaction of individuals (Walsham & Han 1990).

Giddens's structuration introduces these concepts agency, structure, systems and structuration (Albano, Masino & Maggi 2010) in Table 1.1:

Table 1.1 Giddens Structuration (Walsham 1997)

Concepts	Description
Agency	The capability to make a difference to the world, i.e. to exercise some sort of power, reliant on knowledgeable, competent human actors
Structure(s)	Rules (routines, norms) and resources (material, authoritative), organised as properties of social systems
System(s)	Reproduced relations between actors or collectivities, organised as regular social practices; under modernity, plural and open
Structuration	Conditions governing the continuity or transmutation of structures, and therefore the reproduction of social systems

Giddens's structuration theory has been best described as being more of a metatheory (Walsham & Han 1990) where other theoretical approaches can contribute to expanding it to produce a more sufficient concept for analysing a setting or context (Walsham & Han 1990). In 1990, Giddens admitted that his structuration theory lacks the ability to carry out research with a clear conceptual approach, and then proposed that researchers should be inspired by the logic of the proposed framework to develop a context-specific methodological approach (Giddens 1991).

Giddens's structuration theory has been criticised for presuming high knowledgeability of all human agents while ignoring the consequences of unintended actions by human agents (Jones et al 2006). Giddens's structuration theory is also criticised because it tends to ignore the impact of technological artefacts on the structure and it is not clear where technology fits within the proposed structure. It does not explain the active way where technology and social structures mutually shape one another (DeSanctis & Poole 1994; Jones et al 2006). The focus of this research is to explore the active way in which technology (non-human) and social

structure (human) mutually influence each other to realise an integration of ERP into ECM to achieve an overall organisational objective. Giddens's structuration theory is not adopted based on these reasons. However, there have been attempts to propose a technology-related methodology better than Giddens's structuration theory such as DeSanctis and Poole (1994). Their theory was referred to as the Adaptive Structuration Theory (AST) based on Giddens's structuration theory with the ability to address the impact of technology in organisations. According to DeSanctis and Poole (1994), the strength of the AST is that it expands the nature of social structures within advanced information technologies and the key interaction processes that figure in their use. Capturing such processes and tracing their impacts can reveal the complexity of technology-organisation relationships. It enables the attainment of a better understanding of how to implement technologies. It also offers the ability to develop improved designs or educational programmes that promote productive adaptation.

Shifting away from Giddens's structuration theory, the AST pioneers identified technology as a viable artefact which directly influences the structure of an organisation by the interaction of users with those implementing. The AST postulates that structure is inscribed into technology (Rose & Jones 2005). Building the network of an organisation is achieved through the interaction of technology, users and those implementing (DeSanctis et al. 1994). The AST fails since structuration analysts unduly privilege human agency, causing "technology to vanish from their accounts, appearing only as an occasion for structuring, without any activity or specificity of its own". That being the case, the ANT addresses where AST has failed since it aims to understand the development and configuration of alternative heterogeneous networks of actors made up of both human and non-human actors that influence the development and stabilisation of forms of technology such as ERP and ECM integrated (Rose & Jones 2005). The next section unpacks ANT and its concepts that present its strength and usage of it as a theory.

1.2.1 Actor Network Theory

Borrowing from the IS field, one theory that relates to the objective of this study was Actor Network Theory (ANT) represented in Figure 1.1. Actor Network Theory describes the interaction between human and non-human actors as equals and its influence on the outcome of the process (Gregor 2006). The non-human actors are policies, documents, processes and

technology. These non-human agents, together with human agents, are considered actants (Haynes & Carroll 2010; Mitra & Mishra 2016; Ochara 2010; Truex, Holmström & Keil 2006).

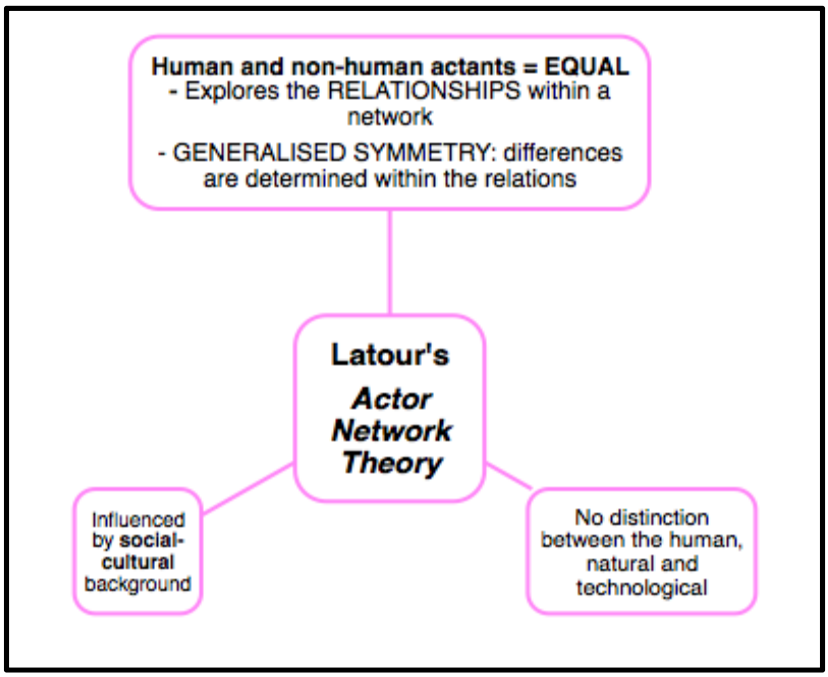

Figure 1. 1 Actor Network Theory (ANT) (Just Another ARTS2090 Blog 2014)

In the context of this research and noting the benefits of theory in information science research, theoretical framework is the only model in the absence of the integration theory in the literature review on integrating ERP into ECM or integrating ECM with ERP or with ERP. The ANT is the foundation of the theoretical application in this research with the application of practical ECM – ERP integration model (Medina 2014; Salamntu 2016). It was used to guide this study because it enables identification of the actors in the integration network that are important to achieve the ECM and ERP integration at Rand Water.

This being the case for this study, in searching the literature on articles related to ECM and ERP integration, it was noted that not much has been written. However, in his article, Van Rooij (2013) elaborated further on ECM integration with other systems, including lessons learnt from ERP implementation. The study by Salamntu (2016) explored understanding the achievement of benefits using ECM systems in public sector organisations. This research focused mainly on ECM and did mention ERP as it was not part of the study (Salamntu

2016:8). On the other hand, research by Kashmeery (2016) used the ANT in the ERP implementation study at MESAIR and did not include ECM. Leikums (2012) notes that the integration of ECM and ERP must be chosen because without integrating them, it is normally not possible to computerise and improve business processes in an organisation.

To further justify the adoption of ANT for this study, the integration capability of the ECM_ERP AP model is limited as it is only applied to the accounts payable module and not to the rest of the ERP modules. The second non-academic article focused on the benefits of Customer Relation Manager (CRM), ECM and ERP offered insights into the expected benefits or the consideration of potential benefits of using ECM or ERP or CRM[1] where the emphasis of integration is suggested for organisations using CRM, ECM and/or ERP. It is to be noted that in these articles, no direct discussion on the integration of ERP into ECM. Thus ANT in this study is appropriate to achieve the integration of ERP into ECM. In the next section, the ANT concepts are discussed in detail.

1.2.2 Actor Network Theory concepts

Orlikowski (2009) citing (Law & Callon, 1994:21) posits that the ANT involves a specific methodology for studying the 'co-evolution of socio-technical contexts and sociotechnical content'. The ANT is concerned with the performance between human and non-human actors and how they converge to sociotechnical heterogeneous networks of aligned interest (Effah 2012).

According to Walsham (1997), the ANT has its strengths and Table 1.2 represents the key elements of the theory as was developed by Law in 1992.

[1] (What is the benefit of using CRM, ERP or ECM systems for your business? 2014)

Table 1. 2 Key ANT concepts (Walsham 1997)

Concept	Description
Actor (or actant)	Are both human beings and non-human actors such as technological artefacts
Actor-network	Heterogeneous network of aligned interests, including people, organisations and standards
Enrolment and translation	Creating a body of allies, human and non-human, through a process of translating their interests to be aligned with the actor-network
Delegates and inscription	Delegates are actors who "stand in and speak **f**or" a specific viewpoint which have been inscribed on them, e.g. software as frozen organisational discourse
Irreversibility	The degree to which it is subsequently impossible to go back to a point where the alternative possibility exists
Black box	A frozen network element, often with properties of irreversibility
Immutable mobile	Network element with strong properties of irreversibility, and effects which transcend time and place, e.g. software standards

Actors (actants) as per description in Table 1.2 above are both human and non-human and can shape the other actors. The actor network is an association of humans and non-humans. There are three fundamental principles for the ANT as outlined by Callon (1986b):

- Agnosticism, i.e. impartiality of a researcher towards humans and non-humans.
- Generalised symmetry, i.e. researcher's commitment to treat humans and non-humans equally.
- Free association, i.e. eschewing separation between human and non-human (Effah 2012).

Researchers using the ANT account for both human and non-human actors while investigating them from the same viewpoint and treating them equally (Effah 2012). The actor network is a heterogeneous network of aligned interest as per in the table above; it includes people, organisations and standards (Effah 2012). The concept of enrolment and translation are mentioned as key concepts used to explain how heterogeneous actors are made to gather in the actor network influence by a different actor known as a focal actor. The inscription refers to embedding the interests and values of actors into technological artefacts and it can happen as part of translation (Effah 2012). It is crucial to expand on translation and problematisation, Table 1.3 presents the model and the description.

Table 1.3 Moments of Translation (Effah 2012)

Mode	Description
Problematisation	A focal actor identifies other actors and their interests, proposes an innovation network as 'obligatory passage point' (OPP) through which the actors can satisfy their interests. The focal actor also suggests actor network roles for them.
Interessement	The focal actor adopts various tactics and techniques to persuade the other actors to accept the innovation and the proposed roles.
Enrolment	Depending on the outcome of interessement, the focal actor coordinates the enrolment of actors who accept to join the network.
Mobilisation	If enough actors get enrolled, the network becomes stable. The enrolled actors also become spokespersons for the network, helping to enrol more actors.

Problematisation is the initial planning phase where a focal actor identifies the problems and interests of other potential actors. Actors propose an innovative solution to their problems and suggest roles for them to help develop innovative ideas. The focal actor does the following during interessement and enrolment phases:

- At interessement phase, the focal factor actor persuades the proposed actors to join the innovation and the assigned roles.
- At the enrolment phase, the focal actor negotiates with the actors who accepted their roles.

Mobilisation is where the network is established as the actors' interests are aligned. The enrolled actors continue to persuade more actors to join the network. According to Effah (2012), translation as being one of the key concepts in the ANT is therefore considered useful for studying complex information system process involving interactions between people, organisations and technology (Walsham 1997).

Johannesen, Erstad and Habib (2012) explain the black box key concept in the ANT as an actant such as physical artefact, a computer system, a human grouping or even a concept, which other actants relate to without requiring understanding or even being aware of its internal working. It is argued that successful networks of aligned interest are created through enrolment of an adequate body of allies and the translation of their interest with the willingness to be part of the thinking and acting, which ensures a maintained network. There is another key concept not listed in the table as an obligatory point of passage, which is explained as the actants that have evolved into being indispensable to the smooth functioning or the very existence of the network. These can be intermediaries between networks or mediating elements between network components as noted in Law & Callon (1992) (Johannesen et al 2012). The next section details the problem statement of this study that leads to some of the objectives, which are influenced by the actor network theory concepts.

It is to be noted that the ANT theory informed the objectives of this study in that it gave the lens to consider ERP integration into ECM from a non-human and human perspective to enable the formulation of a framework as the study topic suggests. The next section articulates the problem in the study.

1.3 Problem statement

There is a lack of integration of ERP into ECM in organisations that have invested in such enterprise systems (Van Rooij 2013). The lack of integration between ECM and ERP results in high costs, slow processing speed, increased storage, increased errors, late payments, reduced efficiency, reduced visibility, records duplication, different sources of correct records, multiple databases and folders on servers with corporate records and a lack of facilitated compliance. An ERP system as a transactional system has records linked to certain entries or transactions while ECM also might have records that are related to transactions in the ERP system but not integrated. That is a disadvantage since there might not be a correlation when records are stored in both or either of the systems (Nordheim & Päivärinta 2004; Malhotra & Temponi 2010; Alaskari, Ahmad, Dhafr & Pinedo-Cuenca 2012). The challenges of integrating the two enterprise systems cannot be ignored. The following are some of these challenges: requirements management, standardisation, data migration, interfacing, infrastructure, organisation, change management and management commitment. These

challenges of integrating ECM are comparable to those already learnt from the ERP implementations in different organisations (Van Rooij 2013).

In ECM evolution, there is a lot to be explored and combining this with the integration opportunity with the ERP brings much of a valuable research opportunity. It is also noted that the ERP integration into legacy systems (existing systems) remains a challenge, as is the case with ECM systems. It thus brings a challenge in integrating ERP into ECM systems (Van Rooij 2013). The absence of integration in ERP into ECM results in organisations losing out on the integration benefits as mentioned earlier: automation, added efficiency to repetitive business process, cost reduction and facilitation of rapid decision-making (Motwani et al 2005). There are other benefits such as reduced paper handling and reduced labour; reduced misplaced or lost invoices; reduced storage costs; increased processing speed; decreased errors (higher accuracy); fast, reliable, easy access to invoices using the familiar ERP user interface; on-time payments; more early payment discounts; and auditable business processes with more visibility, improving efficiency and facilitating regulatory compliance (Medina 2014).

At Rand Water, it was noted that although ECM and ERP solutions had been implemented, they remain not integrated and this justifies this research (Maraba 2017). It was also noted that the research of integration of ERP into ECM is still lacking (Leikums 2012; Van Rooij 2013) as not much was written in the literature about such implementations. In summary, in this research, it was noted that there is no framework for the integration of an ERP system into an ECM system in organisations (Van Rooij 2013). The ANT identifies the actors' network's objective, that is, to integrate ERP into ECM. The network is made up of actors which are human and non-human, with the influence of background (i.e. culture, structure, social and any element that can influence) (Orlikowski 2009). It remains to be the case at a water utility since ERP and ECM are implemented but are not integrated and full return on investment is not realised.

1.4 Purpose and objectives of the study

The main purpose of this study was to explore the integration of the ERP system into ECM at Rand Water, to develop a system integration framework that will ensure maximum productivity and efficiencies in operations. The specific objectives were to:

i. examine the effects of operating ERP and ECM independently at Rand Water.

ii. examine the value-add of integrating ERP into ECM at Rand Water.
iii. examining factors stimulating and inhibiting integration of ERP into ECM at Rand Water.
iv. determine the integration strategy for integrating ERP into ECM.
v. propose a framework for the integration of ERP into ECM at Rand Water**.**

1.5 Research questions

i. What are the effects of operating ERP and ECM independently?
ii. What is the value-add of integrating ERP into ECM at Rand Water?
iii. What are the stimulating and inhibiting factors for integrating ERP into ECM at Rand Water?
    a. What opportunities exist for integrating ERP and ECM at Rand Water?
    b. What are the obstacles to integrating ERP into ECM at Rand Water?
iv. What is the integration strategy for integrating ERP into ECM at Rand Water?
    a. What are the system resources for integrating ERP into ECM at Rand Water?
    b. What is the system architecture of the ERP and ECM at Rand Water?
    c. What are the compatibility and interoperability considerations for integrating ERP into ECM at Rand Water?
v. How can the Actor Network Theory (ANT) be utilised to propose a framework for the integration of ERP into ECM at Rand Water?

1.6 Justification of the study

Leedy and Ormrod (2014) mention that research is a problem that is unanswered in the mind of the researcher. These questions had something to do with the “why?” “what?” and “how?”. Ngulube (2003:20) also posits that studies are concerned with these three major questions. In line with these three questions, the current study is concerned about the question “how?” and attempts to find the answer to the how the part that relates to the integration of ERP into ECM.

This study was justifiable based on the discussion in section 1.4. Studies have been conducted about ECM and in this context considering electronic records/ content or electronic or content management to be in the same tone of electronic records systems from its revolution (Cook 2007), management (Katuu 2016), information science theory (Cibangu 2013), and

implementation (Katuu 2012; Mosweu 2016; Ngoepe 2015). Kashmeery (2016) conducted a study at PhD level where the ANT was applied to explore the benefits of ERP in airline industry, and Salamntu (2016) conducted a study to understand the ECM benefits in a public sector organisation, but neither of these studies addressed the integration of ERP into ECM.

Based on the relevant information collected thus far, there is a need to undertake this study to contribute to the theory and practice of ERP integration into ECM. Thus far this discussion considered the application of ERMS, lessons learnt from legacy issues when implementing ECM in comparison with ERP, the integration of ECM into ERP (accounts payable module), components using the ANT to understand how the human and non-human agents and the social aspects influence the success of integrating ERP into ECM at water utility organisation (Bayram, Özdemirci & Güvercin 2013; Medina 2014; Van Rooij 2013).

1.7 Importance of the study

Research in exploring the integration of ERP into ECM is relevant in that organisations have made investments in both systems (Rickenberg et al 2012). A study of the integration of ERP and ECM is justifiable due to the growing digital volume, which, in this research, is referred to as 'electronic content' while in some articles, it is referred to as 'enterprise content management', 'electronic document management' or 'records management' (Washington State Department of Transport, 2010; Katuu 2016; Ngoepe 2015). This study is important as there is no doubt that organisations with both ECM and ERP do not leverage the efficiency that could be realised if these were integrated. Research on this topic is rare, and much is needed over and above the lessons learnt from implementing ERP and the consideration of the legacy systems when implementing ECM. The integration of ERP into ECM is important to improve the organisation's enabling fast, reliable, on-time payments and auditable business processes where there is regulatory compliance. It is also for the management of records in ERP as it is not a records management system. Records from systems are important for auditing and finance (Bayram et al. 2013; Van Rooij 2013). The study will also contribute to the body of knowledge by using the ANT in the context of ERP and ECM systems.

1.8 Originality of the study

Doctoral studies are expected to provide an original contribution to knowledge in their field.

Baptista, Frick, Holley, Remmik, Tesch and Âkerlind (2015) posit that through doctoral studies, new knowledge might be generated or existing knowledge might be applied to result in a new understanding. Gill and Dolan (2015) agree that to address the issue of originality effectively, the student needs to establish what is unique about his or her study. It is also important that it is demonstrated in a scholarly manner to enable the research to add to the extent of the body of knowledge. It is also the interplay between old and new knowledge and practices in some way.

Given some studies, for example, Kalusopa, Mosweu and Bayane (2017) and AF02, AF03, AF04 and AF05 completed under the InterPARES trust, there was a lack of integration or little integration in the existing ECM and ERP implementations. These studies did not propose an approach for integrating ERP into ECM. Thus, in the absence of a study that fully proposes the approach to or framework for integrating ERP into ECM, it offers the researcher an avenue to explore this area of study.

It is, therefore, the intention of this study to add new knowledge to the integration management of ERP into ECM in the water services sector. Furthermore, the study applies the ANT to explore how the human and non-human actors collaborate to a successfully integrated ECM-ERP system. The research study proposes the design of an integration framework that would improve productivity and operational efficiencies. Rand Water will benefit in terms of the reduction of cost, duplication of work, simplified workflow, improved productivity, improved efficiency, visibility and compliance.

1.9 Scope and delimitation of the study

This study was limited to Rand Water. Rand Water was chosen because it has implemented both ERP and ECM which lack integration to achieve high operational efficiency. This organisation's rich history of electronic records management and enterprise systems (ECM and ERP) made it a suitable candidate. The study was limited to one organisation as a case study in which to explore the integration of ERP into ECM using the actor network theory. Integration with other systems such as SharePoint and CRM in the organisation were excluded in this study. It is also noted that organisations might have different flavours of ERP and ECM; however, the operational architecture is what would be considered had other sectors and organisations considered the proposed framework. The research findings were not to be

conclusive for all environments but only for the candidate organisation or similar organisations. The proposed framework cannot be generalised for all organisations unless assumptions in this research apply to the candidate organisation.

1.10 Definition of key terms

The key terms and concepts for this study include: enterprise resource planning, electronic content management and electronic records management. These key terms are explained in this section to provide the context in which they were used.

1.10.1 Enterprise resource planning

Enterprise resource planning is a comprehensive, packaged software solution that seeks to integrate the complete range of business processes and functions to present a holistic view of the business from a single information and IT architecture (Chen, Wang, Wei, Ren, Shao & Li 2013). The breadth and tight integration of ERP have only become available in current years, as now ERP has a pedigree in large, packaged applications software that has been widely in use since the 1970s (Klaus, Rosemann & Gable 2000). ERP is a business management software system that allows an organisation to use a system of integrated applications to manage the business (Al-Mashari et al 2003). ERP is also defined as a software system for business management that covers modules that support functional areas such as planning, manufacturing, sales, marketing, distribution, accounting, financial, human resource management, project management, inventory management, service and maintenance, transportation and e-business (Rashid, Hossain & Patrick 2002).

This study adopted the definition of ERP as per Rashid et al (2002), as an ERP is also defined as a software system for business management that covers modules that support functional areas such as planning, manufacturing, sales, marketing, distribution, accounting, financial, human resource management, project management, inventory management, service and maintenance, transportation and e-business.

1.10.2 Electronic content management

Electronic content management is the transition from paper to computer (Nelen 2009). The electronic content services can present information using different information technologies (Trappey & Trappey 2004). ECM involves integrating systems, storage, databases, applications like email, data capture, e-discovery, tools such as search, and the provision of services to manage electronic content in a full life cycle manner (Vellante 2006). It is further explicated as a system, method and processes for capturing, creating, managing, using, publishing, storing, preserving, and disposing of electronic content within and between organisations (Ngoepe 2015). The electronic content services can present information using different information technologies. Some of the benefits of ECM use are: central repository, content indexing and full text searchable, manage access privilege, content auditing, system taxonomies, version control, document retention and generation of usage reports and statistics on documents (Chief Engineer 2010).

The term Enterprise content management was introduced in 2001 by the Association for Information and Image Management (AIIM) and it is well adopted by vendors, users and analysts in the industry (Kunstová 2010). ECM is defined as "the strategies, tools, processes and skills that an organisation requires to manage all its information assets regardless of the type of their lifecycle" (Alalwan 2013:297). It is further explicated as an application with strategies, methods and tools used to capture, manage, store, preserve and deliver content and documents related to organisational processes (Katuu 2016).

This study adopted the ECM definition as per Ngoepe (2015), explicated as a system, method and processes for capturing, creating, managing, using, publishing, storing, preserving, and disposing of electronic content within and between organisations.

1.11 Literature review

The literature review offers the reader an understanding of the concepts being discussed and the background to the discussion in the study. As suggested by Neuman (1997), doing a literature review offers a focus on a topic into a researchable question. According to Mouton (2001), the literature review aims to find out what has been done in the field of study while learning from other scholars how they theorised and conceptualised on the topic. It also offers

an understanding of what was found empirically, instruments used and the effect thereof. In summation, the most recent, credible and relevant scholarly developments are crucial when conducting a literature review (Mouton 2001). The following themes guided the literature review and were discussed in detail in Chapter Two: effects of operating ERP and ECM independently, the value-add of integrating ERP into ECM, examining the stimulating and inhibiting factors in integration of ERP into ECM and integration strategy for integrating ERP into ECM.

1.12 Research methodology

The research methodology provides an explanation of how and when the research is executed and it provides reasons why a specific method of data collection, the material utilised, or interviewees in this study are used (Jabar, Kao, Liu, Lin, Orso & Rothermel 2014). To propose a framework that can be followed to integrate ERP into ECM at Rand Water in applying the ANT, a qualitative single case study was used. To gather data, interviews were conducted with employees at different levels of operation in the organisation. Document analysis and system analysis were also used for data collection.

The sample data were purposively chosen. The population would be qualifying Rand Water employees in different areas (finance, IT, procurement, project management, auditing, human resources, records management), levels (executive, general manager, senior management, middle management, technical specialists, and operations) and roles in the leading, managing, operating and administering ERP and ECM systems. Data collected were analysed using NVIVO software to formulate themes of the study emanating from the research objectives guided by the ANT. Data were augmented through analysis of documents such as Rand Water annual reports, legislative and regulatory requirements and ERP, ECM system documents and Rand Water records management policies. A comprehensive discussion of the research methodology employed in the current study is presented in Chapter Three.

1.13 Structure of the thesis

The thesis is structured in six chapters as follows:

- **Chapter One – Introduction and background to the study**

This chapter introduces the study of integrating ERP into ECM at the water utility and the background to justify the importance of the study. Terminology is also introduced and is followed by the research question, aim and objectives. After this, the research context, motivation and boundaries follow in the discussion.

- **Chapter Two – Literature review**

This chapter focuses on literature review where the topic on the ERP integration into ERP is explored in the literature to give the reader the background about the ERP-ECM integration phenomenon guided by the theory and reference model chosen for this study. The background of the theory and the framework to be used in the study to contribute to the body of knowledge is discussed. It further explores what has already been written about the study and what are the latest developments in research along with the proposed research topic.

- **Chapter Three – Research methodology**

This chapter provides the reader with the research methodologies that were adopted for this study. It includes explaining the variety of research methods and techniques that were used in conducting this study. The chapter proceeds to identify and justify the ontological approach that was adopted for this study. Identifying and justifying the epistemological paradigm that was adopted for this study follows in the discussion after the ontological approach. The chapter further explains how this research is to be approached. The chapter continues by justifying the research reliability and validity followed by describing the techniques that were used to collect data.

- **Chapter Four – Presentation of data**

This chapter provides a thematic analysis of the results in relation to the integration of ERP into ECM at Rand Water. The case study was on the exploration of the ERP and ECM systems in the organisation. The researcher explained thoroughly the most relevant challenges that would serve this research objectively. This chapter mainly reviews the two enterprise systems, the social aspect and the human agents involved in line with the business process adopted. The obstacles and opportunities are brought to the surface with the proposition of a potential

framework. The results of data collection via interviews, archival records and documents are also analysed and presented.

- **Chapter Five – Interpretation and discussion of findings**

This chapter provides a discussion of the findings that offer a broader interpretation of the results.

- **Chapter Six – Summary, conclusions and recommendations**

This chapter serves as a synthesis, a summary of each chapter, including a summary of the results, as well as the conclusion regarding the problem postulation and the aim of the study, proving that they have been honoured. It provides the reader with the research findings that were extracted from the data analysis. Finally, some well-justified recommendations for the future were provided.

1.14 Summary

This chapter puts the discussion into perspective by providing the introduction or background of the study, context setting, framework of the study, the problem statement and sub-problems, the aim of the investigation, description of the methods of investigation, the justification of the investigation and definition of concepts. The next chapter reviews the literature to understand the ERP, ECM, integration and their role in the organisation's efficiency of ERP integrated into content management.

CHAPTER TWO
LITERATURE REVIEW

2.1 Introduction

The previous chapter set the scene by providing the background to the study, context and conceptual setting, theoretical framework, problem statement, research objectives and questions, justification of the study, research methodology, as well as the definition of key terms. The presentation of the background and the purpose of the study in the previous chapter leads to the literature review in this chapter where the previous studies and the latest developments in ERP-ECM integration are discussed. This was guided by the ANT from which the objectives of the study were phrased. The existence of ECM and ERP in global and African organisations justifies research to explore the integration capability of these enterprise systems. There was a research gap around this topic and the literature confirms that the topic was of importance as was well noted in section 1.4 (Brocke et al 2011; Medina 2014; Petty, Huckins & David 2002; Salamntu 2016; Salamntu & Seymour 2015).

A framework for integrating ERP into ECM would be of great benefit to both the industry and academic settings. In summation of Rand Water, it is noted to be among the agencies that implemented digital records management. It was an early adopter of digital records management as early as 1991. It has a rich historical background on digital records system evolution (Ngoepe 2017). Rand Water as a water utility in South Africa can be justified to be a suitable candidate for integrating ERP into ECM since the organisation has ERP and ECM implemented but not fully integrated to ensure full benefit from the two systems (Maraba 2017; Medina 2014; Mohamed 2015; Van Rooij 2013). Themes for the literature review emanate from the objectives of the study. These are: Effects of operating ERP and ECM independently, value-add of integrating ERP into ECM, factors stimulating and inhibiting integration of ERP into ECM, integration strategy for integrating ERP into ECM.

Literature review offers the reader an understanding of the concepts being discussed and the background to the discussion in the study. As suggested by Neuman (1997), doing a literature review offers a focus on a topic into a researchable question. According to Mouton (2001), the literature review aims to find out what has been done in the field of study while learning from other scholars how they theorised and conceptualised on the topic. It also offers an

understanding of what was found empirically, instruments used and the effect thereof. In summation, the most recent, credible and relevant scholarly developments are crucial when conducting a literature review (Mouton 2001). This chapter is guided by the theoretical framework based on the ANT as introduced in section 1.2 and the research objective in section 1.4. It also provides the reader with the necessary background knowledge of ERP and ECM as well as a review of the literature on ERP and ECM integration to understand the opportunities and challenges highlighted by in the latest literature.

2.2 Effects of operating ERP and ECM independently

The ANT concept of translation introduces this objective with four moments of translation as problematisation, interessement, enrolment and mobilisation, which offer a detailed expansion of the objective in the discussion (Stanforth 2007). The problematisation phase focuses on articulating the problem and the role of the actors in the study (Effah 2012). In the context of this study as in section 1.4, the problem was identified as the lack of integration of ERP into ECM, which results in high costs, slow processing speed, increased storage increased errors, late payments, reduced efficiency, reduced visibility, records duplication, different sources of correct records, multiple databases and folders on servers with corporate records and lack of facilitated compliance. The discussion on the problem in line with the context of this objective was expanded by the discussion of the differences of ERP and ECM, challenges in ERP and ECM, and operation of ERP independent of ERP and ECM.

The interessement phase is where actors and actants are part of the business and strategic objectives. In the context of this study, the discussion focussed on the stimulating and inhibiting factors for ERP and ECM. The discussion touches on the global actors who adopt various tactics and techniques to try and persuade the other actors to accept the innovation and the proposed roles (Effah 2012). The stimulating and inhibiting factors were detailed in section 2.4. Enrolment was another translation moment where principal actors define the roles that are being contributed and the way in which the other actors interacted and related to another in the integration network of ERP and ECM. The global actor coordinates the enrolment of actors who accepted to join the network (Effah 2012). Hyvönen, Järvinen and Pellinen (2008) identify network as an item that captures the interaction between various actors as a sequence of transformation and translations. It is their opinion following Latour (1999: 17) that ANT focuses on a movement and refers to network sum up interactions through different kinds

‘devices, inscriptions, forms and formulae, into a very local, very practical, very tiny locus’. The word network means alignment of interest including people being human actors, organizations and standards being non-human actors. It can also be referred to as an alignment of actors to achieve a specific objective. In the context of this study, the network’s objective is to achieve the integration of ERP into ECM. The last translation moment is referred to as mobilisation, this happens when enough actors have enrolled in the network and has become stable. It is also at mobilisation that the network is established as the actor’s interest gets aligned. Practically, this means enrolled actors themselves become proxies and urging more actors to join the network (Effah 2012). When the actors are enrolled, they are offered an opportune time to become super actors as initially referred to as ‘super actor’, which mainly enrol more actors for the network. In the context of this study, the network is the integration of ERP into ECM. The discussion in the later section intends to expand on operating the ERP and ECM and exposing the limitations of running them independently. The discussion commences by first giving an introduction and the evolution of each concept, thereby looking at the implementation challenges leading to the stimulating and inhibiting factors.

Furthermore, it was important to introduce the ERP concept and its evolution to find a deeper understanding of how it came about. This section discusses the effects of operating an ERP system as an enterprise system but independent of other systems and applications in the organisation, which is the first objective of the research. The ANT aligns this objective to understanding the actants or actors in the operation of the ERP system and applying the translation concept (Walsham 1997). To be able to fully address the independence of operating ERP and ECM, it is important to explore the background of both to build a foundation for this discussion. The evolution of ERP involved organisations, industries, methods of planning, scheduling structure, technology, cost and operational activities, to mention just a few. The introduction of the concept in review of its history and influences its development to introduce the problematisation discussion (Grant, Hwang & Tu 2013; Jacobs & Weston 2007; Ram, Corkindale & Wu 2014).

2.2.1 Evolution of ERP and ECM

The problematisation moment in the context of this study is introduced as part of reviewing the evolution of ERP as an actant. In the review of its evolution, it is noted that ERP development goes as far back as the 1960s (Jacobs & Weston 2007). It is important in this

study to appreciate the beginning of the ERP and ECM, which goes as far back as 1985 (Kunstová 2010). The ERP concept was built through the drive to improve productivity. Rashid et al (2002) note that the concept was born through the joint efforts of JI Case, a manufacturer of tractors and other construction machines who partnered with IBM (Jacobs & Weston 2007). According to Jacobs and Weston (2007), the primary competitive force was cost. To achieve this, companies had to be product-focused manufacturers with a strategy of high-volume production and cost minimisation, which assumed stable economic conditions. In the 1960s, as per the observation of Jacob and Weston (2007), ERP evolved from an inventory management system and control, which are a combination of information technology and business processes, to a system of ensuring the maintenance of the appropriate level of stock in a warehouse. Mahrami and Hakro (2018) opined that manufacturing resource planning (MRP) and manufacturing resource planning two (MRP2) were mainly beneficial to the manufacturing sector and that its benefits did not extend to other sectors. To provide a more integrated approach from which other sectors could benefit, ERP was developed in the 1990s as multifaceted software that would steadily extend its scope to other areas, such as human resources, finance, marketing, operations, projects and customer relations management. It uses multi-module application software for improving the performance of internal business processes.

The major benefit of ERP is that it integrates business activities across functional departments. These activities can range from product planning, parts purchasing, inventory control, product distribution and fulfilment to order tracking. This may include application modules for supporting marketing, finance, accounting and human resources (Chang, Cheung, Cheng & Yeung 2008; Helo 2008; Malhotra & Temponi 2010; Mahrami et al 2018). Companies seeking a competitive advantage over others drove the development from MRP to MRPII and then to ERP. From the discussion in this study, it was clear that it had an influence from the 1960s, 1970s, 1980s, 1990s to the 2000s. Briefly, in the 1960s it was about early computers, reorder point (ROP) systems and early material requirements (MRP). In the 1970s it was about MRP, computer hardware and software developments such as SAP, JD Edwards, Oracle and Baan. The 1980s saw the coining of MRP II to identify the newer system's capabilities. In the same period there was an emergence of quality such as Deming, Juran, Crosby, Ishikawa and others. It was in the 1990s when there were enhancement of MRP II and early ERP systems that were hoped to address the Y2K anticipated problem. The 2000s saw a consolidation of software vendors, PeopleSoft and J.D. Edwards merging into Oracle resulting in leaving the industry

with two major players (i.e. Oracle and SAP) (Jacobs & Weston 2007). ERP evolved as driven by business demands in trying to find value (Ram & Swatman 2008). As mentioned at the beginning of this chapter, the aim was to report on the developments in ERP as part of ICT development. The discussion of development also covered the evolution of ICT in general. Its development dates back to the 1950s compared to ERP, which dates back to the 1960s. ERP development was driven by competitive forces such as cost, marketing, quality and Y2K. It moved from an inventory management system to MRP, then to MPRII and to an ERP. Table 2.1 presents the evolution of ERP 1 from the 1960s to the present day.

Table 2.1 Evolution of ERP

1960s	1970s	1980s	1990s	2000s
Inventory management system	MRP	MRPII	ERP	ERP maturing

ERP evolution gave a broader understanding of how the concept came about as well as the motivation and drive for organisations to adopt this enterprise system with the integration capabilities for high productivity and efficiency (Mahrami & Hakro 2018). Implementation challenges are inherent in ERP systems as correct deployment was key to ensure success (Mandal & Gunasekaran 2003).

As is the case with any system practice, organisational content in any form and shape needs to be managed. According to Kunstová (2010), the volumes of electronic documents, e-mails, faxes, web presentations, rich media, forms and other unstructured content justify the need to have this content managed. To ensure efficiency in searching for documents and other activities on contents with an objective, it is important that organisations have control over all the unstructured content they happen to produce or receive. In the same article, an enterprise content management system is defined as a system to manage large volumes of unstructured information and to enable accessibility of content. ECM as a term was introduced by the AIIM in 2001 (Kunstová 2010). Electronic content management (ECM) is defined as a transition of paper to computer, its history rests of the evolution of enterprise content management (ECM) since it is a system, method and processes for capturing, creating, managing, storing, preserving, and disposing of electronic content (Nelen 2009; Ngoepe 2015). Katuu (2012) has

also captured the evolution of ECM and he is of the view that this term competes with others such as integrated document management software (IDMS), electronic document management systems (EDMS), electronic document and records management systems (EDRMS) and electronic records management systems (ERMS). In a study by Kunstová (2010) it is indicated that the evolution of ECM started in 1985 with the imaging, data capturing, and document management collaboration tools, and in 1995 archiving was added. With the web content management introduced in 2000, the aforementioned together with knowledge management, digital asset management, e-mail management and records management have been building blocks of ECM beyond 2001 (Kunstová 2010).

The previous chapter was captured in Figure 2.2 and capabilities including capture, store, index search, share collaborate, process manage, publish, reuse, record archive and more. Katuu (2012) expands on ECM further by including other modules such as portal, document management, web content management, digital rights management, digital asset management, knowledge management, workflow and those in Figure 2.2. It was also noted that although ECM evolution was not as old as that of ERP, it also comes with its implementation challenges. According to Salamntu and Seymour (2015), the first study of ECM that used ECM in the context of South Africa focusing on ECM with local government was done in 2001. This study revealed that although ECM was operational and accessible, staff members were challenged. This challenge brought about an opportunity in 2006 for the establishment of policies and procedures to guide the management of electronic records. They further opine that reviewing the growth and maturing of ECM from 2001 to 2011, several new journals were published which focused on the use of ECM, implementation and the benefits of ECM. Kunstová (2010) points to the prediction by Gartner that the world-wide ECM software market was to grow more than 12% per year through 2010 and that ECM investment is deemed to be a positive trajectory in the long term. It was also observed that the implementation of ECM is not always successful. Based on the evolution of ERP and ECM, ERP has an older history than ECM. Based on the discussion thus far, ERP and ECM developments and their intended purpose were not in synch and were independent of each as was discussed above. ERP focused on transactional activity while ECM mainly focused on management of documents. It therefore remains a requirement that the two be integrated to realise efficiency and improved productivity. The differences between ERP and ECM are discussed in the next section to build towards the effects of operating ERP independently. In the problematisation phase of

translation state of the ANT, the discussion on the differences between ERP and ECM forms a solid resource in understanding the attributes of the actors in the integration network.

2.2.2 Differences between ERP and ECM

Information communication and technology (ICT) has evolved to the level at which it is today over a few decades. As mentioned in section 1.1 of this study, ERP is a business management software that allows an organisation to use a system of integrated applications to manage the business (Al-Mashari et al 2003). ECM, on the other hand, is the integrated applications from an actor network in the context of this study (Stanforth 2007). ERP was an actant designed to integrate and optimise business processes and transactions in an organisation. Moon (2007) suggests that ERP has become a business system or solution that is accepted and used globally by organisations to achieve an integrated enterprise business system. Al Mahrami and Hakro (2018) further agree that ERP is one of the smart systems in the business because it improves efficiency and operations.

Figure 2. 1 Enterprise Resource Planning modules[2] (Bi Smart Solutions (2015))

When also considering ECM, it was noted that according to Nelen (2009), ECM is the transition from paper to computer, brought about by the advent of ECM. As defined in the previous chapter, in its introduction ECM is generally known as enterprise content management due to its definition and usage. ECM as a term was introduced in 2001 by the Association for Information and Image Management (AIIM) and now is well adopted by vendors, users and analysts in the industry. Salamntu (2016) noted that ECM as an evolving concept. It has several definitions by several authors according to Grahlmann et al (2011). They consider it as a technology with a platform that houses the unstructured content to have information in a fitting format to multiple enterprise application while the other deems it to be a web-based system to manage a large number of electronic documents. In the context of this study, ECM refers to an electronic content management system. Enterprise content management is defined as the strategies, methods and tools to create or capture, manage, store, secure, preserve, secure/ retain/ destroy, publish/ distribute, search, personalise and present digital content. Figure 2.2 represents the ECM as per the ECM image on CM Mitchell Consulting' website:

[2] Representation of ERP modules from Bi Smart Solutions website http://bismartsolutions.com/wp-content/uploads/2016/01/what-is-erp.jpg

Figure 2. 2 ECM functionalities (C.M. Mitchell Consulting 2018)

Rashid et al (2002) give a timeline of ERP evolution to understand how the ERP system concept came about. To enrich the discussion, it would be beneficial to discuss the challenges in ERP and ECM implementation.

2.2.3 Challenges in ERP and ECM implementation

The challenges in this context related to ERP and ECM implementation. In the context of the ANT concepts, challenges in implementing ERP and ECM link to the interessement phase where actors and actants influence the actor network for the integration of ERP into ECM (Effah 2012). These are discussed further in this section.

Vilpola (2009) posits that ERP implementation comes with challenges that the organisation cannot afford to ignore when considering the impact and the cost it brings to the organisation. In some cases, integrative frameworks are proposed for successful implementation. Being a social-technical challenge, Al-Mudimigh et al (2001) argue that it would require different perspectives and levels (such as strategic, tactical and operational). Thus, it is important to ensure that ERP implementation projects are a success since they do not come at a cheaper price but with a huge impact on organisational operations. Surfing through literature, it is

understood that several ERP implementation projects have failed in the past due to not meeting the business objective (Stefanou 2001). It is also noted that the failure of ERP implementation has a considerable impact on the time and investment that would have been lost as well. Given the investment in just over a decade, it was estimated that an amount of $500 billion was invested in the ERP systems world-wide (Addo-Tenkorang & Helo 2011). Sharma and Rana (2013a) indicate that to some organisations ERP implementation may be the biggest investment relative to its business focus. It is noted that for thorough implementation of an ERP to be a successful project, several approaches are suggested. Given the value of an investment, Ram et al (2014) observe that organisations require a collective effort and collaboration to ensure that deciding to go for ERP implementation is well thought through, based on its return on investment as well as the challenges it brings.

In contrast to the notion that ERP comes with an improvement in efficiency in organisations, the opposite is also true if ERP is not deployed correctly (Mandal & Gunasekaran 2003). Chang et al (2008) deem ERP implementation to be difficult and complex. Added to this difficulty and complexity, other obstacles can be technical problems and people obstacles considered as major obstructions (Chang et al 2008). These obstacles as mentioned are actors that are both human and non-human in the context of this study (Mitra & Mishra 2016). Ngai et al (2008) consider that incorrect deployment of ERP can bring more problems to the organisation such as poor communication, lack of support from management, limited level of user involvement and poor training from vendors. It is therefore critical that ERP deployments are executed with knowledge and skill. Such an approach improves the chances of achieving the set business objective. Ngai et al (2008) further acknowledge that ERP deployment can sometimes be expensive and risky. According to Galy and Sauceda (2014), business could lose revenue due to incorrect deployment of ERP (Chang et al 2008; Galy & Sauceda 2014). Basoglu et al (2007) posit that, in some instances, about three quarters of the ERP implementation projects were not successful and 90% of the projects went over the planned budget or have gone over the allocated period of implementation. Statistics from a Standish report on ERP implementation illuminate the problem further since it points to projects that are on average 178% over budget, have taken 2.5 times longer than planned and only delivered 30% of the anticipated benefits (Basoglu et al 2007). Nofal and Yusof (2016) also state that in the studies they reviewed that 50% to 80% of ERP implementations were unsuccessful. Chauhan, Dwivedi and Sherry (2012) also report that the conference board survey interviewed executives in 117 companies that

attempted ERP implementation and 40% of those projects failed to achieve their business case within one year of going live**.**

Mandal & Gunasekaran (2003) posit that it is only prudent for organisations to invest a bit of planning when embarking on such an endeavour if it is to realise the benefits of ERP deployment (Mandal & Gunasekaran 2003). In some instances, the organisational objective in deploying ERP is mainly to reduce the cost and to manage their data in real time to ensure that they remain competitive (Basoglu et al 2007; Chauhan et al 2012; Lim, Kow, Mahdzir & Abu Baker 2016). According to Mitra & Mishra (2016), some studies on the critical success factors of ERP implementation have also emphasised several behavioural factors such as employee training, teamwork, and user expectation.

Pertaining to the ECM implementation life cycle by AIIM, it has been widely used by organisations in a customised manner and approach. The AIIM approach has 12 steps to a complete ECM implementation (Kwatsha 2010). According to Katuu (2012), the implementation of ECM differs in terms of the modules' implementation. In view of the listed modules in Figure 2.1, not all modules are implemented and integrated into the ECM rollout in organisations. In the African context, South Africa's ECM implementation is the most advanced comparatively speaking, according to Kealoha (2006) and Kemon (2009), as referenced by Katuu (2012). Katuu (2012) further notes that most common ECM modules implemented in South Africa are Document and Records Management, Workflow or Business Process Management. In observation of organisations running ECM, it was found that only one organisation ran Collaboration, Knowledge Management and Digital Asset Management. The observation of installed ECM modules excluded Web Content Management, Digital Rights Management and Portal, as none of the organisations had them installed.

Challenges are as common in ECM system project implementation as in ERP project implementation. Kunstová (2010) concedes that it is possible to have an unsuccessful implementation of ECM, which could be accredited to the discouragement of organisations to implement the solution. In some instances, the implementation of ECM is deemed just as challenging as ERP as they both have stimulating factors required to assist in improving the chances of success (Van Rooij 2013). Kunstová (2010) has identified some of the most crucial barriers to investment in ECM in Czechoslovakia such as, lack of resources (finance,

technology and personnel); difficult argument of return on investment; and lack of understanding the benefits of innovation in ECM and project risk.

Katuu (2012) posits that although South African institutions had eight years of ECM implementation experience, they still only had records management, document management and imaging installed and not much on electronic document and records management. This observation by Katuu (2012) proposed a further study on the assessment of propriety vs non-propriety applications. To respond to this, Ngoepe (2015) conducted a study of the deployment of free and open source software (FOSS) ECM in national government departments in South Africa. FOSS was defined in principle as a software, the underlying source code of which was open and available for others to access and review. The users of FOSS can copy the source code, study its inner workings and customise it to suit their expectations. It means that the original source code of the FOSS could be edited or radically changed or enhanced to perform functions that are different from its initial intended purpose. The rationale behind FOSS is mainly for collaboration and co-creation (Weilbach 2013). In this study, it was noted that there was low usage of FOSS as opposed to propriety in ECM implementation. The reasons for a low uptake are lack of skills by records management practitioners and the failure to raise awareness and benefits of FOSS policy in South Africa. Weilbach (2013) further notes the existence of internal politics such as IT taking a lead while records professionals are spectators, although ECM falls within their competency and IT is merely an enabler. According to Ngoepe (2015), this explains why SITA took the lead in Alfresco implementation while NARS took the back seat.

Furthermore, Hullavarad et al (2015), posit that while ECM enables organisations to cope with the complexity of data, it is not without challenges. It is also important to note that some challenges are due to incompatibility between the ECM platform and the existing applications/ systems used in the daily operations, such as editing documents, storing data files, searching, and electronic record fabrication and preservation tools. Some challenges can lead to the ECM implementation project failing, and some are identified as related to poor needs assessment that does not include a broad stakeholder pool, lack of a good deployment plan, ineffective or lack of change management and lack of executive support (Hullavarad et al 2015; Katuu 2012). Another issue as opined by Salamntu (2016), is that organisations are not benefiting from ECM implementations due to a lack of a practitioner's guide in consideration of different business processes or the consolidation framework of systems and database into an ECM framework.

Van Rooij (2013) observed that there are challenges to ERP implementation and highlights the main challenge as integration. The following are the challenges highlighted in this article:

i. Requirements management – this requires knowledge of the current business practice. It could evolve and customisation is required.
ii. Standardisation – this is not only technology; it is also first and foremost, organisational. In standardisation issues, time and cost involved become clear during implementation.
iii. Data migration – these issues can cause the organisation to incur a large and unanticipated cost when considering time, money and capacity.
iv. Interfacing – like ERP and ECM can only replace a subset of the legacy IT landscape. It can also bring in costs that are difficult to anticipate.
v. Infrastructure – it is noted that IT infrastructure represents a different set of systems that are connected in a complicated connection. Implementation of ECM invokes increased requirements such as bandwidth, additional storage and other additional requirements to ensure adequate performance. It has proven to be more difficult to plan and control.
vi. Organisation – implementation introduces reorganisation of responsibilities in line with roles, powers and segregation of duties.
vii. Change management – it is normally considered a soft requirement and at times, it is not taken seriously or is taken as an afterthought.
viii. Management commitment – it is typically lower than desired, mostly motivated by short-term benefits. Their commitment cannot be guaranteed and this results in governance that suffers and increased costs.

Van Rooij (2013) further explicates that the risks associated with ECM implementation are more than those associated with ERP due to its wider scope. Miles (2010) highlights that implementation challenges experienced when connecting ERP and ECM are caused by a mismatch of metadata standards between the systems, more so in the linking taxonomy-led systems such as ECM. Haug (2012) is of the opinion that implementation of ECM systems is not an easy task as is testament by the many failed ECM projects as a result of budget cuts, business swings, management changes and the end user adoption. Nwankpa (2015) agrees that some businesses do achieve operational efficiencies and other positive changes through the implementation of ERP. On the other hand, in the same article it is noted that although firms invest in ERP with an eagerness to translate it into organisational success, they are left with the difficulty of translating pre-deployment expectations into actual ERP success.

2.2.4 Independent operation of ERP and ECM in an organisation

The discussion on the independent operation of ERP and ECM assists in unpacking the impact of not integrating the two enterprise systems. It was also noted that the human and non-human role players in the operation of these systems also have a role to play in the independent operation of ERP and ECM in an organisation. Organisations invest in ERP to achieve integration in business operations because as mentioned earlier, it is an enterprise system for business management with modules such as sales, finance, human resources, project management, logistics and marketing, to mention a few (Rashid et al 2002). Mitra and Mishra (2016) agree that the introduction of ERP implies business process impact on the business to ensure competitive organisational results. While according to Hullavarad, O'Hare and Roy (2015), ECM can help an organisation improve customer service, streamline processes, enhance employee productivity, track information compliance with regulations, eliminate unneeded information on servers and filing cabinets while ensuring that business continuity is in place. In consideration of the ANT, to achieve these benefits, actors would be directly and indirectly involved in the form of being human or non-human having some social influence or even contributing to the organisation's operations (Orlikowski 2009).

In a study by Gattiker and Goodhue (2005) interdependence was considered as key in SAP integration advantage while the differentiation of the sub-unit differs from other organisational sub-units. They posit that in the case where the sub-unit requires unique, nonstandard systems to cope with its circumstances due to possible poor fit between ERP and the business conditions, the imposed standard processes are not applicable (Gattiker & Goodhue 2005). In the same article, they note that misfit of ERP and the plant's unique business processes are considered as serious problems resulting in misalignments which lead to the concept of differentiation. Arguing that differentiation moderates the degree to a level where the benefits of ERP are still realised, Gattiker and Goodhue (2005) still point to the integration of ERP to a customised level (Gattiker & Goodhue 2005). In contrast to operating ECM independently, there are benefits to integrating ECM into other enterprise systems. It is less beneficial to operate ECM independent of other enterprise systems such as ERP in the context of this discussion (Vom Brocke et al. 2011). Ngoepe (2017) acknowledges that technology has changed the landscape of digital records. Katuu (2016) suggests that managing digital records in government entities remains a challenge, while Mohamed (2015) argues that integration of ERP core functions and activities facilitates rapid decision-making, cost reduction and greater

managerial control. Herbst, Simons and Vom Brocke (2014) agree that ECM is a significant enabler of information management since it supports the creation, storage, retrieval, and retention processes of organisational documents and their content in an organisation. Operation of ERP can be beneficial to an organisation, as can be with ECM, based on the views of Mohamed (2015) and Herbst et al (2014). As initially mentioned in the previous chapter, integration of ERP into ECM can also bring benefits, therefore there is value in enabling integration. Taking into consideration the challenges and the benefits listed thus far, there were some attempts from the ERP vendors as well as the academic fraternity to understand factors that could contribute to ERP and ECM failures and how to achieve the business objective with the ERP implementations. The failure to meet business objectives that relates to efficiency of business processes and improved productivity can be attributed to also operating ERP and ECM independently based on the discussion thus far.

Furthermore, the effects of operating ERP independently were not directly implied in the article by Mahrami and Hakro (2018) when referring to ERP as a smart enterprise system. It was worth articulating them to understand its impact on the value and the drive of ERP as an enterprise system. As for ECM, Iverson and Burkart (2007) attribute the efficiency for document search and retrieval to ECM design that avoids keeping information in separate silos through centralising storage and retrieval. The application referred to in the article was the records management where reuse of content was deemed to be saving time and money, while reusable information from the structured documents are key to automating data entry enabling the creation of a web portal and systems of records management without specifying the system where these documents are from (Kunstová 2010).

As much as Shehab, Sharp, Supramaniam and Spedding (2004) agree with the business integration of ERP, they point out serious concerns around the implementation approach and its integration with other systems such as legacy systems. They further elaborate that the challenge is mainly based on the approach used to implement ERP and its potential to integrate with other standalone applications or existing external applications or legacy systems (Shehab et al 2004). On the integration with other applications, Svärd (2013) postulates that system integration is a salient factor of ECM, which eliminates information silos because systems can talk to each other. Lack of system integration creates interoperability problems and restricts access to data (discussed in section 2.5), which negatively impacts business performance. In an article by Kunstová (2010), emphasis is placed on integration to efficiently manage all

unstructured data. Integration is highlighted to be possible with other enterprise applications such as ERP, CRM and others that are similar. The operation of ERP and ECM independently in ANT concepts in the context of this study means problematisation. For actors being human and non-human to collaborate in addressing its impact on the organisation's ERP and ECM, there ought to be interessement, enrolment and mobilisation. The discussion on the effects of operating ERP and ECM independently aligns to these ANT concepts. The next section focuses on the value-add of integrating ERP into ECM. Based on the discussion thus far, the effects of operating ERP and ECM independently are not beneficial to the organisation as the organisation forfeits the potential return on investment in terms of efficiency and productivity in business processes.

2.3 Value-add of integrating ERP into ECM

Addo-Tenkorang and Helo (2011) poses the question of how the value of ERP is assessed. The question is brought by a few possible challenges that could impact the successful implementation of ERP in consideration of the infrastructure, people, management and data quality issues, and project management, among others. Shehab et al (2004) posit that the value is also derived from the choice of ERP solution and its integration capability. Somers and Nelson (2004) link value to continuous investment in the ERP solution in new modules, upgrades to add functionality, integration with other applications and business process re-engineering, among others. It is admitted by Addo-Tenkorang and Helo (2011) that ERP is a necessity in organisations that are proponents for integrated enterprise systems. ERP comes with a few advantages that offer organisations the ability to efficiently operate their businesses in a competitive environment. ERP is a business management software that allows an organisation to use a system of integrated applications to manage the business. ERP software integrates all aspects of an operation, including development, manufacturing, procurement, finance, sales, billing and marketing (Rashid et al 2002). Mahrami and Hakro (2018) support the idea that ERP is a smart system in the business world that supports organisations to improve their efficiency and operations. The benefits of its deployment include reduced operating costs, increased productivity and improved customer services (Mandal & Gunasekaran 2003). Kale, Banwait and Laroiya (2010) deem ERP as an indispensable tool for businesses that are striving to excel and to be world leaders. Mainly business competitive forces in the market had driven its development. It was since the 1990s that it has been a business solution sought after by a number of organisations, irrespective of the size and line of the market (Kale et al. 2010). In

the early days of ERP, it was initially intended for the manufacturing industries but as it evolved further to became applicable to most industries. According to Elragal and Haddara (2012), even more than the cost saving benefit of ERP, the main drive is the technical and operational integration of the business function to harmonise the information for an efficient flow of goods and services offering. Rothenberger et al (2010) posit that ERP attraction to business is its integration offering that affords companies improved efficiency and improved management of the business. In recent years, it has been implemented in many industries and businesses of different natures. Furthermore, Nwankpa (2015) argues that the success of ERP was dependent on how far the deployment extends, such as the inclusion of supply chain and web-based application technologies make business process integration and ERP functionalities richer (Nwankpa 2015; Jacobs & Weston 2007). The integration and functionalities in this instance point to an actor network referred to as a heterogeneous network driven by the non-human and human actors (Hanseth, Aanestad & Berg 2004).

Pertaining to ECM integration, its main goal is to enable transparent content sharing between different applications such as content management and records management to be interoperable (Hullavarad et al 2015). Hullavarad et al (2015) recommend that the implementation strategy should cover the majority of records (paper and electronic, structured and unstructured) to ensure that the needs of the various stakeholders are met and that legal discovery is enabled. As many manual processes as possible should be removed by enabling automated processes and it should be ensured that ECM is in line with technology.

Grahlmann et al (2011) observed that organisations implement ECM to avoid the problem of the accessibility, consistency and publication control of the content of files that are stored locally become tough. Tyrväinen, Päivärinta, Salminen and Iivari (2006) agree that benefits such as integrated paper documents, data, reports, web pages and digital assets are realised when ECM is deployed in an organisation. Hullavarad et al (2015) agree that once deployed in an organisation, management of data complexity is enabled since it offers a strong functionality of systematic analysis and control of all information throughout its life cycle. Cost saving is also one of the benefits of ECM in an organisation from an operational point of view. They further note that the infrastructural benefits are also part of the deployment of ECM in an organisation because servers can be reduced to a minimum while implementing business continuity measures and complying with regulations and enhancing employee productivity.

Similarities in ECM and ERP projects exists. Elkhani, Soltani and Nazir Ahmad (2014) observed that ECM project implementations are similar to those of ERP implementation. These projects at times they also do fail when they do not have executive support (Elkhani et al 2014). As highlighted by Medina (2014) in the previous chapter, it is also highly beneficial when enterprise systems such as ECM and ERP are well integrated and delivered according to the business objective or needs for efficiency and productivity. Based on the discussion in the previous chapter, the integration of ECM was considered significant if an organisation was to leverage on the benefits and the drive to achieve an expected business objective. Vom Brocke et al (2011) opine that ECM in its design and function can be characterised as an approach that integrates a variety of related concepts such as document/ content management at an enterprise level. Its integration is considered to be an integration of all types of information, of technological and managerial challenges, and content lifecycle.

Nordheim and Päivärinta (2004) posit that integration can happen with other existing applications in an organisation and it is at times recommended to be integrated with applications such as web publication tools, MS Office and collaboration suite, and search and content classification or taxonomy tools of the future. However, Vom Brocke et al (2011) considers it a challenge to have Business Process Management (BPM) and ECM integration fully implemented. In an article by Nordheim and Päivärinta (2004) on the customisation of ECM systems, analysis done related to customisation challenges pointed at integration cases (almost 50%) where ERP is mentioned, amongst others, such as database APIs, off-shelf components, scanning systems, PDM, GIS, XML applications, portal integration and legacy systems (Nordheim & Päivärinta 2004). Based on the discussion in this section, the integration of ECM and other applications such as ERP is possible and could be recommended in an organisation that intends to benefit from their integration.

ANT plays an important role in the integration of ERP into ECM. In comparison with ERP, ECM as an enterprise system has similar features and challenges as per the article study by Nordheim and Päivärinta (2004), which justify the application of the ANT to ERP (Nordheim & Päivärinta 2004). Elbanna (2006) in applying the ANT to ERP implementation while citing Law and Callon (1992) remarks that ANT is the assimilation of alliances by an actor to enable the pursuit goal. Alliances are presented as comprising of actors (human and non-human) that come together and are aligned to support the network builder and achieve its goal. In the same

article, Elbanna (2006) elaborates further that translation is the process of displacement with four moments: problematisation, interessement, enrolment and mobilisation as in Chapter One.

In this case study, Elbanna (2006) uses the SAP implementation project at Drinko Company to illustrate the application of ERP implementation using improvisation. It was observed that the ERP constructed network that is sufficiently stable and channelled to different actors to fulfil their required roles to enable the implementation network to achieve its objectives. In this study, it was revealed that there was an application of different translation strategies to recruit and align several actors that could result in the creation of multiple perceptions of the project and its desired goals which impact the consistency of the actors' perception of the ERP implementation project and the understanding of the required delivery. Redefinition for all the parties and finding the objective that can guide the interests of the actors while realigning them to achieve the main objective is on project management. Thus, a central theme was identified for the actors that can be related and subscribed to through brainstorming sessions while enrolled in the primary network they were recruited in. Elbanna (2006) concludes that improvisation is inherently in the process of network building as actors interpret their interests in relation to others and act accordingly. However, Nandhakumar, Rossi and Talvinen (2005) citing Monteiro and Hanseth (1995) argue that the ANT assumes a symmetrical treatment of human and machine agency. The aforementioned authors also cite others such as Latour (1991) and Jones (1998) who argue that human and machines are not as symmetrical, which is different because of the characteristics of human intentionality. In their study, they used inter-related theoretical concepts: human intentionality, affordance systems and social structures as cited by Giddens (1984) and Norman (1998) in their articles. On the other hand, Hanseth and Braa (1999) discussing the SAP case study, argue that as and when infrastructures grow and their use increase, they grow large and become irreversible actor networks. They justify the use of the ANT by pointing out that stability, technology, and social order are negotiated continually with a social process of interest alignment. It is also noted that actors have different interests and thus stability rests crucially on the ability to translate. This means to reinterpret, represent, or appropriate others' interest to one's own. It is through translation that the same interest or anticipation is made possible to be presented in diverse ways and therefore mobilise broader support.

As an example, SAP in Hydro was an information infrastructure and an actor network. This was due to some installations developing the characteristics of infrastructure while being

integrated with other SAP installations or other systems and infrastructures (i.e. the Bridge infrastructure). Therefore, SAP in Hydro organically became a large and complex emergent infrastructure (Hanseth & Braa 1999). Based on the Van Rooij (2013) argument, ERP and ECM are both enterprise systems and have similar challenges. Thus, the application of the ANT can also apply in the integration of ERP into ECM. Discussion on the stimulating and inhibiting factors on ERP into ECM integration in an organisation would enrich the study.

2.4 Factors stimulating and inhibiting integration of ERP into ECM

ANT concepts such as enrolment, interessement and focal actor enable this discussion to articulate the examination of the factors stimulating and inhibiting the integration of ERP into ECM (Stanforth 2007). To align the discussion, enrolment was discussed in the previous section under the system architecture of ERP and ECM and it is also part of this discussion looking at the factors stimulating or inhibiting the integration of ERP into ECM. Interessement is important to note among the actors in achieving this objective in the actor network (of integrating ERP into ECM at Rand Water). These interests of the actors and the actor network should be in line with the focal actor (Johannesen et al 2012). As mentioned in section 2.5, that these interests ought to be aligned and then inscribed into several artefacts. Artefacts include reference to the design of the enterprise, such as the legal and governance structure, business model being the core business processes, and the reference to technology and personnel requirements, to mention just a few (Sidorova & Kappelman 2011).

The focal actor fulfils the role of an obligatory point of passage which is defined as actants that have assumed a crucial role to the smooth functioning of the network (Johannesen et al 2012). The focal actor commitment to the objective brings the discussion about the irreversibility of the ERP and ECM. According to Ochara (2010), irreversibility happens when a withdrawal is unlikely to be an option. In the case of ERP and ECM, there has been an investment and thus the benefits to the business are greater to consider the return on investment when these systems are integrated (Ochara 2010). The ANT concepts offer the lead to the discussion to identify these factors from human and non-human actors.

2.4.1 ERP and ECM critical success factors

Critical factors are key to the success of ERP implementation. Actors, actor network, obligatory passage, interessement, enrolment and mobilisation are included in the critical success factors discussed in this section (Mitra & Mishra 2016). Lim, Kow, Mahdzir and Abu Bakar (2016) suggest that to achieve successful ERP implementation, critical success factors were identified. These critical success factors focus on key areas that influence the success of ERP implementation to also ensure that the business can flourish and the business objectives are realised. They further motivate that achievement of business objectives is to be as per the initial business case in using ERP as an integrated and strategic system. On the other hand, according to Hullavarad et al (2015), to achieve success in ECM implementation, an organisation must involve all stakeholders in selecting the ECM solution and the supplier while ensuring that there is a developed implementation plan that is deployed and users are trained. Some critical factors include all stakeholders. Alaskari et al (2012) support the idea of critical success factors by noting their value when integrated with the lean tool. Lean tools are defined as tools that offer value and reduce waste such as Just-in-Time (JIT) and Total Productive Maintenance (TPM). The number of CSFs has increased over time, as attempts are improving ERP implementation failures. In Table 2.2 are some of the critical success factors for the implementation of ERP as noted by different authors.

Table 2.2 ERP Critical success factors

Critical success factors	References
Appropriate business and IT legacy systems	(Ngai et al 2008; Wagner & Newell 2006) (Helo 2008) (Alaskari et al. 2012) (Lim et al. 2016)
Business plan/ vision/ goals/ justification	(Ngai et al 2008; Wagner & Newell 2006) (Alaskari et al 2012) (Lim et al 2016)
Business process reengineering	(Ngai et al 2008; Wagner & Newell 2006) (Lim et al 2016)
ERP strategy and implementation methodology	(Alaskari et al 2012; Kale et al 2010; Ngai et al 2008; Zainal-Abidin, Uisimbekova & Alias 2011) (Lim et al 2016)
Change management culture and programme	(Alaskari et al 2012; Chauhan et al 2012; Helo, Anussornnitisarn & Phusavat 2008; Ngai et al 2008; Stefanou 2001) (Lim et al 2016)
Communication	(Al-Mashari et al 2003; Alaskari et al 2012; Chauhan et al 2012; Helo et al 2008; Ngai et al 2008; Sarker & Lee 2003) (Lim et al 2016)
ERP teamwork and composition	(Alaskari et al 2012; Chauhan et al 2012; Gallagher & Gallagher 2010; Ngai et al 2008; Stefanou 2001)
Data management and integration	(Alaskari et al 2012; Ngai et al 2008; Jacobs & Weston 2007)
ERP vendor	(Alaskari et al 2012; Ngai et al 2008; Sarker et al 2012; Vilpola 2009; Wagner & Newell 2006; Lim et al 2016)
Monitoring and evaluation of performance	(Alaskari et al 2012; Kale et al 2010; Ngai et al 2008; Stefanou 2001; Vilpola 2009)
Organisational characteristics	(Alaskari et al 2012; Basoglu et al 2007; Ngai et al 2008)
Project champion	(Alaskari et al 2012; Hwang 2011; Ngai et al 2008; Vilpola 2009; Lim et al 2016)
Project management	(Alaskari et al 2012; Chauhan et al 2012; Helo et al 2008; Ngai et al 2008) (Lim et al 2016)
Software development	(Alaskari et al 2012; Ngai et al. 2008)
Testing and troubleshooting	(Alaskari et al 2012; Helo et al 2008; Ngai et al 2008) (Lim et al 2016)
Top management support/ Senior management involvement	(Alaskari et al 2012; Chauhan et al. 2012; Ngai et al 2008; Ram & Swatman 2008) (Lim et al 2016)
User training	(Wu & Wang 2006; Chang et al 2008; Schmidt, Davis, Davis & Cronan 2011; Addo-Tenkorang & Helo 2011; Alaskari et al 2012)
Fit between ERP and business/ process	(Alaskari et al 2012; Helo et al 2008; Ngai et al 2008)
National culture and country related functional requirements	(Alaskari et al 2012; Helo et al 2008; Ngai et al 2008)
Financial resources	(Alaskari et al 2012) (Lim et al 2016)
Use of consultant's services	(Alaskari et al 2012)

Spathis and Constantinides (2014) consider factor analysis of ERP system benefits in the context of ERP implementation summarised into only five as effective logistics, effective communication function, effective decision-making process and efficient data processing. These are directly and indirectly included in Table 2.2. Critical success factors are both human and non-human actors; in this case, both are represented in the table above. Top management or senior management are actants that have assumed a crucial role in the smoothing function on the integration network (Johannesen et al 2012). Wu and Wang (2006) note that these non-human and human actants such as project management principles, feasibility/evaluation, business process reengineering, top management support, cost/budget analysis and consulting services are critical to the successful ERP implementation. It is also crucial to note that social influences such as change management culture and programme are also key to the outcome of ERP success. Interessement of actants and enrolment of other actors are key to ensuring that there is success in the ERP implementation network (Silva 2007).

Table 2.3 presents the CSFs in ECM implementation and integration are listed with reference from different authors and articles where they reflected the factors deemed crucial to ensure that business objectives are met adequately.

Table 2.3 ECM critical success factors

Critical Success Factors	References
Committed and informed executive sponsor	(Haug 2012)
Area identification and realistic needs/ business case	(Hullavarad et al 2015) (Vom Brocke et al 2011; Maican & Lixandroiu 2016; Rickenberg et al 2012)
Early involvement of stakeholders and get buy-in	(Alalwan 2013; Alalwan & Weistroffer 2013; Hullavarad et al 2015)
Analysis of content first arrive at the decision to choose appropriate ECM technology	(Alalwan & Weistroffer 2013; Hullavarad et al 2015; López & Ishizaka 2018; Haug 2012)
Training	(Alalwan & Weistroffer 2013; Hullavarad et al 2015)
Routing upgrades	(Hullavarad et al. 2015; Katuu 2016b)
Certification	(Katuu 2015; OpenText 2014; Hullavarad et al 2015)
Clear quantitative expected outcome	(Hullavarad et al 2015; Salamntu 2016)
Security access control in with the roles and responsibility	(Alalwan & Weistroffer 2013; Vom Brocke et al 2011; Hullavarad et al 2015; Smith & McKeen 2003)
Document access and procedures	(Hullavarad et al 2015; Rickenberg et al 2012)
Project management	(Grahlmann et al 2011; Katuu 2016a)
Communication	(Katuu 2016; Vom Brocke et al 2014)
Value-added reseller (VAR)	(Katuu 2015)
Appropriate IT staff	(Haug 2012)
Lessons learned	(Hullavarad et al 2015)

As seen in Tables 2.2 and 2.3, critical success factors as mentioned earlier as interessement, influence enrolment and reveal the focal actor, mobilisation, inscription and irreversibility are well depicted in the critical success factors (Stanforth 2007). Based on these success factors listed in Table 2.3, the human and no-human actors through the guidance of the focal actor being project sponsor ensures that they are enrolled (e.g. through training and communication) their interests are aligned (e.g. stakeholder involvement and buy-in) to a level of ownership to ensure success in ECM implementation and integration through project management. All the critical success factors listed ensures that there is a realisation that the investment in the project is worthwhile and it would not be beneficial to revert back to when the system never existed.

While CSFs usage are encouraged, Lim et al (2016) caution their usage as highlighted in the above table in that they are not equally important in all cases; it must be contextual to the company. Lim et al's (2016) reasoning suggest a need for further study to investigate disparities in the performance in certain critical success factors. In the same study by Lim et al (2016), 90 CFSs were identified for further investigation. Upon conclusion of their study, it

was noted that the nine most critical CFSs could be further consolidated to five most CFSs: benchmark implementation progress on clear milestone and performance metrics, project champion, competence project team, user acceptance and ERP system capability. These CSFs form part of the ANT concept as discussed thus far.

When aligned to ECM, the ANT in the discussion on ERP, the critical success factors of ECM according to Walsham (1997) and Worrell, Gallagher and Mason (2006) can be motivated that actors form networks which can result in enrolment and translation, delegation, inscription and irreversibility (Walsham 1997; Worrell et al 2006). While these functions are noted, Salamntu (2016) opines that these benefits are not fully realised. According to Medina (2014) and Van Rooij (2013), the limitation could be due to the lack of integration as highlighted in the previous chapter. Concerning the CFSs in Table 2.2, Walsham (1997: 465) states that "ANT is concerned with investigating the social and technical taken together or, put another way, with the creation and maintenance of coextensive networks of human and nonhuman elements which, in the case of IT, it includes people, organisations, software, hardware and infrastructure standards.". The theory as stated previously, refers to a relationship between human and non-human resources with each other in achieving the desired intent of the network, which is the integration of ERP into ECM.

Worrell et al (2006), citing a study on hospital accounting systems by Bloomfield and colleagues, provide an example of how the ANT can be employed in IS research. They contend that accounting systems are social technologies aimed at facilitating or reinforcing social organisations while understanding the dynamics between the numerous constituencies. In their study, they observed different outcomes, which meant that the variances in the translation process were as the result of negotiations between different actors in the network. This brings the observation that stimulating and inhibiting factors do involve focal actors who fulfil the role of enrolment of other actors motivated by the organisational history, decision-maker autonomy and distribution of knowledge and skills, among others. This enrolment is also critical to overcoming resistance to new technology by canvassing the stakeholders within the network. It also identifies actors who must be enrolled to improve the chances of success. While the enrolment is an evolving process and resulted in a negotiated order and aligned network, they point out that it creates path dependencies that could set the course for future decisions and the course can become irreversible in some of the created networks.

The next subsection elaborates on factors stimulating the integration of ERP into ECM in organisations and that includes the opinion of other authors. The discussion of factors stimulating the integration of ERP into ECM further enriches the understanding of achieving an integrated ERP into ECM in an organisation such as Rand Water.

2.4.2 Factors stimulating the integration of ERP into ECM

Vom Brocke et al (2011), Nordheim and Päivärinta (2004) and Van Rooij (2013) agree that ERP and ECM are enterprise systems, although ECM evolution substantially lags, both concepts have much in common. Integration of one into the other would bring much value to an organisation. As highlighted in the previous chapter, Kwatsha (2010), Vom Brocke et al (2011), Alalwan and Weistroffer (2013), Van Rooij (2013), Vom Brocke, Sonnenberg and Buddendick (2014), Medina (2014) and OpenText (2014) posit that integration can reduce costs, improve productivity and efficiency, visibility and compliance. It is, however, noted that ERP and ECM do come with their own integration challenges which could result in a failed project (IDT Consulting 2017). The integration of ERP into ECM thus becomes crucial for organisations that intend to operate the two systems in an integrated manner. Medina (2014) and Van Rooij (2013) both agree that integration of ERP and ECM bring benefits to an organisation. These challenges noted by IDT Consulting (2017) offer stimulation for the integration of ERP into ECM and the framework thereof.

In a review of instances where the integration is discussed in the literature, one study is noted by Petty et al (2002) who produced a document that points to a United States Patent Application Publication of 2010 with the title “Systems and methods for coupling structured content with unstructured content”. This document details how to integrate ECM and ERP. In the same document, structured is referred to as content in ERP and unstructured as content in ECM. Following the diagram in the document, the method of mapping information relates structured content to index of at least one piece of unstructured content. This would apply to content that is digitised or a scanned copy of a paper document or an electronic document (word-processing application, spreadsheet program, email package, computer aided and similar programs). Examples of ECM include IBMR FileNet(R) P8 by IBM Corporation, the Oracle RECM Suite by Oracle Corporation, and OnBase(R) by Hyland Software Inc. (Petty et al 2002). This was to suggest a method of pairing ERP and ECM based on the word “coupling” as defined in the Merriam-webster Dictionary (2018). The document does not offer assistance to the

organisations where it was fully implemented, which leaves a gap to apply the theory behind the method proposed. Thus, it motivates the reason for this study and the exploration of the framework for integrating ERP into ECM with the application of the ANT concepts.

Nordheim and Päivärinta (2004) performed a study on a Norwegian oil corporation, Statoil, as a case study where ECM implementation considered integration with web publication tools, MS Office, collaboration suite and search and content classification or taxonomy tools of the future. These different architectural components were discussed earlier as part of the system architecture as they form part of what the actors are made of (Sidorova & Kappelman 2011). Although ERP integration was mentioned and graphically represented in the discussion, it was not the focus of the customisation of ECM in the organisation. The paper refers to a future longitudinal study to shed some light on ECM customisation without much emphasis on ERP integration. This stimulated the discussion of this study.

In comparison between ERP and ECM, more has been written on ERP integration than ECM integration. Kashmeery (2016), in a doctoral thesis, focused on the effects of power relations in the implementation of ERP. The discussion in the thesis is based on the organisation MESIAR ERP implementation without the mention of ECM. The focus on ERP implementation offers a reason for scholars to consider an opportunity to research the possibility of integrating ERP into ECM. Relevant to the study by Kashmeery (2016) was the use of the ANT as it is part of the theoretical framework in this study. The other study on ECM performance by López and Ishizaka (2018) focused on a European organisation in Spain which had a footprint; this organisation was a pioneer in providing business process services and digital technology. López and Ishizaka (2018) on ECM performance in 2018 confirm the interest in the topic related to ECM theoretical and practical contribution, which makes further studies of ECM an area of scholarly interest.

Zooming into South Africa on ECM and coming to closer to this study, Ngoepe (2017) points to several government entities that implemented digital systems such as Hummingbird, Documentum, Livelink and Alfresco to manage digital records. These government departments referred to included Science and Technology (Hummingbird and migrated to Alfresco), Trade and Industry (Documentum), Public Service Administration (Hummingbird), Arts and Culture (Hummingbird and migrated to Alfresco), Environmental Affairs (Livelink) and Transport (Documentum). These systems at these departments were included in the panel

of products evaluated in 2006 by NARSSA working together with the State Information Technology Services (SITA). The panel of these products was referred to as Tender 398: Enterprise Content Management Solutions, which are ECM solutions. The observation by Katuu (2012) and Ngoepe (2017) that South Africa has ECM implemented in several government entities offers further exploration of a possible way to leverage on existing enterprise systems such as ERP and integrating it into ECM. Still, in the context of ECM in South Africa, the focus of Salamntu (2016) in a master's thesis was on understanding the benefits of ECM in a public-sector organisation.

The stimulating factors for the integration of ERP into ECM are made more relevant and have a level of importance by a presentation on the four African countries: Botswana, Kenya, South Africa and Zimbabwe, which was made by four academics representing research work done in each country through the InterPARES Trust project. The research work was focused on the topic "Managing records in a networked environment: the case of four countries", which also had questions relating to ERP and ECM integration. It was also observed that based on the sample responses, ERP and ECM integration still lacks while the two enterprise systems are in existence and remain operational in some organisations in Africa (InterPARES 2018).

Although not addressing the integration of ERP into ECM, Bakunzibake, Grönlund and Klein (2016) posit that ECM and ERP are the two main technologies to manage mainly unstructured and structured information, respectively, in an organisation. In implementing ECM-labelled DTWMS (document tracking workflow management system) in Rwanda, success factors are summarised as organisational fit, skills, management structure, strategy, software systems design, user involvement and training, technology planning, project management, user friendliness, alignment with user needs, and change management. Citing Norton in the same article, the implementation factors are listed to be 27, and they also include factors such as balanced team, business process re-engineering, change management, clear vision and communication plan as the top five. As in Tables 2.2 and 2.3, critical success factors point to the actors, actor network, enrolment and focal actors that stimulate the integration of integrating ERP into ECM (Sidorova & Kappelman 2011). These are both human and non-human actors since there is a mention of users, top management, committed and informed executive sponsor, project management, project champion, vendors, appropriate IT staff, team work and stakeholders and executive sponsor (Alalwan 2013; Alalwan & Weistroffer 2013;

Grahlmann et al 2011; Haug 2012; Hullavarad et al 2015; Katuu 2015; 2016; Lim et al 2016; Sidorova & Kappleman 2011).

These human actors form part of an actor network as well as the non-human actors such as software design, software communication strategy, business process re-alignment, skills, data management and integration, organisational characteristics, financial resources, change management and culture, monitoring and evaluation of performance, ERP and ECM strategy and implementation methodology, business plan/ vision/ goals/ justification, document access and procedures, training and certification, business process re-engineering (Alalwan & Weistroffer 2013; Alaskari et al 2012; Hullavarad et al 2015; Kale et al 2010; Katuu 2016b; Lim et al 2016; Ngai et al 2008; Rickenberg et al 2012; Sidorova & Kappelman 2011; Stefanou 2001; Vilpola 2009; Herbst et al 2014)

The human and non-human actors forming an actor network enrol in the integration of ERP into ECM in line with the focal actor, which in the case of this study, is implied to be committed to executive sponsor or top management support/ senior management involvement since they fulfil the smooth functioning of the network (Haug 2012; Lim et al 2016; Sidorova & Kappelman 2011; Worrell et al 2006).

The literature has exposed the limitation of the ERP and ECM discussions and the globalised concern about the integration of these systems; therefore, it is prudent to explore other related factors stimulating the integration of ERP into ECM. On the other hand, it would also be beneficial to explore the factors inhibiting the integration of ERP into ECM. Critical success factors in Tables 2.2 and 2.3 points to the actors, actor network, enrolment, interessement and focal actors that stimulate the integration of integrating ERP into ECM.

2.4.3 Factors inhibiting the integration of ERP into ECM

As mentioned earlier in the preceding discussion, the ANT concepts guide the discussion on factors that inhibit the integration of ERP into ECM. According to Van Rooij (2013), there is a need to have the ERP and ECM enterprise systems integrated to realise the benefits and return on investment on their implementation in an organisation. In this section of the study, the discussion intends to unpack the factors that inhibit the integration of ERP into ECM.

The inhibiting factors are implied in the critical success factors represented in Tables 2.2 and 2.3 and they are represented similarly in these tables for both ERP and ECM. Spathis and Constantinides (2014) list integration among the other three (i.e. friction delays, personnel and adaptation). Leikums (2012) posits that 80% of integration projects are failures and this is credited to poor risk management, unsuccessful setups and other reasons. He further cites Bakulin (2007) who states that integration is gradually becoming more complicated because the complexity of data schemes has increased (Leikums 2012). In the case of ERP projects, Gargeya and Brady (2005) point to the Gartner Group report that states that 70% of all ERP projects fail to be fully implemented, even after three years. The definition of project failure is deemed as either complete or partial. Complete failure is when the project starts but never gets to realise the implemented system, resulting in organisations suffering significant long-term financial damage. On the other hand, partial failure refers to tenuous adjustment processes for the organisation, which creates some form of disruption in daily operations. Sumner (2000) posits that ERP projects fail due to what can be referred to as risk factors that contribute directly to the failure of the ERP projects, and six such factors that contribute to the failure of the SAP ERP project are identified. Amid, Moalagh and Ravasan (2012) refer to these factors as the ERP critical failure factors in the context of Iranian industry. In line with the ANT concepts, actors in the actor network, interessement, inscription and focal actor are applied in the implementation of enterprise systems such as ERP and ECM (Stanforth 2007). The factors identified by Gargeya and Brady (2005) are listed below:

Factor 1 – ERP functionality/ maintained scope: most many organisations are failing to specify their organisations' objectives due to the idiosyncratic ways of doing business that might have been manageable, although inefficient, in the old system, which became intolerable. The other component of this factor is scope creep due to additional requirements added too late in the project (Gargeya & Brady 2005). In the article by Sumner (2000), she associates this factor as an organisational fit risk where there are resource failures, these conflicting with people, time, project scope and poor requirement specification compilation. Amid et al (2012) identify a lack of clearly defined IT strategies and a goal as another source of ERP failure in the Iranian industries. It becomes more complicated when ERP is implemented without the understanding or thought on why an ERP should be implemented and what its predetermined objective is to be achieved (Amid et al 2012). EDMS is no exception as it can also be misunderstood and can make it hard to be utilised due to a lack of

understanding of the organisation's circumstances and user requirements (Abdulkadhim, Bahari, Bakri & Hashim 2015).

Factor 2 – Project team/ management support/ consultants: lack of a team that consists of cross-functional and knowledgeable people in the organisation. These teams are not solely dedicated to the project and might have other responsibilities in the organisation (Gargeya & Brady 2005). According to Amid et al (2012), project management remains to be the main component contributing to the ERP failure. A lack of a balanced team with both technical and business knowledge is likely to cause ERP failure as well. Sumner (2000) identifies this as a lack of expertise, which includes lack of development expertise, application-specific knowledge and user experience. It can be caused by inappropriate staffing and personnel shortage. It is also identified as a lack of senior management commitment. These are actors in an actor network with an interest in fulfilling their role and collaboration, which is due to a lack of required skill (Stanforth 2007).

Factor 3 – Internal readiness/ training: the lack of people training has historically received the least attention due to its benefit not being quantifiable although it does have an impact in the long term. Resource training is also treated with little regard and financial support and it involves both managers and employees. Organisational readiness is also contributory as organisations fail to deal with levels of cultural change brought about by the introduction of ERP (Gargeya & Brady 2005). Lack of ERP readiness assessment in the organisation is another component that causes ERP failure, according to Amid et al (2012). When it comes to non-technical challenges such as people, organisations cannot recruit, select, place appraise and develop appropriate people. Sumner (2000) identifies this factor as insufficient training and reskilling where staff members lack needed technical skills. This can also be caused by ineffective communications. In the EDMS environment, lack of staff training is contributory to their failures (Abdulkadhim et al 2015).

Factor 4 – Organisational diversity: in global organisations, diversity is identified as an obstacle to ERP implementation success. It is different from factor 1 as the organisation would have to change the culture as well as the processes (Gargeya & Brady 2005). Amid et al (2012) agree that a lack of alignment between the organisation's strategy and the chosen ERP software strategy remains a risk identified in the literature. Poor change management and a lack of knowledge of how the introduction of ERP would impact the organisation are more components of this factor. Another angle to the impact of a lack of change management is the lack of morale and motivation among the employees. Resistance to change in the EDMS

implementation is deemed to be one of the main contributing factors to its failure (Abdulkadhim et al 2015).

Factor 5 – Planning/development/budgeting: taking the ERP project with little forethought results in adequate comprehensive planning and high costs of implementation. It is also highlighted that developmental delays could result in extra cost in making the legacy systems operational, as well as resource attrition and possible budget overrun (Gargeya & Brady 2005). Amid et al (2012) note that a lack of long-term goal planning is also a cause of failure since ERP is not a short-term project and achievement of business goals might not be immediate. Sumner (2000) identifies a lack of business analysts who can understand both business and technology to ensure that the right number of analysts are allocated accordingly as another hindrance to ERP implementation. Adding to the challenge in terms of planning for the resources, is the lack of ability to recruit and retain qualified ERP systems developers, which also results in ERP failure. In the EDMS projects, a lack of budgetary foundation is a factor in their failures, particularly when there is no agreement on an amount between the stakeholders (Abdulkadhim et al 2015).

Factor 6 – Adequate testing: inadequate testing can be the main reason for unsuccessful and costly implementations. The red flags ignored during implementation re-emerge after go-live, resulting in inventory and delivery problems which become costly in the long run. The ERP modification tends to introduce errors when newer versions are not necessarily considered (Amid et al 2012). There is a lack of top management involvement in the decision for go-live due to fear of delaying the project. (Gargeya & Brady 2005). According to Amid et al (2012), lack of top management support is the most critical aspect in ERP implementation. It fails when the ERP project does not receive approval and support from top management (Amid et al 2012). In addition to the six factors identified by Gargeya and Brady (2005), Sumner (2000) identifies additional risk factors that contribute to ERP implementation failure as:

Lack of integration: this is where the project is not based on an enterprise-wide design. It is also admitted that a lack of integrated strategy for supporting the client server causes additional risks and bottleneck in ERP project success. It is also increased by designers trying to implement bridges between ERP modules and legacy systems. A lack of system integration with existing infrastructure environment and business is one of the main contributors to EDMS implementation not being successful, according to Abdulkadhim et al (2015). In the article by Abdulkadhim et al (2015) factors of implementing EDMS into three divisions are summarised as:

i. organisational (top management, budget cost, strategic planning, legislation environment, collaboration)
ii. technical (ICT infrastructure, IT implementation team, security and privacy/ trust, user requirements, data quality, system integration)
iii. user (awareness, staff training, resistance to change)

In review of Tables 2.2 and 2.3, in comparison to the study by Gargeya and Brady (2005) on success and failure factors of adopting SAP, the factors were summarised into only six. Therefore, based on the discussion thus far in this study, it can be observed that there can be a minimum number of factors for success and failure in achieving success in integrating ERP into ECM based on the arguments by Van Rooij (2013), Sumner (2000) and Amid et al (2012)

These factors are actors in the actor network where these focal actors are identified. Top management involvement is identified as one of a focal actor in the network as well as project managers ensuring enrolment of other actors in the business (Heeks & Stanforth 2007). The interessement that ensures that actors' interests are also fulfilled is done through the process of change management, planning, budgeting, training, scope, lack of integration, adequate testing, project team, senior management, and organisation (Amid et al 2012; Gargeya & Brady 2005; Heeks & Stanforth 2007; Sumner 2000). These are the factors that could inhibit the implementation of ERP as far as the articles are concerned. In the context of this study and the objective, these factors apply to ECM as argued by Van Rooij (2013). It is therefore fitting to consider these as factors that could inhibit the integration of ERP into ECM. It is also noted that the articles considered under this section were not directly addressing the water utility types of organisations.

2.5 Integration strategy for integrating ERP into ECM

This objective that discusses the integration strategy for integrating ERP into ECM is fitting in this study as it elaborates on the non-human actors' role and their inscription in the integration of ERP into ECM. The concept of inscription is defined as a process of embedding the interests and values of actors into technological artefacts (Effah 2012). The following sub-sections of this objective intend to discuss system resources for ERP and ECM, as well as the examination of the architecture, compatibility, interoperability and governance of electronic systems for integrating ERP into ECM.

ERP and ECM have strategies concerning their implementation and operation. Møller (2005) states that the ERP strategy is a single vendor strategy. The integration strategy in the context of the ERP project discussion extends to it becoming a significant design issue which entails a top-down system (Sumner 2000). In the discussion about ECM integration, Gottlieb (2005) also mentions the application-level integration strategy. In this section, the integration strategy discussion elaborated on determining the system resources, architecture, compatibility and operability of integrating ERP into ECM.

2.5.1 System resources for ERP into ECM integration

As mentioned before, the resources being discussed in this section are referred to as actors and they are key in understanding what builds the ERP system and what resources are required for its integration with ECM. As mentioned, integration is the actor network which is heterogeneous with the inscription of the ANT concept described as the embedding of interests and values of actors into technological artefacts (Effah 2012).

Karimi, Somers and Bhattacherjee (2007) note that the organisations invest millions of dollars in ERP implementation. At the time of their research on ERP implementation costs, it was estimated that these millions were spent to achieve a significant operational and strategic outcome. Resources are generally considered to be scarce, rare, and unique, and not substitutable organisation-specific assets that add value to organisations' operations by enabling them to implement strategies that improve efficiency and effectiveness. Hwang (2011) refers to system resources as all assets, capabilities, organisational processes, firm attributes, information, and knowledge, to mention just a few. Other than focusing on resources, Karimi et al (2007) introduce the word capabilities to refer to the organisation's abilities to coordinate a set of tasks, utilising internal resources for achieving the desired outcome. In terms of IT capability, it refers to how the organisation leverages its investment in resources and integrates them to build systems that can influence the organisation's overall efficiency, effectiveness and flexibility. These resources as identified by Karimi et al (2007) are:

i. IT components resources – IT assets
ii. Human IT infrastructure – includes knowledge resources
iii. Shared IT services – user-specific IT capability

iv. Shared and standard applications

Singhal, Tandon and Sharma (2011) explicate that the ERP system is required to have the following characteristics:

i. Modular design comprising distinct business modules such as financial, manufacturing, accounting, distribution, etc.
ii. Use centralised common database management system (DBMS)
iii. Modules are integrated and provide seamless data flow among the modules, increasing operational transparency through standard interfaces
iv. Modules are generally complex systems involving high costs
v. Modules are flexible and offer the best business practices
vi. Modules require time-consuming customisation and configuration setup for integrating with the company's business functions
vii. These modules work in real time with online and batch processing capabilities
viii. Modules are or soon, they will be internet enabled

In some of the ERP systems, the following modules are included:

i. Accounting management
ii. Financial management
iii. Manufacturing management
iv. Production management
v. Transportation management
vi. Sales and distribution management
vii. Human resources management
viii. Supply chain management
ix. Customer relationship management
x. E-business

Figure 2.5 represents the ERP concept:

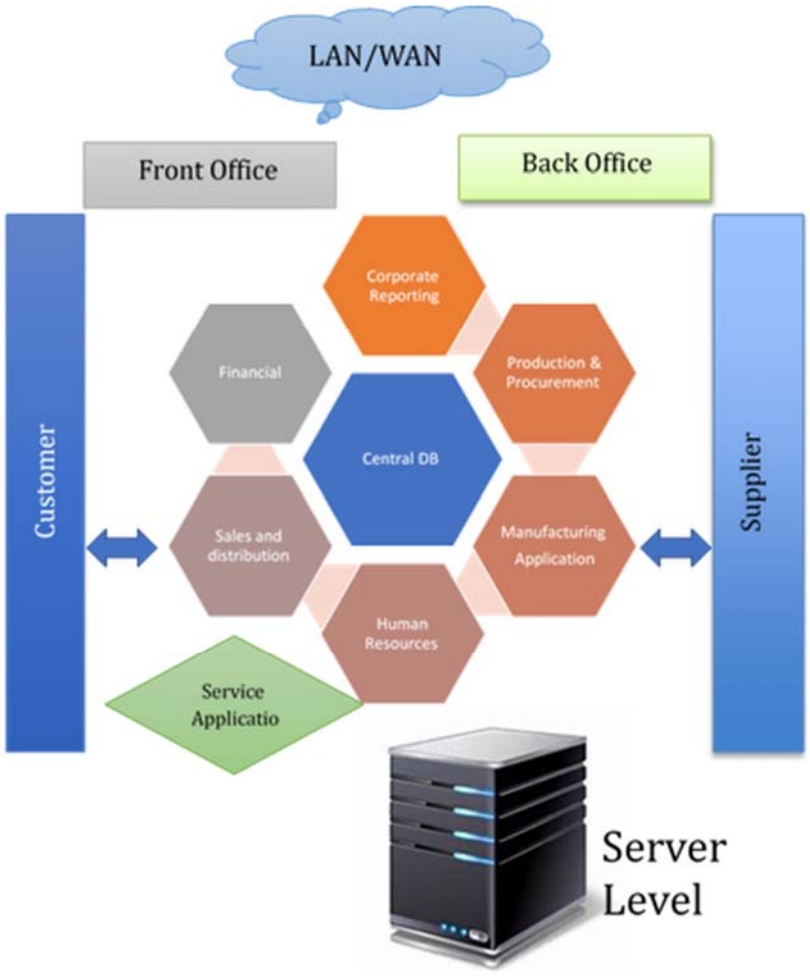

Figure 2.3 ERP resources and architecture based on Karimi et al (2007) and Singhal et al (2011)

Regarding open source ERP, Olson, Johansson and Carvalho (2015) note that the open source was emerging as a significant alternative to what is referred to as closed software in the server market, office productivity tools, accounting software and database systems. They highlight that the Open Source Software (OSS) and the closed software (e.g. SAP Oracle ERP and many smaller proprietorial competitors) benefit is the accessibility of the source code of the open source ERP. However, OSS dominates in small and large organisations with simpler database applications, while the propriety products attract organisations with large database users (Olson et al 2015). The study by Ngoepe (2015) offers input into conducting a study on open source electronic content management software at national government departments in South Africa. This is one of the studies that considered the free test trial for 30 days to ensure technical and architectural assessment of the FOSS implementation as endorsed by SITA. The study was relevant in the context of integration of ERP into ECM, and architectural

consideration formed part of the process. However, it is noted that the study did not directly address the ECM FOSS integration to ERP; it offered a lead and knowledge in conducting a test for integration of ERP into ECM.

Seppälä (2015) emphasises that successful interaction between the ICT systems facilitates the application of holistic information-based process control and management system for the water utility, utilising the existing ICT-systems without the need to invest in expensive and complicated SAP systems other than ERP systems. A practically working ERP system could consist of the utility's existing ICT systems, which are made to interact and communicate through automated data transfer interfaces. According to the ERP, resources and architecture are non-human agents that have a direct impact on the outcome of the organisational operational objective through collaboration with human agents (Rose & Jones 2005).

The same applies as in the discussion of ECM for the case of ERP with the human and non-human resources as actors making up the ECM solution. As mentioned, integration is the actor network which is heterogeneous with the inscription ANT concept described as the embedding of interests and values of actors into a technological artefact (Effah 2012). According to Iverson and Burkart (2007), ECM uses servers that run software that centralises content into databases from which versions of websites are built up and published from separate organisational branches and workgroups. On the client side, software or the java applets grant the contributors a template for structuring and editing documents that are commonly used. ECM's technical components include "database for creating and storing virtualised and versioned component (media, text, formatting) of every document (Web site, newsletter, portal); templating software for capturing and applying standard formatting to the text in unstructured documents; business rules and roles for workflow; and Web server for delivery" (Iverson & Burkart 2007:6). These authors posit that information document search and retrieval practices in an organisation are restructured by the creation of collaborative workspaces that are linked by workflows. When automated, workflows send contents through the appropriate online review and online approval process before being published.

2.5.2 System architecture of integrating ERP into ECM

This research objective is informed by the ANT concept of translation, which focuses on enrolment and mobilisation. As mentioned earlier, mobilisation happens when enough actors

become super actors with the responsibility to enrol others actors. It should be understood that the role of the system architecture is also referred to as super actor to mainly enrol more actors for the integration network (Effah 2012).

Winter and Fischer (2006) posit that the ANSI/IEEE STD 1471-2000 defines architecture as a fundamental organisation of a system that is embodied in its components, their relationships to each other and the environment, and the principles governing its design and evolution. The architecture concept is represented by the following layers: business architecture, process architecture, integration architecture (e.g. agility, cost efficiency, integration and speed), software architecture (e.g. software services and data structures) and technology (infrastructure) architecture (e.g. computing/ telecommunication hardware and networks). IT architecture comprises deployed applications that are linked to application services on the superordinate layer and IT components referred to as configuration items (these are servers, databases, etc.). Enterprise architecture is explicated as the fundamental organisation of a corporation in its totality or collectively with partners, suppliers, customers as well as principles governing its design and evolution. According to Gunawan and Surendro (2015), enterprise architecture has evolved since it was established by John Zachman in 1987. They note the development of different frameworks such as The Open Group Architecture (TOGAF) to adhere to best practices in the field of enterprise architecture. The traction of enterprise architecture is that consistent continuous development allows a continual alignment steering business and IT to capture all necessary processes, methods, tools and responsibilities. Figure 2.4 represents the general enterprise architecture depiction according to Gunawan and Surendro (2015).

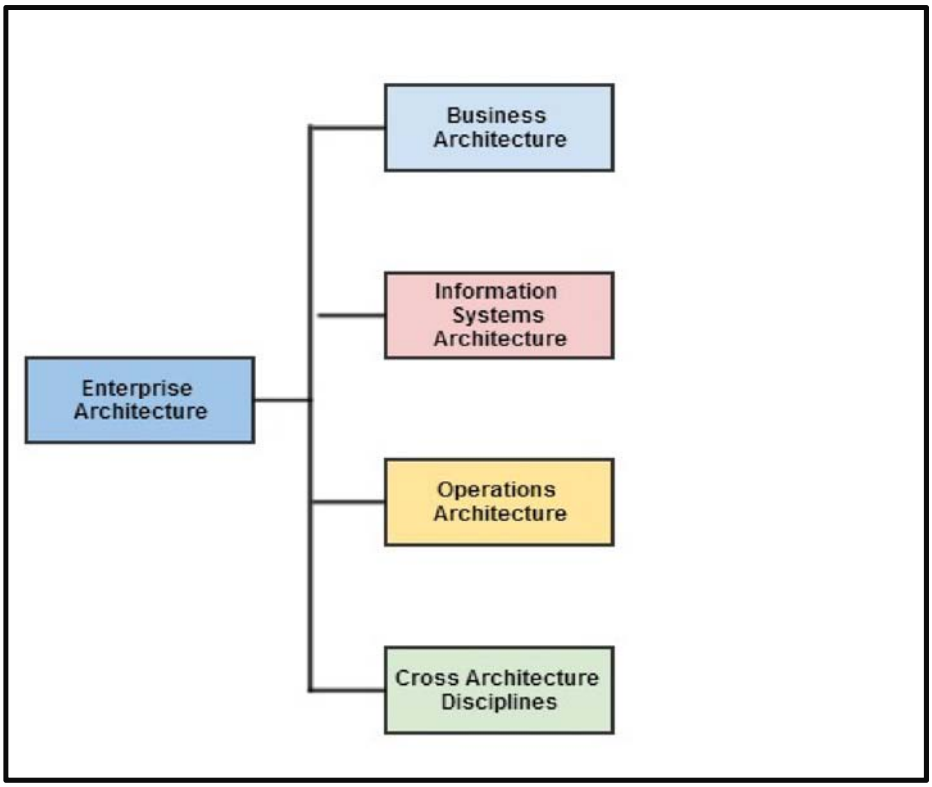

Figure 2. 4 General enterprise architecture overview (Gunawan & Surendro 2015)

Gunawan and Surendro (2015) explicate information systems architecture as the architect that outlines how applications and data architecture are modelled as well as the governance of architecture discipline. It can be broken down into several architectures: application architecture, IT compliance architecture, reporting architecture, information architecture and life cycle architecture. The operation architecture is explained as the architect of the operations of IT components in an enterprise, which provides the model and the documentation on how the operational aspect of enterprise information architect operates. These architects fall within the operations architecture: security architecture, network architecture, technical architecture, technical services architecture, infrastructure architecture and system recovery architecture. Yen, Idrus and Yusof (2011) note that the misfit can occur at the core level of the system architecture, which could be data, application, and business logic level. System architecture remains significant for managers to resolve ERP misfit. According to Hirschheim and Klein (1989), technological architecture is how specific hardware and software components are configured and matched with structural units of the organisation. In the research conducted in an interview approach by Svärd (2013), it was found that when electronic information systems become standalone, they create inefficiency, duplication of information and required separate

maintenance. This is due to the absence of enterprise architecture even though there is a policy that governs the procurement of electronic information systems.

According to Sidorova and Kappelman (2011), modern enterprise architecture represents an example of an actor network. To illustrate the connection between enterprise and actor network, organisations from an outsider, they are distinct legal entities with strategies, legal representation with unique identities. The members of those organisations are constantly changing assemblies of people, objects, rules, ideas, politics, etc. Another example used to demonstrate the application of the ANT in this article points to an entrepreneur with an excellent idea and technology, and an investor in possession of capital and other required resources. When the negotiation process between the two actors become successful, an enterprise actor network is created. In applying ANT terminology, the negotiations involve what is called translation process where the interests of both the investor and entrepreneur are aligned. The achieved stability of agreement during the translation process, these aligned interests are then inscribed into several artefacts, such as business plans, a charter, a loan agreement, articles of incorporation and so on. Artefacts include reference to the design of the enterprise, such as the legal and governance structure, business model being the core business processes, as well as the reference to technology and personnel requirements. They further posit in the same article that depending on how the enterprise architecture is defined, some or all the artefacts are part of the architecture of the enterprise. It is also argued that as the enterprise grows, the enterprise actor network also grows to include vendors, customers, suppliers, employees, production technology, information technology, contracts, annual reports and so on (Sidorova & Kappelman 2011).

2.5.2.1 System Architecture of ERP and ECM

According to Sidorova and Kappelman (2011), the technical artefacts such as software, computer hardware, requirements documents, or other enterprise architecture artefacts are either used or created and can be viewed as actors from an enterprise architecture point of view. This inscription happens once the interests' alignment is achieved with those of the focal actor. As mentioned, these are inscribed into technical artefacts such as ERP application or another element that is difficult to change, such as a legal contract. The discussion below unpacks the architectural components in the ERP application and that of ECM, which are part of the translation as discussed earlier.

Chan (1999), considering the ERP market trend, notes that the architecture is made up of an integrated database, client/server architecture, three-tier thin client/server architecture, web client/server, web enablement and electronic commerce technologies, and open systems environment (Chan 1999). Qin and Wei (2013) concur that traditional information systems of several enterprises are in most cases based on the client/ server or browser/ server architecture that is three-tier architecture:

- **User Interface (UI)** – provides data for users and interactive operation interface. It is simple, eye-catching and has a reasonable organisation.
- **Business Logic Layer (BLL)** – handles different business operation to finish the corresponding function (e.g. information input by users).

a) **Data Access Layer (DAL)** – responsible for data interaction between business data and the underlying database.

Qin and Wei (2013) further explicate the advantages of a three-tier architecture. These advantages are as follows:

i. Configuration of the application level and database level to the configuration of the server level is promoted while offering a strong scalability and fault tolerance support.
ii. Powerful support for the development and distribution of the client application was achieved by separating the application logic from the client computer.
iii. Management scheme and security configuration can be achieved since each running environment of the application program of each level.
iv. Business logic components of the system and the web servers run from the same computer, thus the performance of the system can be enhanced.

Singhal et al (2011) explicate that the three-tier architecture representing the client/ server system functions are performed on the following layer:

1. Presentation layer – graphical user interface (GUI) or browser where data entry or accessing system happens.
2. Application layer – this is where business rules, functions, logic and programs executing actions on data received/ transferred from/ to the database server happen.

3. Database layer – organisational operations or transactional data, including metadata, are managed using standard RDBMS with structured query language (SQL).

(Singhal et al 2011)

Chan (1999) considers three possible IT environments representing a different generation of technology architecture and organisational maturity:

a) **Mainframe-centric** environment is characterised by centralised legacy systems, fragmented LANs, limited use of desktop computing and data access. Normally preferred in the not-for-profit sector and smallest companies.

b) **Network-centric** environment built on a WAN and client/server computing, resulting in a high degree of user competency and interactive organisation enabled by networks, common tools and database.

c) **Internet-centric** environment assumes internet and web technologies to accelerate the sharing and distribution of information within and outside of the enterprise boundary. When a distributed network is in place, the environment is achieved is in place and users are adequately trained (Chan 1999).

Qin and Wei (2013) explain that systems as a combination of project management and manufacturing management are also used to advance the business efficiency and management efficiency at commencement. It is also noted in the article that due to the fast development of the enterprise's business, information systems could not satisfy this development. Noting the limitation, they propose a new solution for the enterprise's ERP based on the six-tier architecture (Figure2.8). The weaknesses of the three-tier architecture are as follows:

a) System is at risk due to the business logic of the system being open to the client.
b) Cost of the system is high due to the cost of hardware for supporting the application server and the webserver which is more expensive than supporting web servers. Therefore, it makes adding a new user more expensive than a separated application server and a web server.
c) System migration cost is very high when it is a three-tier system due to developers having to develop different systems for different terminals (e.g. different operating system between PC to a mobile terminal, tablet computer and smartphone).

d) Integration cost of the three-tier system is high as the developers would be required to rewrite the systems being integrated using possibly different programming languages.
e) Reusing the modules is often very difficult due to different technologies, which require modifications and adjustments (Qin & Wei 2013).

Below is a depiction of a three-tier architecture:

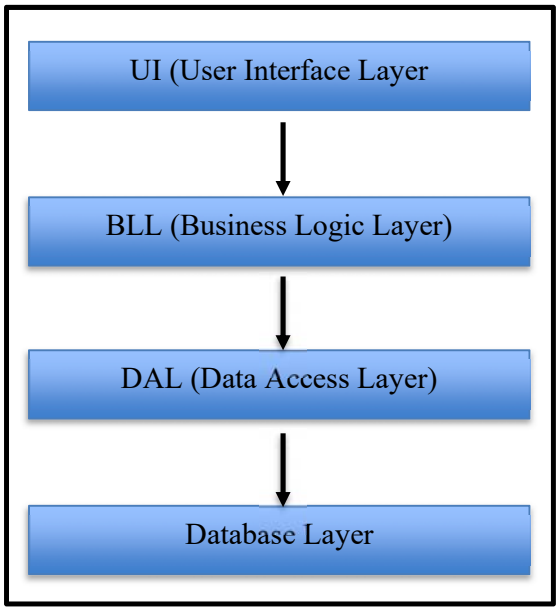

Figure 2. 5 Three-tier architecture (Qin et al. 2013)

Noting the weakness of three-tier architecture, Qin and Wei (2013) propose a six-tier architecture to solve the issues in the three-tier architecture. These are:

i. System security problem – clients include only the components layer and the application layer, and other layers become transparent to users.
ii. System integration and system migration – the migration problem is solved effectively through the separation of the application layer from other layers and the abilities of platform transplantation and system integration are enhanced. Unlike with the three-tier architecture, to increase the system terminal or to modify the data source, adding or modifying codes of the corresponding layer is all that is needed.

iii. Reducing the coupling of systems – decoupling of the system is achieved since modification and adjustment of the system can be focused on certain layers and not on all layers. Thus, the difficulty and cost of later maintenance are reduced.

iv. Component-based development – according to the business logic or requirements any two or more components can form a new application system. Good use and reuse can be achieved through the function of modules or components in the six-tier architecture (Qin & Wei 2013).

Figure 2.6 is a depiction of a six-tier architecture:

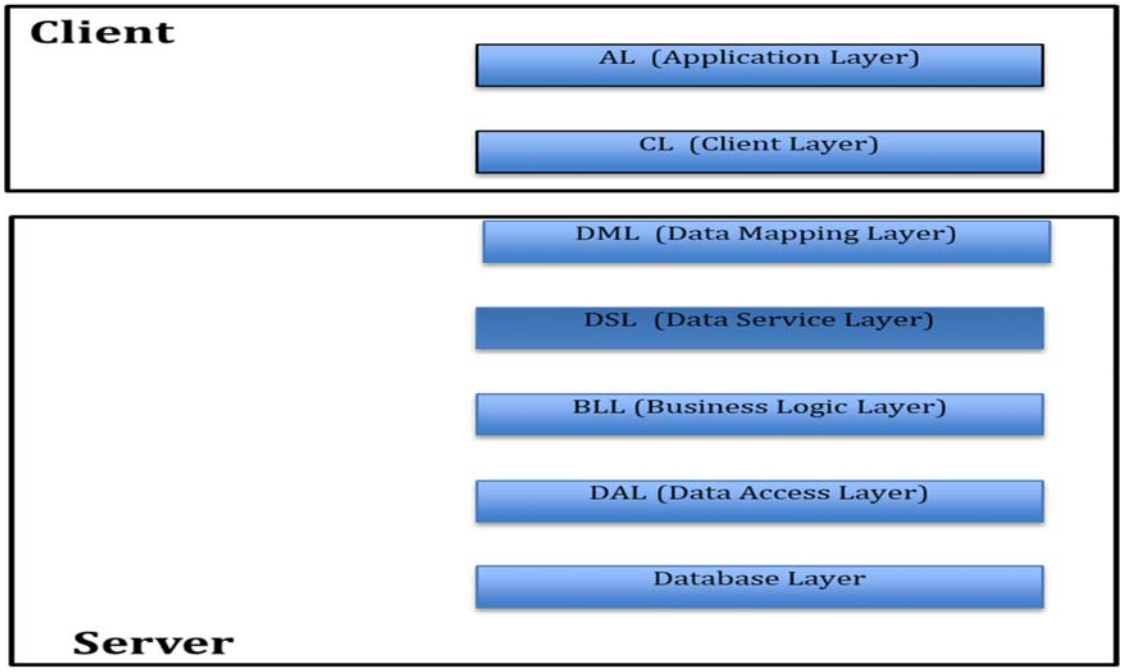

Figure 2. 6 Six-tier architecture (Qin & Wei 2013)

However, Chan (1999) proposes that the ERP architecture framework should be made up of eight components: (1) network infrastructure, (2) server platform, (3) database management system, (4) data ownership, (5) client platform, (6) Web technology, (7) Prerequisite user skills, and (8) IT capacity. These are both technical and non-technical for enterprises that have not fully migrated from the main-frame centric environment.

On a practical side of ERP system architecture perspective, it was while doing a study at a certain water utility formed in 2004, Singh and Singh (2016) noted that the implemented ERP had the following business units – strategy and leadership, customer services, engineering, operations, environmental services, human resources, corporate services, finance and technology. At the implementation stage, it was also noted that the utility lacked the resources and technically skilled staff to lead the project. The background of this water utility in South Africa points to the services it is responsible for, which include the provision of water, wastewater management and other environmental services (i.e. include a supply of water, from the source to consumer, from sewer connection to wastewater treatment and disposal to the environment as the final stage). Water services as articulated in the article are provided to a range of consumers, including community households, industries, businesses and government institutions. The modules that were implemented were as follows: supply chain management, contact management, accounts payable, accounts receivable, fixed assets, project finance, cash management, interfaces, budgeting, management information, and information technology.

ECM has its architecture in the IT context. According to Tyrväinen et al (2006), ECM can be viewed from four perspectives: content, technology, enterprise and process. In each perspective, there is a content perspective concern about the identification of content items, their semantics, structuring and organisation, also noting the creation and use of the content by a human user and IS. The next perspective is concerned about the development of hardware, software and standards in an organisational context. On the other hand, the enterprise perspective considers organisational, social, legal, and business issues of content management. Lastly, the process perspective is concerned about the development and deployment of new content management solutions in enterprises. Figure 2.7 depicts the perspectives of ECM:

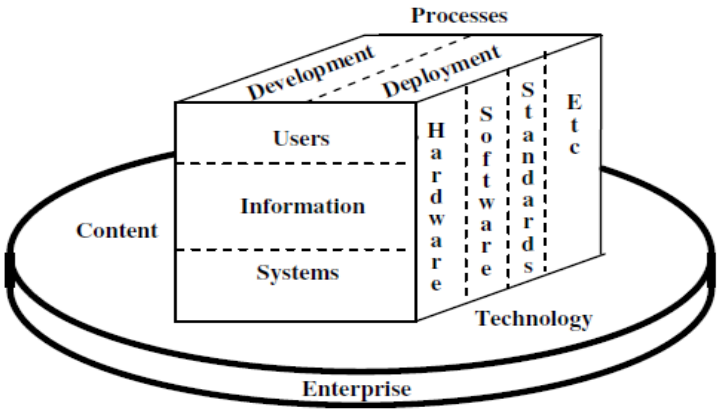

Figure 2. 7 A framework for ECM research (Tyrväinen et al 2006)

Sturdy (2007) argues that the word 'enterprise' in ECM is just bolted on to making it sound more important. Munkvold et al 2006) argue that ECM development builds competencies and technological platforms in an organisation, making it quicker to develop and maintain specific content management applications for development purposes. They refer to a Winterthur-Europe Insurance company as an example pointing to XML-based content management architecture where the intention was to build applications that can adapt automatically as and when an insurance product is modified in the central database. In explaining further, Sturdy (2007) only focuses on the more important part, which is the content management of ECM. The content management part includes three processes:

i. Storage – its records management
ii. Editorial – its content capture and creation
iii. Publishing – its content distribution

These components are also in Figure 2.7 depicting stages in the process of content creation from O'Callaghan and Smits (2005). Hullavarad et al (2015) depict the ECM solution as typically consisting of four essential components:

i. **User interface** – is a process through which information is brought into the ECM. In the article, it is stated that it can be accomplished by uploading an electronic version of information into ECM or by converting a hard copy document by image capture scanning. This information is made up of hard copy or digital format. In this instance,

it referred to digital format generated by Microsoft or Mac, or by Google documents. Maican and Lixandroiu (2016) refer to this as image-processing applications where document capturing takes place (scanning hardware and software, optical and intelligent character recognition technologies and form-processing technology). It is further explained as the ability to store images of scanned documents in the repository as a regular content type in a folder and the ability to route them through an electronic process.

ii. **Information governance** – being deemed as the key ECM functionality separating ECM from other digital archival systems. The incoming information becomes an official record assigned with functional area-specific records and retention rules. At this components level, ECM automatically deletes records after the retention period or duration to provide regulatory compliance. Maican and Lixandroiu (2016) suggest that ECM component composition refers it to records management where long-term retention of content through automation and policies, legal, regulatory and industry compliance is ensured and retention of critical business documents is enforced based on a records retention schedule.

iii. **Attribute**s – these are to meet business objectives by using the following features:
   - *Data archive* provides a systematic approach to archive and retrieves the information by utilising selected keywords.
   - *Intelligent data* capture which converts image-based information to a computer readable format using optical character recognition.
   - *Workflow* is an automated process where information flows through various stages as per a pre-configured logic.
   - *Integration/ data processing* is a built-in information management solution connecting different data streams.
   - *Information disposal*, which when complaint, automatically deletes documents in compliance with the deletion time affixed to specific information.

iv. **Repository** –provides a secure approach to store information for on-demand access. It is achieved through various protocols that allow information to be stored on arrayed disks that allow for enhanced data security. This repository can be on-site or through the cloud offering (Hullavarad et al.2015). In an earlier paragraph, Sturdy (2007) refers to it as storage.

Sturdy (2007) elaborates further that the three processes include many other functions such as document management and client management systems. Sturdy (2007) also introduces four pervasive processes in content management applied to the three processes (storage, editorial, publishing) as:

i. Managing wrapper and formats, which mainly is the content management function.
ii. Managing workflow, which is the unit that makes up business processes. Maican and Lixandroiu (2016) refer to workflow/ business process management (BPM) where document review and approval workflow take place and this all include graphical process builders and serial and parallel routing.
iii. Managing compliance for both external and internal standards.
iv. Managing access and security is intensely connected to access and security as mostly the content of the materials that define the application of access rights and security provision. Maican and Lixandroiu (2016) refer to it as document management where check-in/ check-out, version control, security and library services for business documents, compound document support, and content replication take place.

In comparison, according to Maican and Lixandroiu (2016), ECM suites are specified more articulately in comparison to how Sturdy (2007), Smith and Mckeen (2003) and Hullavarad et al (2015) did:

i. Social content such as document sharing, collaboration, knowledge management and project team support. Blogs, wikis and support for other online interactions are also important components. Social content, including video, is the fastest-growing category of new content in the enterprise.
ii. Extended components such as document composition, e-forms, search, content and analytics, email and information archiving, email management and packaged application integration (Maican et al. 2016).

Smith and Mckeen (2003) note that there are four lifecycle stages in ECM, which are as follows:

i. Capture – all activities that have to do with collecting content.
ii. Organise – has to do with indexing, classifying and linking content and databases granting access within and across business units and functions.

iii. Process – sifting and analysing content in ways that inform decision-making.
iv. Maintain – this has to do with ensuring that the content is kept updated (Smith & Mckeen 2003).

In furthering the discussion on storage by Sturdy (2007), the vital pieces are: where the content is found, what applications are used to read, view, download, change, remove and archive the content, noting that more activities can be done to the content. The other important part in ECM, according to Sturdy (2007), is that the creation and editing of content are managed accordingly. Where there are mechanics to be in place, such as templates and rules for creating content, structures, and format and link management. It also requires collaboration with the management of authorship from either internally or externally, or both. Control such as identifying, controlling and recording change is crucial, as are the approval process, version control, access control and security, metadata creation (including classification and management).

On the other hand, Smith and McKeen (2003) emphasise that metadata is important, particularly for the workflow design and the overall management of content. It is also important for content exchange between enterprises or different software applications. Metadata, according to O'Callaghan and Smits (2005), is information about data and it is defined as instruction that comes with data as it adds context and wider interpretation to data; it is not content because it exists apart from content. They explicate metadata as standards that groups agree to for a definition of information. These standards become the basis of any kind of data sharing and bring potential large-scale efficiencies in information interchange among groups that do not know one another. Citing Wei et al (2002), they posit that metadata offers the capability to share data across applications or systems and that metadata enables publications that need a somewhat different form of the same data to draw from a common repository in the context of content management. Content capturing is a cognate set of processes to internal content creation and editing. The mechanics involve storing a hard copy, copy materials, scanning and imaging, and moving content from emails (body or attachments). The right management involves asking questions relating to the content public domain, associated rights, asking if they will change over time and the content being affected by the management of rights. Smith and Mckeen (2003) note that capturing is the first stage in the content life cycle that includes all activities associated with collecting content.

Content integration refers to understanding collaborative content, which then would require wrappers and formats to be applied. On the other hand, publishing mechanics are text and graphics needed for the application to be what is required for users to access the published content. Destinations such as intranets, extranets, printed materials, websites and emails while format translation is primarily based on the destination (Sturdy 2007). In a discussion by Maican and Lixandroiu (2016), the destination is referred to as web content management where there is content creation functioning, templating, workflow and change management, as well as content deployment functions that deliver pre-packaged or on-demand content to web servers.

According to O'Callaghan and Smits (2005), for ECM to function as a central repository, it must extend and have sources (author), components (components and metadata), publications (information products), and an audience (target users, workflows/ processes) as depicted in the figure below:

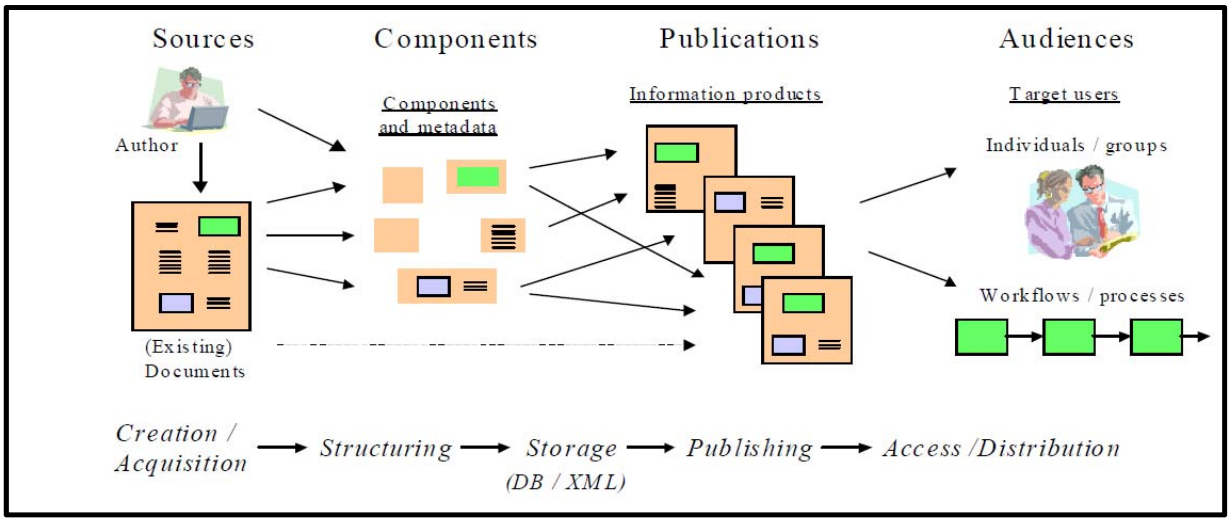

Figure 2. 8 Stages in the process of content creation from O'Callaghan & Smits (2005) (taken from Gupta (2002)).

There is a unified content structure that is standardised across all data sources as it is chunked and tagged accordingly. The unified content has the hierarchies and other organisational schemes used to categorise and get the content to extend to anywhere content is stored. Unified access refers to how a query is made and retrieved and the content used ought to be the same across all data sources (O'Callaghan & Smits 2005). Sturdy (2007), Smith and Mckeen (2003),

O'Callaghan and Smits (2005) expressed a similar view on the components for ECM while Maican and Lixandroiu (2016) expand by adding more components that articulate the components of ECM in a generic organisation, except for social content and extended components. In the article by Maican and Lixandroiu (2016), the context of discussing ECM is in the context of an academic organisation. The architecture is represented as in Figure 2.9.

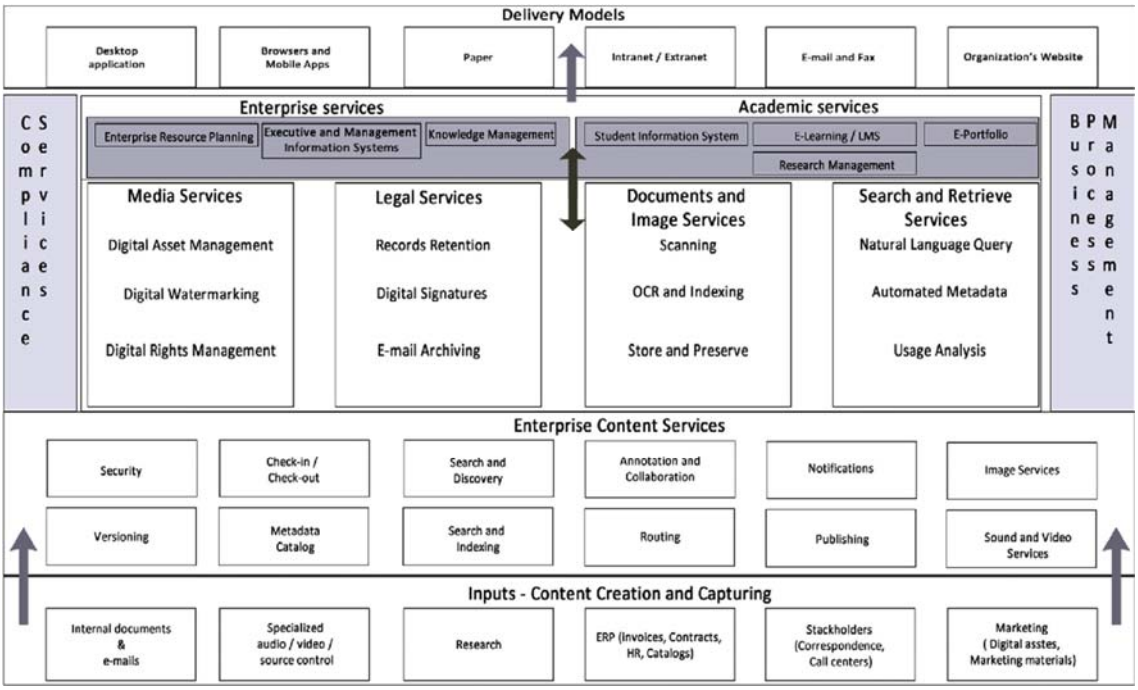

Figure 2.9 Conceptual system architecture regarding ECM uses in academic institutions (Maican & Lixandroiu 2016).

In considering the latest technological platform, Sharma (2012) argues that cloud computing is fast becoming as pervasive a platform as the internet and is transforming the stand-alone IT infrastructure to resemble social public infrastructure like water utility systems and electricity, as it facilitates a shift to on-demand and pay-per-usage arrangements. Enterprise content management as a browser technology is an area that can prove to be profitable in the context of cloud technology looking to cloud solutions such as IBM and ECM. The discussion focused on the architecture of ECM in the general context.

2.5.2.2 System Architecture of ECM at a water utility

Svärd (2013) highlights that enterprise architecture is one of the factors to its implementation success for institutions such as a municipality. These municipalities offering services such as water and electricity to its customers (Svärd 2013). Katuu and Ngoepe (2015) argue that in assessing a public institution such as Rand Water being a water utility, records professionals ought to consider the wider technological environment within which EDRMS applications are utilised. They further posit that the management of digital records ought not only to be originating from EDMRS applications but also other disparate information systems in the enterprise architecture.

Bekker (2016), in his discussion on digital governance in support of infrastructure asset management diagram, states that Figure 2.10 depicts an enterprise information management framework where databases of document management, ERP, water consumption and billing, GIS, reliable centre maintenance and risk management are among the information sources layer in Rand Water. The next layer above information sources, called information management processes, includes records and document management such as information architecture and standards management, information ownership management, information security and risk management, information quality management, explicit knowledge management, compliance management, and information classification and categorisation. In the same diagram, the next layer is information format where there are electronic, paper, structured and unstructured content. The last level is the information life cycle which includes create, update, retain/ archive, disseminate and delete/ dispose.

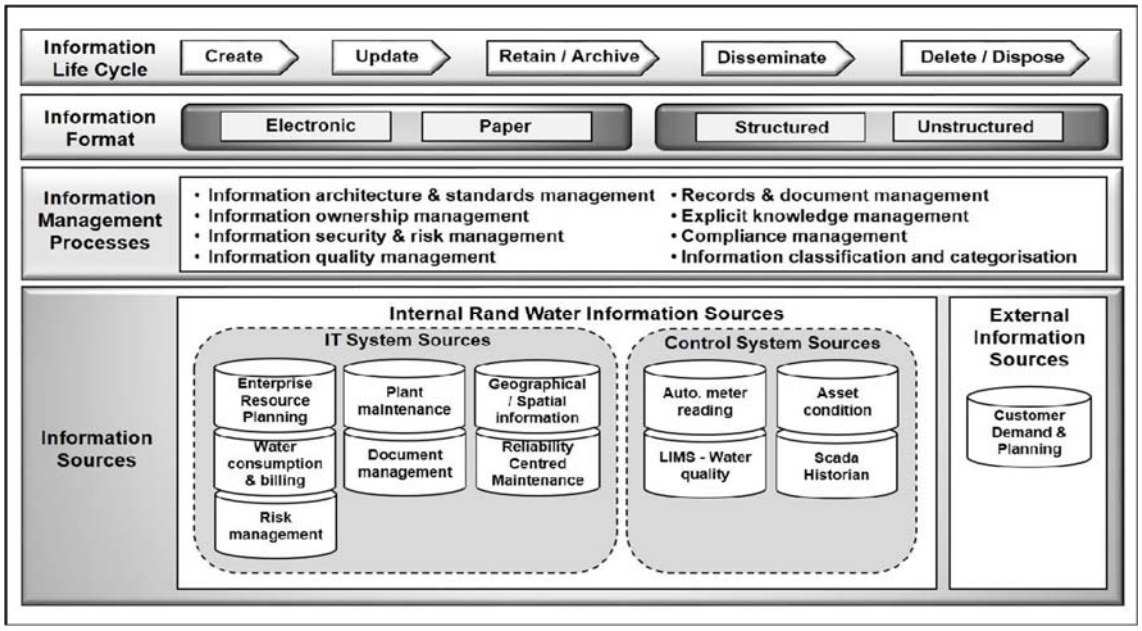

Figure 2.10 Rand Water Enterprise information management framework (Bekker 2016)

The enterprise architecture by Bekker (2016) represents Rand Water's technical architecture, information architecture (i.e. application and data architectures) and information security architecture. In the technological view, the enterprise architecture includes server, storage, end-user devices and network infrastructure.

InterPARES Trust Project Report by Ngoepe and Mukwevho (2018) notes that the information and records systems include electronic systems such as ERP and ECM. In the authenticity and reliability of records, a checklist compiled was tested at a water utility company (Rand Water) making it a convincing case study in their research (Ngoepe 2017). In this report, they also argue that NARSSA mandates that all government bodies must implement an EDRMS such as ECM capable of managing electronic records according to their requirements. They further argue that the functionality by NARSSA should be present, regardless of the system(s) being:

1. A standalone system
2. Part of an EDRMS suite
3. Part of an ECM suite, or
4. Part of the ERP or Line of Business system

The architecture components of ERP and ECM are actors in the actor network of integrating the two enterprise systems. The water sector also has an influence on how the integration ought to happen in this context and where the issue of enrolment is important as part of translation (Sidorova & Kappelman 2011). System architecture discussion enriched the discussion to offer an understanding of the architecture of each system to ensure an informed approach to achieving integration of ERP into ECM. It further enriched during the data collection phase of the study at a South African water utility.

2.5.3 Compatibility and inter-operability of ERP and ECM

ANT's concepts such as irreversibility and mobilisation introduce this research sub-questions that discuss the compatibility and operability of ERP and ECM. According to Walsham (1997), irreversibility focuses on the degree to which it is subsequently impossible to go back to a point where an alternative possibility exists, while Heeks and Stanforth (2007) define mobilisation as when a focal actor seeks to ensure that the specific representation of the actors come to be accepted as the main voice that represents all actors in the integration network (Leikums 2012; Walsham 1997). The global actor in this instance plays the role of decision-maker and has authority (Effah 2012). For ERP and ECM to achieve integration, there needs to be an alignment of actors and decision-making should be made possible through the mobilisation concept. The data moving from ERP to ECM lead to a discussion of the compatibility and inter-operability of ERP and ECM. Interoperability is defined as the ability to share information and services. It enables data to be interfaced from control systems to IT systems for further processing and decision-making as one of the examples (Bekker 2016).

The benefit of integration systems is the ability to exchange data. Leikums (2012) defines integration as a process that enables systems (enterprise systems in the context of this study) to cooperate and exchange data according to the business processes of an organisation. In the context of electronic document management, integration is understood as the promotion of interoperability for different types of information systems such as ECM and ERP. This is to be considered to ensure optimal work directed towards processes of document circulation during the entire life cycle, for all types of electronic documentation. On EDMS implementation in government, Abdulkadhim et al (2015) posit that integration is essential for any organisation when it has many separate systems that would normally require a long time and high fund to match information. Leikums (2012) agrees that integration of information systems for an

organisation is necessary more than ever before since organisations find themselves having to spend large amounts of money and much time trying to match the information. He further highlights that "integrated information systems must inter-connect and inter-communicate as a complex, complete and coherent system and all systems parameters should interfere to assure compatibility and combined inter-operability" (Leikums 2012:195). Svärd (2013) notes that a lack of system integration creates interoperability problems which negatively impact business performance. Leikums (2012) emphasises that integration should be the chosen option because, without the integration of systems, it is not possible to digitise and improve business processes in an organisation. He also argues that ECM, in combination with ERP, can ensure creation, processing, and storage of the required data and that it is usually expensive. He also proposes that it should be upgraded gradually to ensure optimal interoperability.

According to the Gartner magic quadrant in September 2008, EMC, IBM and Microsoft announced completed development of a web services protocol called Content Management Interoperability Services (CMIS). It is a standard that rules the exchange of content between ECM repositories, and it is expected to have a high probability of succeeding where others failed. It also acknowledged that integration of ECM could take several forms as the content stands do exist, such as Open Document Management API (ODMA), Java Specification Request (JSR) 170, JSR283 and Web Distributed Authoring and Versioning (WebDAV). However, it is noted that content can be narrow or complex and with limited options (Maccomascaigh, Bell & Murphy 2008). It is Leikums's (2012) opinion that the integration should be gradual by integrating with either one module or an application at a time. The integration of some could be considered mandatory, advisable or optional, depending on the case of an organisation. This can be achieved through integration with the following:

Mandatory integration:

- Finance management system
- Human resource management system
- Workflow system

Advisable integration:

- AD or it's analogue
- CRM

Optional integration:

- Geographic information system

- Office software
- Web portal
- ERP

(Leikums 2012)

As an example of integration with the financial management system component, Medina (2014) proposes the ECM_ERPAP reference model that assists in explaining "a complex situation – like how a complex business process (AP) can be decomposed into different activities, which in turn can be made more efficient by applying different ECM capabilities", then "in turn can be addressed by the products of different vendors".

In summation, the model breaks the process down into nine different activities, requiring different ECM capabilities. The different colours (green, red, yellow, blue) show which types of ECM systems are best suited for each of the nine different activities (Medina, 2014:4):

1. **"Blue** stands for ERP system itself – such as SAP, PeopleSoft, Oracle and JD Edwards (oracle), Microsoft Dynamics, Sage and others.
2. **Green** stands for the activities that are the core strengths of capture-centric solutions – such as ABBYY, Hyland/AnyDoc, EMC/Captiva, IBM/Datacap, Kofax, Parascript, ReadSoft, etc.
3. **Purple** stands for the activities that are the core strengths of ECM-centric solutions — such as EMC Documentum, IBM FileNet, Hyland, Metafile, OpenText, Microsoft SharePoint, etc. •
4. **Yellow** stands for the activities that are adequately provided by advanced solutions in both the capture-centric and ECM-centric categories."

The ECM _ERP AP reference with an AP that is approved by ECM follows the process detailed below:

i. Firstly, paper invoices and related documents are captured. Electronic invoices are also ingested. This will be called the relevant capability Capture (#1 in the model above).
ii. Then documents are sorted into relevant categories, the relevant information is extracted from them, and the documents are indexed with metadata. This is done manually or automatically, using IDR (intelligent document recognition) and OCR.

Data from ERP systems are often used to identify and validate the documents and data. The relevant capabilities are OCR, Indexing, and Validation (#2).

iii. The metadata and digital documents are released into the managed ECM repository. The relevant capabilities are Repository Services (#3).

iv. The software also transfers a subset of the data extracted from the documents into the ERP system. The relevant capability in ERP Integration (#5).

v. Typically, if there is a complete match between the invoice and the purchase order in the ERP system, it is automatically posted for payment. If not, the invoice is routed in the workflow to the correct the AP specialist. The relevant capabilities are ERP Integration (#5) and Workflow (#4).

vi. AP specialists can use the familiar ERP UI for accessing documents. Depending on the ECM solution and how it is implemented, AP specialists and non-accounting participants may use other UIs as well for accessing documents and participating in workflows. The primary relevant capabilities are User Interface (#6) and Search (#7). But the documents are also managed by the ECM system (Repository Services -- #3), which is integrated with the ERP system (ERP Integration -- #5).

vii. The workflow is provided by the ERP system, by the ECM tool, or both. Workflows are usually designed for exception handling, matching, and approval processes. The relevant capability is Workflow (#4).

viii. The ECM system provides records management. The relevant capability is Records Management (#8).

ix. The ECM system provides reporting, auditing, and analysis. The relevant capability is Reporting (#9).

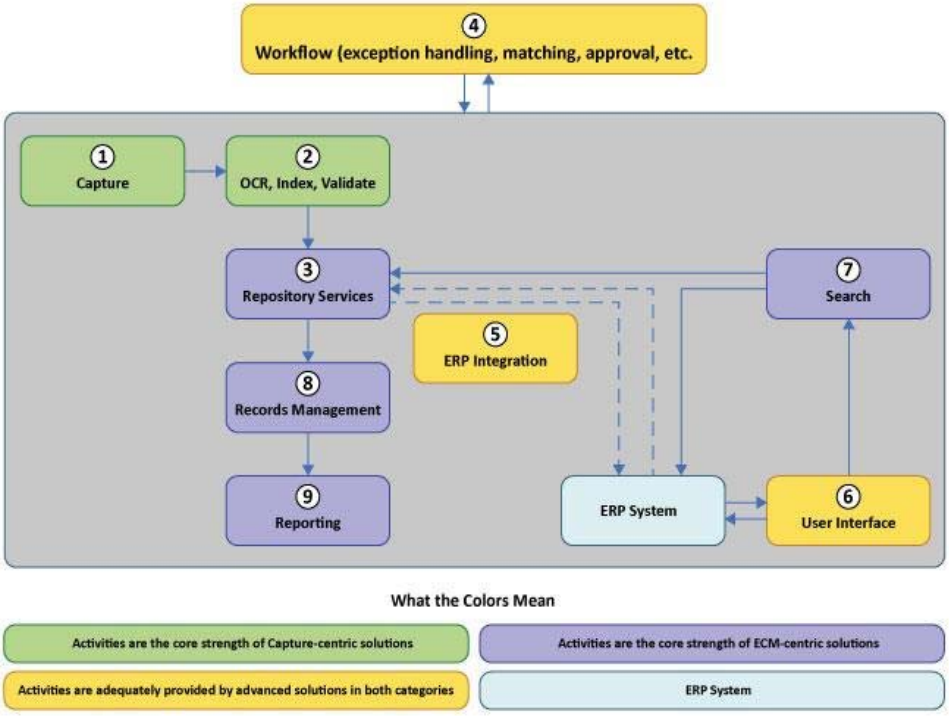

Figure 2.11 ECM-ERP AP Reference Model (Modena 2014)

The benefit expected in Accounts Payable is to improve efficiency in processing by enabling fast, reliable, on-time payments and auditable business processes where regulatory compliance might be realised. This is further supported by another paper written by IDT Consulting company[3] entitled "Making ERP Work for the Mid-Market", which offers services to assist clients to automate Accounts Payable and Content Management. The benefits are clearly stated in their paper without considering alternatives or broader integration into the entire ERP solution and the entire ECM solution. It is however limited in terms of the context of this study as it is intended to extend the integration beyond the AP module of the financial system. In consideration of the conceptual system architecture regarding ECM used in academia institution proposed by Maican and Lixandroiu (2016), it is divided into components. Where the input level (such as ERP (invoices, contracts, HR, catalogues)) as one of these, enterprise content services (such as publishing, etc.), enterprise services as well as academic services at the top are delivery models. On other hand, Simons and Brocke (2014) propose a functional scope of ECM system where there are four layers in its build up; which are infrastructure that has enterprise integration element, services (includes capturing, management and publication),

[3] Making ERP work for the mid-market (IDT CONSULTING 2017)

process (with workflow, collaboration and analysis) and presentation (with client application integration, desktop application, portal integration, intranet, extranet, website and mobile use).

The research sub-question on the compatibility and interoperability in the integration of ERP into ECM at Rand Water is important and relevant to this study, as it provided the application level component to be considered when proposing the framework that enables the desired integration. In the context of the interoperability and compatibility of ECM and ERP, actors, being human and non-human, influence the integration actor network of the two systems (Abdulkadhim et al 2015; Effah 2012b; Leikums 2012). The two enterprise systems ought to be compatible; which can be achieved by address lists of issues such as requirement management, standardisation (i.e. both technology and organisation), interfacing, IT infrastructure, organisation (i.e. roles, power, segregation of duty) and change management.

2.6 Summary

This chapter focused on the literature review as framed from the objectives of the study which emanated from the ANT theory. This allowed the introduction of the development of ERP and ECM background concerning its timeline. Intriguingly, ERP development was driven by the competitive forces that are still being experienced. The chapter offered insight into the history of ERP development. This, in turn, addressed the objectives of this study and identified the stimulating and inhibiting factors to consider in the integration of ECM and ERP. The chapter enables strategists to understand how ERP and ECM contributed to the aim of this study since it offered a broader and deeper understanding of the product under discussion.

In line with research objective four, the system architecture, resources, compatibility, interoperability and governance of electronic content of the ERP and ECM were discussed in consideration of the challenges of operating ERP and ECM independently.

ECM is as critical as ERP, although ERP might have received more focus than ECM earlier, the business impact is as important. Integration of the ERP into ECM has more to offer to the business as noted in the earlier discussions. To achieve integration of ERP into ECM, resources are needed and the architectural consideration is key to the full achievement of the objective. It is also important to consider the factors that stimulate and those that inhibit the integration

of ERP into ECM. The other objective of this study discussed in this chapter focused on the compatibility and interoperability of ERP and ECM at Rand Water.

It was observed that there is a benefit to the organisation's operation that when these two enterprise systems exist in an organisation, they need to be fully integrated. As mentioned in the previous chapter, there is a research gap in integrating ERP into ECM, the research done thus far and the literature exposes the gap in the studies conducted thus far and to date. The next chapter provides the research methodology adopted in this study.

CHAPTER THREE
RESEARCH METHODOLOGY

3.1 Introduction

The previous chapter reviewed the literature on the independent operation of ERP and ECM, the value of integrating ERP into ECM, factors stimulating or inhibiting integration, as well as interoperability of the ERP and ECM systems. This chapter discusses the different aspects of the research methodology to lay the foundation for collecting and analysing the data to extract the findings required to achieve the objectives of the research outlined in section 1.4 in Chapter One. Research methodology provides an explanation of how and when the research is executed and it provides reasons why a specific method of data collection, the material utilised, and interviews in research are used as opposed to other methods (Jabar et al 2014). Ngulube (2003:194) argues that scholars tend to concentrate on the findings of their research without reviewing the method used. Ullah and Ameen (2018) argue that the use of appropriate methodology is necessary for reliable and valid research (Ullah & Ameen 2018). These research methodological aspects were logically discussed in sequence from those that are theoretical to the practical activities related to the research, as depicted in the map of the research methodology in Figure 3.1.

As per Figure 3.1, this chapter covers research paradigm whereby the philosophical assumptions of this study are outlined along with the relevant ontology, epistemology and discussion on interpretivism. The research approach is discussed in section 3.3, where the research adopted was described. The application of the research design to respond to the research questions was also discussed. In section 3.4, the research design of the study was discussed in detail where the justification for the case study design was explicated. It was in section 3.5 that the population and purposive sampling were discussed. Section 3.6 discussed research instruments applied for data collection through interviews, system analysis and document analysis. Section 3.7 discussed the trustworthiness which predominantly related to the best-known criteria such as credibility, transferability, dependability and confirmability of the study. Following this, the chapter was concluded with a discussion of data analysis and analysis tools in an ethical considerations and an evaluation of the research methodology.

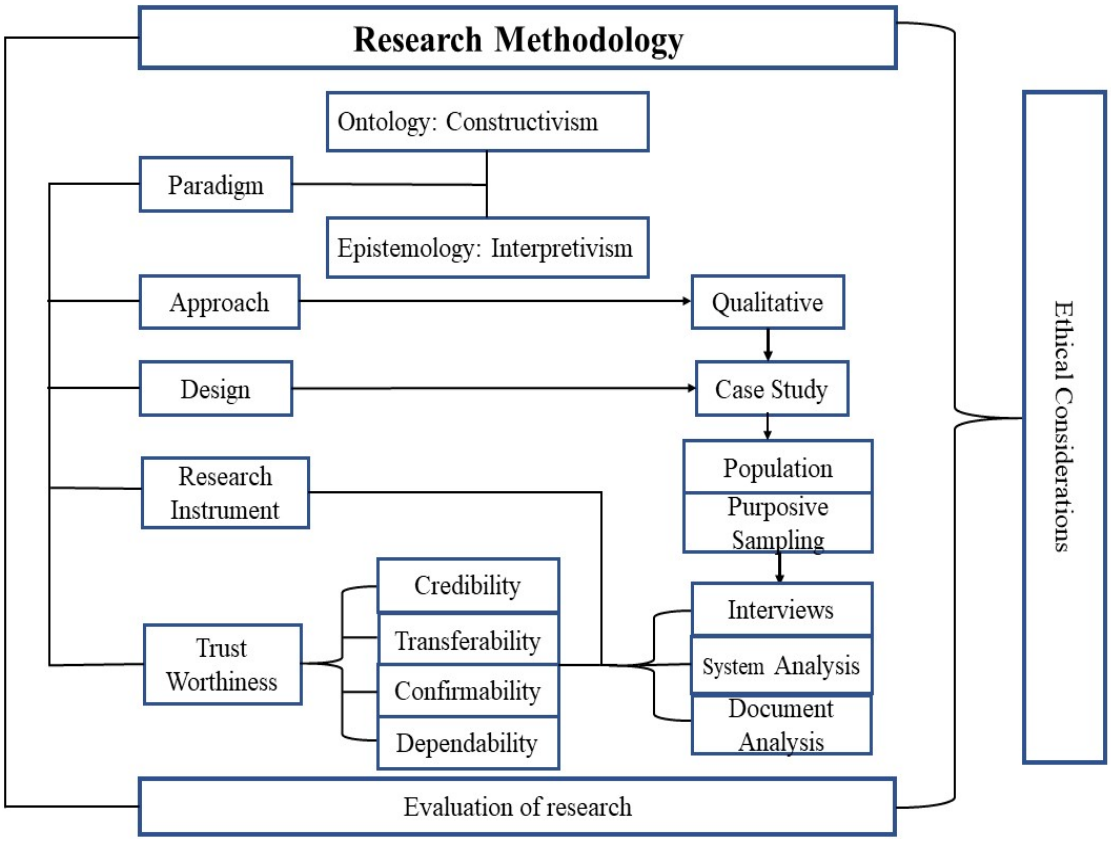

Figure 3.1 Research methodology road map (synthesised by the researcher)

3.2 Research paradigm

The term paradigm is derived from a Greek word. It is perceived as a way of seeing the world that frames a study topic and influences the way that researchers ponder about the topic (Kivunja & Kuyini 2017). According to Kamal (2019), paradigms represent the researcher's beliefs and values about the world, the way they define the world and the way they work within the world. Paradigms consist of the four elements, namely epistemology (the relationship between the knower and the would-be known) and ontology (nature of being and existence), research design and ethical issues (values to adhere to) (Kivunja & Kuyini 2017).

Research ontology is mainly concerned with opening the view of researchers on the nature of reality. It deals with questions about existence, which involves exploring the assumptions held by researchers regarding how the world operates and their commitment to a set of views.

Ontology addresses the question about existence, it involves exploring the assumptions held by researchers regarding how the world operates and their commitment to a set of views.

The ontology in line with this study underpins constructivism, which is simply explained as the sociology of technology. It offers an understanding of technology and social aspects with consideration of the past and present philosophical inquiry in technology and philosophy (Saunders, Saunders, Lewis & Thornhill 2008; Winner 1993). Constructivism is defined as an ontological position asserting that social actors are continually accomplishing social phenomena and their meanings (Dudovskiy 2018). This was relevant in the current study as it involves the understanding of the social, human, non-human, technology and network of influence in integrating of ERP into ECM.

The emphasis of research epistemology is on the kind of knowledge that is suitable in a specific discipline, as well as on being able to examine how social aspects can be investigated using the principles, procedures and philosophy of natural sciences (Bryman 2012). An interpretive approach assumes that the realities accredit certain meanings (Myers & Klein 2011). It assumes the position that knowledge of reality is a social construction by human actors (Walsham 1995). Meaning is influenced by its background (history and culture) (Gregor 2006). In this study, an interpretive researcher aims to study a phenomenon by attempting to comprehend what the human actors and non-human actors assign to a condition of integration of ERP into ECM. It is also believed that reality exists inside individuals' minds and that the only way to expose it is by mining it out. This is the major characteristic of the subjective perspective. This study involved exploring the integration of ERP into ECM at Rand Water. It involved examining the social phenomenon (inscription and the translation of actors in fulfilling integration (technical, operational and social) by investigating the effects of social entities (powerful actors in the network and the notion of "othering" (Elbanna 2007)) in a setting (organisation under study).

The interpretive research paradigm assumes that realities accredit certain meanings (Myers & Klein 2011). It assumes the position of knowledge of reality is a social construction by human actors (Walsham 1995). The interpretivist paradigm has been widespread in IS research throughout the last 20 years (Walsham 2006). According to Walsham (2006) citing Minger (2003), after surveying six of the well-respected US and European journals, 17% of the papers published during the period between 1993 and 2000 the adopted interpretive paradigm and 8%

of these related to IS. It is, therefore, noted that there has been a leap in the adoption of this paradigm in the IS field from the 1980s to the 1990s (Walsham 2006). According to Orlikowski and Baroudi (1991), on a survey that was conducted to identify a percentage of studies conducted using the interpretive paradigm, was 3.2% out of all the papers that were reviewed in the journal sample. When considering the paragraph before highlighting an increase of interpretive research in the IS field, the product of these studies had a direct impact on the body of knowledge and the business world. Walsham (1995) traces some elements pointing the emergence of interpretivism in IS research in the number of bodies that are proponents for adopting an interpretive stance in the following areas: system design, organisational intervention and management of IS, the social implication of IS, CSCW and AI. Also, Elbanna (2007) critically examined the notion of integration by focusing on the role of the social fabric of an organisation in the implementation of ERP systems and primarily its integration capability. Examining using ANT lenses, she performed a case study of an implementation in a large international organisation and the introduction of the concept of "organisational othering". In the study, it was argued that institutionalised marginalisation of some business units within the organisation can create a highly political and largely dis-integrated social context for ERP implementation. It was also revealed that the organisational disintegration can be reproduced and inscribed into the implemented ERP system that tends to hinder the realisation of its integration capability (Elbanna 2007). The interpretivist paradigm was the most suitable and fitting paradigm for conducting this study because it enables the exploration of organisational determinants. These organisational determinants include the structural, cultural and political environment of the project, meaning top management support, administrative inertial and inter-organisational interaction (Truex et al 2006). It, therefore, provided the ability to produce an understanding in the IS context, and a process whereby the information system influences and is influenced by the context while investigating the phenomenon in this study by translating people's different interpretations of the phenomenon being investigated. In its assumption, this can be understood only through the development of a social construct (Walsham 1995).

According to Orlikowski and Baroudi (1991), interpretivism states that reality and our knowledge are social products and hence incapable of being understood independent of the social actors (including the researchers) that construct and make sense of that reality. Bryman (2012) agrees that the interpretivist paradigm or perspective argues that the study of people and/or organisations are fundamentally different from natural sciences studies because

reflections on people and social orders are given greater attention than in the natural sciences. Interpretive studies are known to investigate phenomena being investigated. According to Oates (2006), the interpretive perspective inclines to view how people perceive their world as individuals or as a group and try to understand the phenomena through the meaning and values that people allot to them. It aims to enrich the understanding of possible unique context and an organised discovery of how human agents make sense of their perceived world. The researcher intended to investigate the phenomenon in this study by adopting an interpretive paradigm with the whole intention to adequately address the research objectives. The integration of ERP into ECM to be achieved require that there be an exploration of the actors that are human and non-human as equals. These interactions through the ANT lens include technological, social, cultural and any other internal and external influence in achieving integration of ERP into ECM at Rand Water (Walsham 1997; Gregor 2013; Myers 2013). The interpretive perspective was adopted because it was expected that the outcome of the study could identify, explore and explain how the factors (social agents including individuals and artefacts) and social setting (the organisation under study) are related and interdependent (Oates 2006). The interpretive perspective/ epistemology was more suited for this research as it seeks to understand the phenomena by comprehending what human actors and non-human actors assign to a condition of integration of ERP into ECM.

The positivist epistemology was not adopted because such a paradigm takes the object under study through the narrowest possible angle, leaving out the bigger picture. To gain a deeper understanding, repetitively tests ought to be performed to achieve more accurate results. It the context of this study, the researcher argues that repetition of tests may not necessarily provide a lot of findings when investigating the social implications that are typically revealed when investigating an issue in the information system discipline. Positivism has some limitations as pointed out by Orlikowski and Baroudi (1991); in the quest for universal laws, it tends to disregard the historical and context conditions as they are possible triggers of events or influencers on human action. It is also noted that the design and use of in information technology in organisations is intrinsically embedded in a social context, marked by time, location, politics and culture. When these influences are neglected, the picture of information system phenomena revealed may be incomplete.

Also, one of the major outcomes of this epistemology is the generalisability that results in missing out on the critical issues in the study. It aims to explain and predict external reality,

which implies that people are not active contributors to their physical and social reality. Another reason for not adopting this epistemology is that everyone has a unique interpretation of the world and these differences are at times useful to the range of understanding concerning certain issues, especially in social-related research (Oates 2006).

In critical epistemology, the researcher attempts to critically evaluate and transform social reality under study. It differs from positivism and interpretivism in that it is concerned with critiquing the existing social systems and revealing potential contradictions and conflicts that may be permanently within their structures (Orlikowski & Baroudi 1991). A critical research perspective was not adopted because it presumes that social reality has objective properties that dominate people's worldview. It is understood that people have the ability, the will and the desire to manipulate their social and economic circumstances; however, their ability to do so is limited by the range of social, cultural, and political dominations (Oates 2006). It was not the intention of this study to recommend changes to social reality but to study the phenomenon insightfully to gain a deeper understanding of effects of social entities (powerful actors in the network in a setting (organisation understudy) in the integration of ERP into ECM at Rand Water.

3.3 Research approach

All research involves an explicit, disciplined, systematic approach to discover things using the method that is most appropriate to the research question and problem (Hancock, Ockleford & Windridge 2006). There are two research approaches in IS and these are qualitative and quantitative research. The two research approaches when combined lead to the third one referred to as mixed method research (Creswell 2014). Ngulube (2013) notes that the qualitative or quantitative field methods have been the dominant research processes in several disciplines (Ngulube 2013). To understand IS, there needs to be a theory to link the natural world, the social world, and the artificial world of human (Gregor 2006). Ngulube (2005:127) considers that methods employed by researchers are key to the quality of their output. Qualitative research is linked to the interpretive approach, and quantitative is linked to the positivist approach. Mixed methods research is linked to the mixing or integration of both qualitative and quantitative data in a study (Creswell 2014). Leedy and Ormrod (2014) concur that there are times in research where both qualitative and quantitative research are combined

and they form an approach termed the mixed-method design. To achieve the aim of this study, the researcher followed a qualitative research approach.

Table 3. 1 Differences between the quantitative and qualitative research approaches to research (Welman, Kruger, Mitchell & Huysamen 2005)

Quantitative	Qualitative
Objective	Subjective
Deductive	Inductive
Generalisable	Not generalisable
Numbers	Words
Outsider's perspective	Insiders view
Positivism	Interpretivism
Reliability	Validity
Large sample	Small sample

3.3.1 Quantitative research

According to Jabar et al (2014), the quantitative research approach was developed in the natural sciences to enable the studying of natural phenomena and its focus is objective measures. Leedy and Ormrod (2014) opine that the quantitative approach involves looking at amounts or quantities of one or more variables of interest. Quantitative research approach attempts to measure variables in a numerical way commonly applied in the measurement of the physical world or psychological characteristics or behaviours. Researchers in quantitative research are most concerned about specific extrapolations made from test scores and psychometric instruments such as the construct, criterion, and content validity of the interpretation of scores (Creswell & Miller 2000). According to Jabar et al (2014), quantitative tools include test performance scores, physiological readings, survey responses and spectrometer readings. Quantitative data collection involves identifying one or a few variables that are intended to be studied and then collect data that is specifically related to those variables. Researchers in quantitative rely on deductive reasoning, they begin with certain premises (such as hypothesis, theories, etc.) and then draw a logical conclusion on them. Objectivity in quantitative is maintained in their data analysis, conducting predetermined statistic procedures and using objective criteria to assess the outcome of the chosen procedures (Leedy & Ormrod 2014).

Case study research used within the positivist tradition would be designed and evaluated according to the criteria of the natural science model of research where there is controlled observations, controlled deductions, replicability and generalisability (Shanks & Parr 2003). Though this study is a case study research, quantitative research was not chosen for this study as it is not positivistic in tradition since there are no controlled observations and controlled deductions.

3.3.2 Qualitative research

According to Jabar et al (2014), the qualitative research approach was developed in social science to enable the studying of social and cultural phenomena. Leedy and Ormrod (2014) opine that qualitative approaches focus on phenomena that occur in a natural setting and they involve capturing and studying the complexity of the phenomena being studied. The qualitative research approach involves using different techniques to analyse IS research concerning issues of society, organisation, politics, economy and management rather than technology (Myers 1997). It was designed to assist researchers to understand the views of individuals and the socio-cultural phenomena in which they exist (Myers 2013). Key benefits of conducting qualitative research are to gain a deeper understanding of the context that assists researchers to explain the motives of individuals' actions, understood by mainly talking to them (Myers 2013). Qualitative data collection includes observation and participant observation (fieldwork), interviews and questionnaires, documents and texts, and the researcher's impressions and reactions (Jabar et al 2014). The justification for choosing qualitative research was that it offers a deeper understanding of the context in which decisions are made and actions take place. It is commonly inductive rather than deductive in its approach, meaning that it generates theory from the interpretation of evidence. The qualitative approach makes it possible to explain a range of social, political, organisational, economical and managerial interpretations concerning the integration of ERP into ECM in an organisation.

3.4 Research design

There are a variety of research strategies that are usually adopted for attaining a sufficient outcome of qualitative research methods (Bryman 2012). These research strategies include, but are not limited to, the following: survey, action, research, grounded theory, ethnography and case study. This study adopted an explanatory case study design. Case study research

design refers to describing a state to conclude a phenomenon (Myers 2013). This case is studied in depth for the sake of developing rich insight to capture the evolvement of complex relationships and processes that usually develop in a social setting (Oates 2006). According to Yin (2014), a case study research strategy is an inquiry that explores a phenomenon in its real-life context, intending to lift off the boundaries between that phenomenon and its context. According to Yin (2003), a case study is used in numerous situations to contribute to our knowledge of an individual, group, organisational, social, political, or related phenomenon.

A case study is investigated so that it offers an in-depth analysis of certain instances to explore in its natural setting by breaking down the setting (being studies) into the smallest units. Similarly, a case study can adopt a holistic approach where the focus is primarily on examining the inter-related and interconnected relationships whilst avoiding isolated individuals (Oates 2006). Case study research may attain the characteristics of being intensive and greatly detailed, and the phenomenon is studied in a specific context using interviews as data collection technique. According to Yin (2014), there are three basic types of case study research strategies. The first one is exploratory, which is used when the researcher tries to come up with a question or hypothesis to be adopted in a study. It is applicable and helpful when the aim is to determine the sort of questions to be asked in a questionnaire. The second one takes a descriptive approach and provides a detailed analysis of a certain phenomenon in its context. The third is the explanatory approach, and this becomes useful when the main aim is to investigate the reason why events occurred as they did. This one tends to want to analyse the inter-linked actions that impacted the events that took place.

This study adopted an explanatory case study research strategy because this study aims to describe a specific situation to conclude phenomena being studied (Myers 2013). The case study performed an in-depth analysis to develop a rich insight out of investigating the complex relationships and processes with the boundaries of the case study (Oates 2006). Case study research investigates a phenomenon in its real-life context. As mentioned, this study aimed to analyse the integration influencers among the actors who can be involved in the integration of ERP into ECM project at Rand Water. The reason for adopting an explanatory single case study is to enable the investigation of the phenomenon by opening the development of actions in a specific circumstance. The case study intends to follow the explanatory type that Yin (2014) identified in the discussion thus far. It also intends to explain how inter-linked factors affect integration.

3.5 Population of the study

The population is the study object and consists of individuals, groups, organisations, human products and events, or the conditions they are exposed to. In qualitative research, data are drawn from different sources. Gentles, Charles, Ploeg and McKibbon (2015) define it as "the selection of specific data sources from which data are collected to address the research objectives" (Gentles et al 2015). The research problem thus relates to a specific population and that population is made up of the total collection of all the units of analysis, for which the researcher wishes to formulate a specific conclusion (Welman et al 2005:52). It is not only used on people but sometimes also on objects, test material, audio-visual and electronic records. These entities selected for analysis are their samples and this process is called sampling. The identification of the sample is dependent on the research question(s) and the problem that the researcher wants to be answered or resolved. To try and draw an inference about the entire population or body of objects, the researcher must choose a sample what can be presumed to be representing that population or body. Choosing this sample can be completed through a random selection or through a process that includes appropriate proportions of each subgroup within the whole group of people or objects, therefore, non-random. Qualitative researchers are intentionally non-random in their selection of data sources (Leedy and Ormrod 2014:154).

The sampling approach was purposeful and called purposive sampling. The researcher relied on the wealth of experience relating the subject under study, ingenuity, and/or previous research findings to deliberately obtain units of analysis in such a way that the sample may be considered as representing the relevant population (Welman et al. 2005:69). In the case of this study, the individuals were identified to be interviewed in line of their area of work, role and level of operation. This was done purposefully to ensure that the integration of ERP into ECM dynamics are captured from leadership, management, business, operational, technical and administration point of view. This also extended to document analysis on identified documents as well as system analysis of the ERP and ECM leading to the build-up of the framework to fit the desired outcome of the organisation, which is a case study. In comparison to quantitative research where sufficiently large sample sizes are required to produce statistically precise estimates, smaller samples are employed in qualitative research (Gentles et al 2015). As mentioned in section 3.3, qualitative research tends to offer a deeper understanding and meaning to the phenomenon. In the context of this study "There are no rules for sample size in

the qualitative inquiry" (Patton 2002:244). The sample size is dependent on what the researcher wants to know – the purpose of the study, "what will be useful, what will have credibility, what can be done with available time and resources" (Patton 2002:244). On the other hand, Creswell (2014:231) argues that it is expected that a qualitative researcher would study a few individuals or fewer cases that range between 1 and 40 since its ability to offer the researcher a deep understanding of the phenomenon in the study. At the same time, Creswell (2014) states that the sample size depends on the qualitative design being utilised. The researcher of this study aligns to Patton's (2002) argument which states that "the validity, meaningfulness, and insights generated from qualitative inquiry have more to do with the information richness of the cases selected" (Patton 2002:245) than with the sample size. Considering this argument and the deliberation of the sample size, the researcher based on a wealth of experience relating the subject under study and ingenuity deems the sample size of fourteen (14) qualifying members of the organisation in different areas (finance, IT, procurement, project management, auditing, human resources, records management), levels (executive, general manager, senior management, middle management, technical specialists, and operations) and roles in the leading, managing, operating and administering ERP and ECM systems, together with the document analysis and system analysis, as adequate to offer an answer to the research problem. The sample was identified in relation to their role in the organisation and contribution to the usage of ERP and ECM, effect of snowballing lead to saturation concept. While conducting interviews in a qualitative study, the researcher was at risk of hitting some saturation point. This was when after a few interviews, it becomes quite clear that fresh data no longer sparks new insight or reveal new properties (Creswell 2014). In the context of this study, the chosen number of interviews and archived documents were deemed to be adequate to address the objectives of this study.

3.6 Research instruments

This study is based on a case study research strategy, and data collection suitable for this study is necessary. According to Yin (2014), there are six data collection methods and they are documentation, archival records, interviews, direct observation, participant observation, participant observation and physical artefacts. The study adopted three data collection methods. Interviews remain the main data generating method, ERP and ECM system analysis, and documents and archival records enrich the study. The utilisation of multiple data generating methods makes the study more credible. Presenting the discussion in context, the

outcome of this study intends to offer an approach to integrating ERP into ECM from an actor network point of view where human and non-human actors influence the achievement of the objective.

a) Interviews

Interviews as a method of data collection are deemed to be one of the most important sources for interpretive case study research (Yin 2014). Interviews provide rich data that can be collected from individuals who may have different backgrounds (Myers 2013). Interviews can be structured, semi-structured or completely open and unstructured. For a structured interview, questions are standardised for all participants to enhance the reliability of data. In an unstructured interview, individual questions will be developed spontaneously during the interview as the objective may be general. It is the prerogative of the interviewer to adapt the interview to leverage on the knowledge, experience or insight of the participants. Semi-structure is the one between the two extremes, and as it may have specific objectives, the interviewer would be permitted some level of freedom in achieving them (Gill, Stewart, Treasure & Chadwick 2008; Oates 2006). The interview technique is a powerful tool research tool and it is believed to provide a 'deeper' understanding of social phenomena. It is considered as an excellent mean of gathering data and it is extensively used in IS research. Interviews can yield a great deal of information and it is appropriate where not much is known about the phenomenon. Interviews are also appropriate for exploring even sensitive topics where individuals may not be willing to talk about those issues in a group (Gill et al 2008). This study adopted the semi-structured interview approach as it is intended to collect data from the executive level, senior management, technical professionals, administrators and normal users in different areas of work utilising ERP and/or ECM applications. This interview approach enabled the interviewer to have some level of freedom to achieve the objective using the interview questions appropriate to the level of understanding of the interviewee.

According to Gill et al (2008), questions should be those that are likely to yield as much information about the study as possible. Designing an interview schedule requires that questions should be open-ended, neutral, sensitive and understandable. It is also advised that in any research it is always wise to first pilot the interview schedule on a few participants before data collection. As for the length of interviews, it will vary depending on the topic, the researcher and the participant (Gill et al 2008). The interview questions were compiled in

consideration of them being open-ended, neutral, sensitive and reasonably understandable. The piloted among colleagues passionate and supportive to the academic development in the working environment. A total number of fourteen (14) interviews were conducted in this study. These interviews lasted an average of 30 to 45 minutes each and the participants were well introduced and informed of the scope of the research study. Data presented in chapter four do not reveal the names of any individual that participated in this study as anonymity was promised during data collection.

In line with the current study, Table 3.2 below represents the proposed interview schedule.

Table 3.2 Interview schedules

Roles	Description
Executive Level	Group portfolio
General Management	IT and Business General management
Senior Management	IT, OT, Records management and Business
Middle Management	IT, OT, Records management and Business
IT ECM team	Team that manage and support ECM
Electronic Records team (including Business)	Team that manages and supports electronic records
SAP team (IT and Business)	Team that manages and supports SAP, process owners and super users
Operational Technology team	Team working with electronic storage and digital records

The interview questions were compiled in line with the objectives articulated in Chapter Two of this study. The interview questions asked to fulfil the study's objective are contained in Annexure A.

b) System analysis

In performing system analysis, Lin, Hsu, Leu and Tsai (2004) propose a simplified analysis of ERP systems showing the IT infrastructure, major ERP modules and the relationship with some external systems by an interface. The major modules may include finance, manufacturing,

human resources, sales and marketing, to mention only a few. From the perspective of IT infrastructure, ERP has three components: client/ server system, enterprise-wide database and modules. The attributes in the analysis of ERP systems include client, webserver, application server, database server, system architecture and business-enabling functions. The researcher performed an ERP and ECM system analysis based on the organisation's ERP documentation and its architecture on the architectural representation of the architectural depiction. ECM has been described from four dimensions, namely: content, technology, processes and enterprise. The content dimension includes identifying and organising content and usage by the employees. The technology dimension includes systems and hardware needed for content management support while the process perspective focuses on the implementation of business processes to standardise the way content is handled from beginning to end while the enterprise perspective includes business operations in the industry to ensure the organisation remains economically competitive and functional (Hoëseb & Seymour 2017). From a technical point of view, key components of ECM include document management, image processing applications, workflow/ business process management, records management, web content, social content and extended components (Hanseth et al 2004). The researcher performed an ERP system analysis based on the organisation's ECM documentation and its architecture on the architectural representation of the architectural depiction. The ERP and ECM architecture documentation was obtained from Rand Water internal filing system shared by the architecture personnel without revealing any information that would be considered confidential and not relevant to the study.

c) Documents analysis

Another data collection method that was adopted for this study is the use of documents. The documents include but are not limited to: letters, memorandum, emails, minutes of meetings, written reports, proposals, internal records, newspaper articles, presentations etc. According to Yin (2014), case study research uses documents to support the analysis that is originally extracted from the interview analysis. Additionally, including documents as part of the analysis assists the researcher in providing the other sources of information. A variety of sources support the accuracy of the findings, which would support the validity of the study. This study used documents obtained from the organisation and South African governance document sites as another form of data collection.

The following documents were intended to be analysed:

i. SA Constitution, 1996, section 195
ii. The NARSSA Act (Act No 43 of 1996, as amended)
iii. The ECT Act (Act No. 25 of 2002)
iv. Rand Water Records Management Policy
v. Rand Water Annual reports

The other part of the document analysis used in this study included archival records. These are described as computer files and records such as public use data, organisational records, demographic information in context (country, region, organisation, etc.), and the data that are publicly and readily available in libraries or on the World Wide Web (Yin 2014). Archival records were useful for case study building since they provided context information. In this study, the researcher in the document analysis considered the type of the documents they were, who produced them, the date when it was produced and the historical context of the documents. The analysis further considers the reason why the document exists and the motivation to the production of the document and what kind of information could be found in the document that is in line with the current study. The researcher also used the annual reports, Rand Water records management policy obtained from the library and organisation's website and the South African Acts from the government website to collect data that relate to the ECM, ERP and regulation compliance required to ensure that proper governance is in place. The researcher remained careful, critical and curious throughout the document analysis in the study. The analysis of the documents (i.e. on SA Constitution of 1996, NARSSA Act and RW Records Management Policy) was done from a context of the legal framework where clauses bearing governance of electronic content were identified. In the annual reports, compliance and the evolution of electronic content management in the organisation were identified.

3.7 Trustworthiness of research data

For qualitative researchers to have confidence in their findings, they rely on trustworthiness. Trustworthiness is an attempt to give comfort on the question of whether the findings can be trusted (Korstjens & Moser 2018). In quantitative studies, researchers consider reliability, objectivity and validity to ensure the trustworthiness of the study findings (Anney 2014). There are several definitions and criteria of trustworthiness but the best-known criteria are credibility,

transferability, dependability and confirmability well defined by Lincoln and Guba (1985) (Korstjens & Moser 2018) which are expanded on further below.

3.7.1 Credibility

Credibility is the equivalent of internal validity in quantitative research concerned with the truth-value. It is established if the study findings represent plausible information drawn from the participant's original data and that is a correct interpretation of the participants' original views (Korstjens & Moser 2018). The researcher establishes an inquiry by adopting credibility strategies. These strategies that ensure credibility of the study are prolonged engagement, persistent observation, triangulation and member check (Anney 2014). The researcher maintained credibility when reporting a qualitative study by ensuring a lasting presence during long interviews with participants during data collection. The researcher invested adequate time to become familiar with the setting and the context to test for misinformation, building trust and getting to know the data to attain rich data. This approach ensured that the prolonged engagement strategy is applied to achieve credibility. Characteristics and elements that were relevant to the integration of ERP into ECM at Rand Water were focused in detail as to apply persistent observation (Anney 2014). Spending an extended time allowed participants to adjust to the presence of a researcher and to satisfy themselves that they can contribute to the research objective (Guba 1981).

Data triangulation was also completed to address credibility. Triangulation enhances credibility by using or involving different or multiple methods to answer the research questions. Triangulation helps the researcher to reduce bias and it allows the cross-examination of the integrity of the participants. This researcher achieved triangulation by using interviews, document analysis and systems analysis of ERP and ECM at the organisation, being the study case (Anney 2014; Korstjens & Moser 2018). It is to be noted that the researcher was an employee at a managerial level at the time of this study, however, the bias was managed closely to ensure that trustworthy credibility remained intact (Leedy & Ormrod 2014). Member checking also assisted the researcher in ensuring that credibility is maintained. Member checking happened when data and interpretation were tested continuously as derived from different participants through interviews for data collection (Guba 1981). It was deemed to be a crucial process that any researcher should perform because he understood the heart of credibility. It also strengthens the data since the researcher and the participants view data with

different lenses (Anney 2014; Korstjens & Moser 2018). The researcher did member checks by asking participants to verify some of their statements and participants were fine with the member-checking process conducted comfortably.

3.7.2 Transferability

Transferability refers to the degree to which the qualitative study results can be transferred to other contexts with other participants. Guba (1981) refers to transferability as generalisability which is dependent on the degree of similarity between two contexts. It is concerned with the aspect of applicability. The researcher used thick description to demonstrate the study's findings where the participants were purposively selected to facilitate the transferability of the study. Purposive sampling as described in section 3.5 is also described as selecting individuals based on specific purposes associated with answering the research study questions. The context was also described to become meaningful to the reader or an outsider (Anney 2014). Anney (2014) further explicates thick description as enabling judgements about how well the research context fits into other contexts. This means rich and extensive details concerning methodology and context being included in the research study report. The thick description involved that the researcher elucidates all the processes from data collection, the context of the study to the final study report. Thus, to ensure the transferability of a qualitative study, the researcher collected thick descriptive data that allow the comparison of the context to other possible contexts, which transfer might be considered. The researcher achieved transferability by ensuring that research context on interviewees in different categories as selected, their responses were also considered in the context of other participants. The total number of fourteen interview sessions lasting an average of +-35 min were achieved during the interview period spread within an average of two months in total.

3.7.3 Confirmability

Confirmability refers to the degree to which the results of the study can be confirmed or corroborated by other researchers. It is concerned with establishing that data and its interpretation of the findings are the imaginations of the researcher, but that they are derived from the data. It is also proposed that confirmability can be achieved using an audit trail, reflexive journal and triangulation. The purpose of the audit trail is to provide evidence to show that the researcher simply did what he sought to find (Anney 2014). Confirmability description

can also be demonstrated by how conclusions and interpretations were established and exemplified to confirm that the findings were derived directly from the data (Guba 1981). The researcher established confirmability using NVIVO where an audit trail was automatically kept. This NVIVO audit trail highlighted every step of data analysis that was made to provide a rationale for the decisions made. It was in the audit trail that the processing of the inputs from the participants was reviewed in conjunction with each other to enable the researcher as much as possible to remain objective.

3.7.4 Dependability

Dependability refers to the stability of the study findings over time. It involves participants evaluating the findings and the interpretation and recommendations of the study to ensure that they are all supported by the data received from the participants (Anney 2014). Dependability includes aspects of consistency as there is a need of a researcher to check whether the analysis process is in line with the accepted standards for approach (Korstjens & Moser 2018). The researcher may establish an audit trail to provide clear documentation of all research decisions and activities. The researcher can also use an external auditor to review their study. The goal of establishing the audit trail and involving an external auditor is to ensure examination of the process and the product of the study and determining trustworthiness (Creswell & Miller 2000). The researcher achieved dependability using NVIVO to keep the documentation of each step taken in the research process to ensure that the study is repeatable. The researcher established an audit trail on the NVIVO system used to perform thematic analysis in this study.

3.8 Data analysis and the analysis tools

The use of the qualitative descriptive approach as descriptive phenomenology, content analysis and thematic analysis remains suitable for researchers who wish to employ interpretation that is not as high as the one involving grounded theory and hermeneutic phenomenology. Thematic analysis, qualitative content analysis and other analytical qualitative approaches resulted in the use of titles such as phenomenological thematic analysis or thematic content analysis. Content analysis is defined as a systematic coding and categorising approach used to explore a large amount of textual information. It is thematic as an independent qualitative descriptive approach is defined as a method for identifying, analysing and reporting patterns (themes) within data. Qualitative researchers have become more familiar with thematic

analysis as an independent and reliable qualitative approach to analyse qualitative data (Vaismoradi, Turunen & Bondas 2013).

The data analysis method in this study applied thematic analysis. Attride-Stirling (2001) explicates thematic analysis as a way of organising a thematic analysis of qualitative data. Thematic analysis is a qualitative type used to analyse classifications and present patterns that relate to data. It involves the search and identification of common threads that extend across an entire interview or set of interviews (Vaismoradi et al. 2013). Thematic analysis was chosen for this study due to data interpretation, deductive and inductive approaches, analysis of two different types of phased data (understand current practices of any individual), coding and categorising (Alhojailan & Ibrahim 2012). It was fitting to the study as it seeks to explore using interpretations and because of its systematic element of data. It is also appropriate to the study due to its ability to offer an opportunity to understand the issue of integration more widely (Alhojailan & Ibrahim 2012). NVIVO is a qualitative data analysis tool used to manage empirical data. The data primarily consists of documents containing qualitative text such as interviews and observation notes. It is also used in document analysis such as reports, websites, emails and other sources, including images (Beekhuyzen 2007). As the analysis tool, the NVIVO application was used for this study.

In summary in line with Table 1 in the article of Vaismoradi et al. (2013) when performing thematic analysis in this study, interviews were conducted and the audio-recordings were transcribed into documents. The transcribed data were read and re-read to take note of the initial ideas. Codes were then generated with the use of the NVIVO qualitative analysis tool. The codes were collated to identify the potential themes, all data relevant to each participant were gathered accordingly. Themes were reviewed to generate a thematic map with the refining of the overall story told by the analysis, clear definitions and names of each theme were generated. Categories and themes formed a coding index which was used to organise the data set from participants. NVIVO was used more intuitively with the process of tagging data into relevant categories moving away from a paper-based exercise to directly coding in NVIVO. The first stage of more in-depth analysis was through NVIVO as it facilitates preliminary thoughts that emerge across cases and develops linkages between categories and initial themes as it retains the original data (Smith & Firth 2011). This process of thematic data analysis was suitable for this study. In summation, the explanatory single case study research

strategy was adopted as it enables the investigation of the phenomenon that explains how the inter-linked factors affect the integration of ERP into ECM at Rand Water.

3.9 Ethical consideration

According to Resnik (2011), ethics is commonly defined as norms of conduct that are used to distinguish between acceptable and unacceptable behaviour. Ethical norms serve the aims or goals of research and it would apply to individuals who conduct scientific research or scholarly or creative activities. Among the specialised disciplines, research ethics is also listed and it studies these norms. There are several reasons for justifying the need for adherence to ethical norms in research:

i. Norms promote the aims of the research, such as knowledge, truth and avoidance of error or minimisation of error. An example could be the prevention of fabrication, falsifying, or misrepresenting research data.
ii. Ethical standard endorses the promotion of values that are essential to collaborative work such as trust, accountability, mutual respect and fairness. These could be among many norms in research, guidelines for authorship, copyright and patenting policies, data sharing policies, and confidentiality rules in peer review, they are all designed to protect intellectual property interests in the interest of collaboration.
iii. In many ethical norms, researchers can be held accountable to the public. Guarding against misconduct, conflict of interest, human subjects' protection and animal care and use.
iv. Norms of research promote important moral and social values such as social responsibility, human rights, animal welfare, and compliance with the law, health and safety.
v. Where ethics lapses in research, there can be significant harm to human and animal subjects, students and the public (Resnik 2011).

Unisa's Policy on Research Ethics (2013) objectives states that it is not intended to restrict or discourage research in its university, but to enable researchers to enhance their capability to undertake ethical research while maintaining their independence, especially when confronted by undue influence or pressure that might compromise their integrity or that of their research. The policy further states that the rights and interests of human participants should be protected in research. This was quite relevant and important where the information collected had the potential to invade the privacy and dignity of participants. The participants in the research interview have the right to be treated with respect, dignity and, where possible, gain some

benefit from the research. Thus, the researcher complied with the Unisa ethics committee where there was a need to abide with the forms on ethics information and informed consent forms (See Appendix B for the research ethics certificate). Oates (2006:55) states that the rights of the participants include the following:

i. Right not to participate
ii. Right to withdraw
iii. Right to give consent
iv. Right to be anonymous
v. Right to confidentiality

In a presentation by Schellnack-Kelly (2016) in the department of information science at Unisa, she highlighted the following points in the code of conduct document:

1. It has been approved by the Unisa council as it sets out the university's values and standards of ethical standards.
2. Solid ethical foundation to create a respectful environment to enable people to constructively contribute to achieving the university's vision and mission.
3. Promote four core values – integrity, accountability, excellence and respect.

The researcher also received permission to do the study from Rand Water which allowed him to collect data through interviews conducted among the personnel in the organisation (See Appendix C for the permission letter). The thesis was submitted for Turnitin to ensure a low similarity index and that all sources used were cited. All participants were informed that their participation was voluntary and information shared will be treated as confidential. Furthermore, the information collected were used only for this study.

3.10 Evaluation of research

All research methods are likely to have some challenges and imperfections (Leedy & Ormrod 2014; Ngulube 2005). The evaluation of the research methodology assists to explain the errors, biases and difficulties that would have affected the collection of data, including the analysis (Ngulube 2005). Reflecting on the research methodology used, it was essential because it enlightens the reader(s) as to what information was needed and how it was collected and analysed, including the advantages and pitfalls of using the research procedures (Ngulube 2005). Failure by the researcher to communicate errors and difficulties encountered during the

research process constitutes a serious defect in the data and may create a false impression about data. According to Jabar et al (2014), research methodology explained how and when the research is executed and it provides reasons why a specific method of data collection, the material utilised and an evaluation tool are utilised. The researcher used a qualitative methodology, as qualitative research was conducted. It should be noted that qualitative research is also limited (Chetty 2016).

All research methods have their strength and weaknesses. There were several challenges during the interviews with the participants. At times, it was difficult to book appointments with some of the potential participants even when the appointments were changed due to the urgency of their operational work. There were also times when there would be a misunderstanding of questions relating to the technical level of the ERP and ECM. Other times, the participants would continue to give an answer that is not specific to the question. The researcher overcame these challenges by going back to the participants as per the newly arranged interview appointment. As for the long-wounded answers, the researcher allowed the long answers but tactfully realigned the participant back to answering the question. The researcher took notes on the interview sheet and made use of a recording device (i.e. apple tablet) and collected the documents for further analysis to achieve system analysis for the study.

3.11 Summary

This chapter discussed the methodology and explained the rationale for utilising interviews as a data collection tool as well as documents to be considered at Rand Water. The discussion was informed by the research problem at hand. The study population was discussed with the interview schedule proposed. The chapter also looked at trustworthiness, as well as how ethical issues concerning the study were considered. The next chapter (Chapter Four) focuses on the presentation of results obtained via interviews with selected officials from the water utility and analysis of the documents to be reviewed during the data collection period. The next chapter provides a thematic analysis of the results in relation to the integration of ERP into ECM at Rand Water. The case study was on the exploration of the ERP and ECM systems in the organisation. The researcher explained thoroughly the most relevant issues that served this research objectively.

CHAPTER FOUR
PRESENTATION OF DATA

4.1 Introduction

The previous chapter provided the path to finding answers to the research questions by justifying the research methodology. The path guided the scientific enquiry to organise and increase knowledge about the phenomenon being studied. In this regard, the aim was to assist the reader to validate the results of the study (Creswell 2007). This chapter presents the results of the data obtained via interviews, system analysis and document analysis. The qualitative data were organised and were based on the thematic analysis in line with the research objectives guided by the Actor Network Theory (Chapter One). The ANT concepts used were based on translation that encompasses problematisation, interessement, enrolment, actors and actants, global actors, irreversibility and mobilisation (Chapter Two). Data was analysed using NVIVO software in line with the research objectives guided by the ANT (Chapter Three). This led to the development of themes to identify and interpreted clusters of meaningful patterns from data (Saunders et al 2008). The overall aim of deploying the thematic analysis was to identify and interpret meaningful patterns out of the collected data that could sufficiently address the research objectives (Alhojailan & Ibrahim 2012). The developed themes were then interpreted to provide an in-depth understanding of each phenomenon to derive helpful pieces of information that can contribute positively to fulfilling the objectives and aims of the research. Given the objectives of this research (see section 1.4 in Chapter One), the researcher was mainly concerned with identifying related elements that are key to achieving an integrated ERP into ECM system environment in the study. Data are presented as per the objectives of the study.

4.2 Participants' profiles

Many researchers are concerned about the need for their findings to be generalisable to a wider population. They often find themselves battling to justify the applicability of their findings to another comparable context. While there is consensus regarding what should be an adequate response percentage of return or response percentage, most scholars are of the view that the higher the response rate, the more representative the sample (Bhattacherjee 2012). It is, however, argued by Creswell (2007:126) that is not about the size of the sample but reaching

saturation in data collection. Purposeful sampling is used in qualitative research because the researcher selects participants that inform an understanding of the study problem and central phenomenon in the study. The researcher needs to decide who or what should be sampled and how many participants need to be sampled (Creswell 2007:125). The participants in this study were selected purposively because they fitted the desirable criteria according to the researcher. Purposive sampling is beneficial because it may be adjusted to accommodate snowball sampling which is a technique in which the data collected at a point in time would indicate which other interviewees are needed to achieve the richness of information (Creswell 2007; Henning, van Rensburg & Smit 2004). The current researcher was not worried about the number of participants but rather about the coverage of the concepts relevant to developing an acceptable framework for integrating ERP into ECM at Rand Water.

The researcher obtained responses from participants that were satisfactory and offered an in-depth understanding of the study (Patton 2002:46). The participants were from various departments in the case study organisation offering different perspectives in response to the interviews. These interviews were semi-structured and were used to gather data from interviewees. The investigator prepared an interview schedule containing questions listed according to the objectives of the study. The questions were mainly used as a guideline for the interview because they were never asked in the same sequence and, in most cases, not all questions were asked. The flow of discussions determined which questions were asked and which ones were left out so that there were no interruptions. The questions asked were aimed at addressing the research questions of the study. It should be noted that this study is interpretive and thus did not set out to test hypotheses or to generalise the results, but to explore the meaning placed on issue(s) under investigation. Interviews were conducted primarily in the participant's offices and two were conducted in the researcher's office as there was no neutral and open office to use at the appointed time of the interview appointment.

Before the actual interviews, the researcher explained to all participants the purpose of the study. The participants were informed that participation was voluntary and that they had a right to discontinue the engagement at any point they feel uncomfortable during the interview. The participants were further ensured that they will remain anonymous and that confidentiality will be kept always. None of the participants was quoted or identified with any of the responses recorded. The areas of work of the participants were as follows: records management, finance, HR, strategic asset management, internal and IT audit, and IT work areas. The levels varied

from executive to records administrator. Where the participant mentioned the name of a colleague or a specific job title, the researcher coded it using a pseudonym or job title. The researcher interviewed a total of 14 participants to achieve the objective of this study as detailed in Table 4.1.

Table 4. 1 Participant's profile and level in the organisation.

Participants	Participants roles	Level in the organisation
Participant A	Portfolio Executive	Group Executive
Participant B	ICT and Information Management	General Management
Participant C	No department but section – Training Information Systems, Wellness, All HR transversal – ER, Talent Acquisition, All site HR functions.	Senior Management
Participant D	Financial planning and financial control. The other one financial control, is debtors, creditors, payroll and compliance and reporting.	General Management/ Executive
Participant E	Audit	General Manager
Participant F	Projects Planning department Section is a Design office	Middle Management
Participant G	IT Audit	Middle Management
Participant H	Project Controls	Middle Management
Participant I	Records and Knowledge Management	Senior Management
Participant J	Records department	Management
Participant K	IT Applications (Project Management and Integration)	Middle Management
Participant L	GSSE, Working as executive compliance support.	Manager in the Office of Executive
Participant M	Electronic Content Management.	IT ECM technical
Participant N	Records Management Department	Records Administration

The profile of these participants offers the researcher input from various operational perspectives in the organisation. This further offer richness in the analysis of the results to reflect levels and areas in business where there be more emphasis on the objective of the study.

4.3 Data presentation

In this study, the results are presented through written descriptions according to the research objectives. The broad objective of the study was to explore the integration of ERP into the ECM system at Rand Water to develop a system integration framework to ensure improved productivity and efficiencies in operations. The specific objectives were to:

i. examine the effects of operating ERP and ECM independently at Rand Water
ii. examine the value-add of integrating ERP into ECM at Rand Water
iii. examine factors stimulating and inhibiting integration of ERP into ECM at Rand Water
iv. determine the integrating strategy for integrating ERP into ECM at Rand Water
v. propose a framework for the integration of ERP into ECM at Rand Water.

The study results are presented in themes to adequately address these objectives. The following themes are discussed:

i. Effects of ERP and ECM on business operations at Rand Water.
ii. Value-add of integrating ERP into ECM at Rand Water.
iii. Stimulating and inhibiting factors for an integrated ERP into ECM at Rand Water.
iv. Governance of electronic content in ECM and ERP at Rand Water.
v. Integration strategy for integrating ERP into ECM at Rand Water.

Some of these themes presented results that addressed more than one objective. Elaboration of each theme and the objective(s) it addresses are included in the data presentation discussion. In the presentation of the results, it should also be noted that where the was no answer, repetition of the answer or the participant did not answer directly, the data are omitted but is noted in the analysis to indicate a lack of understanding.

4.4 Effects of ERP and ECM on business operations at Rand Water

This theme presents results to address the first objective, which was to investigate the effects of operating ERP and ECM independently. As mention in Chapter Two, this objective covered the concept problematisation in the ANT concepts. In the interview schedule, the researcher asked interviewees questions relating to modules used in their work environment relating to both ERP and ECM (i.e. technical actors). It was also the intention of the researcher to obtain an understanding of the known effects of working with these systems independent of each other and the participants' opinion of what would be the benefits in their area of work if they were to be integrated. Before finding out about the questions relating to objective one, the participants were asked about the system they use between ERP and ECM or if they worked with both. In this objective, the question was about the benefits of ERP and ECM being

integrated versus not being integrated. It was noted that most were using the systems to a limited extent. Participant (K) responded that:
Mostly ECM, ERP as well, but we just in the front end. Leave approvals. I release requisitions, approve decision gates on PPM.

While the other participants did not know the usage of ERP (they only knew ECM, one participant (N) responded by saying: *It's more of a FileNet system were using it for capturing.*

It was also noted that some of the participants expressed an opinion that they were using both ERP and ECM. Participant (L) responded that:
I work with both (SAP and FileNet).

It was also noted that some of the participants expressed an opinion that they were using both ERP and ECM. Participant (C) responded that:

We use mainly ERP as you mentioned SAP. ECM is a project in waiting since 2013.

It was also noted that some participants preferred to give a long explanation rather than a short direct answer. The researcher allowed that to ensure that the participants are comfortable and express themselves freely.

4.4.1 Modules utilised in the ERP and ECM applications

As discussed in Chapter Two in the literature, there are several modules in the ERP and ECM being actors in ANT concepts. The investigator sought to find out which modules were used in the work area. The participants were asked to list the modules they work within the context of ECM. The answers varied and in some instances, participants were not aware of the module used and said, *I don't know if FileNet has modules, not sure, we don't really have a module*. The modules that were mentioned by participants for ERP and ECM during the interviews were as follows:

i. For ECM: ERM, website and intranet, risk management, document management, records manager, content manager and workflow
ii. For HR ECM: e-recruitment and exit surveys

iii. For ERP: finance, projects, SCM, HR, plant maintenance

iv. For other related systems: CRM and GIS

4.4.2 ECM module used in the area of work

For the question "Which module(s) of ECM are you using in the area of work?", the participants indicated the following modules: limited BPMS, risk module, internal audit, records manager, content manager with a little bit of workflow, document management and web content. In the next question, the researcher sought to find the components in the ECM module that are being utilised. As mentioned in Chapter Two, architecture is the fundamental organisation of a system, embodied in its components, their relationships to each other and the environment, and the principles governing its design and evolution (Winter & Fischer 2007). ECM's technical components include "database for creating and storing virtualised and versioned component (media, text, formatting) of every document (website, newsletter, portal); templating software for capturing and applying standard formatting to the text in unstructured documents; business rules and roles for workflow; and web server for delivery" (Iverson & Burkart 2007:6). It was noted that this question was almost not answered as the participants mentioned modules and not components and in other areas, they did not answer about the modules and systems and applications in SAP and ERP. One participant (K) responded that, *Capture, obviously retrieval, and also disposal.* In the quest to establish the benefits of the modules or components used, the investigator followed up to collect data on the role of ECM modules in the area of work.

4.4.3 The role of the ECM and ERP modules used in the area of work

In answer to the interview question "What does ECM module(s) help within your area of work?", the participants identified several benefits of ECM modules that were asked about in the previous question. They identified management and governance of information, ability to make business decisions, ease of retrieval, publishing, sharing of information, preservation of information, disposal and which information can be archived for a longer period. Participant I mentioned that *It enables me to make to make the corporate records, find and direct information and to engage with internal and external stakeholders*.

The investigator noted that based on the responses, the benefits of the ECM module(s) are acknowledged and valued. ECM module(s) do support their area of work to achieve a better level of productivity. This agrees with the discussion in Chapter Two where the water utilities achieve ease of retrieval, productivity and improvement of services.

Since the study is about the integration of the two systems, ECM and ERP, the researcher sought to know the modules used in ERP.

During the interview, the question "Which modules of ERP are you using in your area of work?" was asked. The participants indicated that they are using SCM, HR, plant maintenance, SAP ESS, PPM, costing (CO), ESS and MSS. These are in line with the modules mentioned in section 2.2.1. Participant B mentioned CRM and GIS that are not modules of ERP in the comparison with the responses of other participants. In section 2.2.1, modules are well depicted in Figure 2.1 and GIS is not included in the literature discussion.

The investigator sought to understand what the module(s) of ERP helps the participant within their area of work. The discussion below presents the findings in the context of the question asked.

4.4.4 The usage of the ERP module(s) in the work area

In response to the question "What does this ERP module(s) help with the area of work?", the participants mentioned that the ERP assists with HR functions such as leave, ESS/MSS, projects, procurement process, and reduced turnaround time for recruitment and administration. Participant J summed it up by saying, *Is more of efficiency as well as controls, reporting budget, budget tracking.* The ERP in this question was identified as SAP with different modules in the organisation. The participants have shown that there is an understanding of what the help in the use of ERP in their area of work was.

The investigator understood in the context of integration of the two systems the functional effects of working with ERP and ECM not integrated. The discussion below presents the results:

4.4.5 Functional effects of ERP module(s) not integrated with ECM module(s)

As mentioned in Chapter Two, the effects of ERP modules and ECM not integrated are not beneficial to the organisation as the organisation forfeits the potential return on investment in terms of efficiency and productivity in business processes. ANT concept of problematisation refers to the lack of integration of ERP into ECM. During the analysis of the systems, the functionalities were noted in ECM (FileNet) which were that the Workplace provides access to document management features such as adding, and updating, rerouting tasks, launch and workflows. Records manager provides chronological and event-based retention types while the content manager provides services such as classification and indexing of an object, user authentication and authorisation, event processing, storage, deletion and retrieval of content. Process engine uses content engine for user authentication as this simplifies its installation and administration (Rand Water IT team 2012).

During the system analysis, the following functionalities for ERP (SAP) were noted as:

vi. human resources functionality enabling engagement and termination of employees enabling to leave taking, payroll and training
vii. finance functionality enables the management of corporate finances
viii. supply chain functionality enables the procurement processes
ix. projects enable the management of capital projects in the organisation (Rand Water records).

In responding to the question “What are the functional effects of working with ERP module(s) not integrated with ECM module(s)?”, the participants highlighted efficiency, completeness and trustworthiness (authenticity and quality of electronic records). In their responses, it was noted that the talent acquisition process would not be efficient. The potential risk of data manipulation was also noted to be a disadvantage of not integrating ERP into ECM. The manual interface would be allowed to take place. It was also noted that the fragmentation of information could result in having gaps in the information flow and the destruction policy is not applied consistently when there is a lack of integration. It should also be noted that contrary to identifying a lack of integration as a negative, two of the participants are proponents of not having integration of ERP into ECM as the job requires the usage of mainly FileNet and just the financial report on the ERP system. The other reason some prefer it not integrated is that in the audit area, the system is used for audits (i.e. Barnowl). This remains a different system

not needed to be integrated with SAP to fulfil the audit job. The elements of workflow, data exchange, the role of each system, the interaction and relationship of the actors (both human and non-human) reveal what could be the factors of consideration in the study (Leikums 2012). This is a contradiction with Medina (2014) as discussed in Chapter Two who states that it is highly beneficial to the organisation when ERP and ECM are well integrated and delivered according to the business objective or need for efficiency and productivity.

Participant J, being a manager in records section, has no issues working with ECM and ERP not being integrated as stated, while the majority in this sample states that there are several challenges if they are not integrated. *I am quite happy to do my FileNet work and ones that is done and then do my financial report.*

In the same context of integration of ERP into ECM, the investigator wanted to obtain an understanding of the benefits of having an integrated ERP and ECM in their work area. The discussion below presents the responses from the participants:

4.4.6 Benefit of integrating ECM module(s) to ECM module(s) in the work area

From the discussion in Chapter Two, it was noted that it is always beneficial to have the ERP and ECM integrated. In comparison to most participants' responses to the question "How will integrating ERP module(s) to ECM module(s) benefit your area of work?", it is generally conceded that integration is important as the quality of data is improved through the principle of capture once (taken from participant B as quoted below) and one point of access to information. Participant B (being at an IT GM level) coined the response very creatively as "principle of capture-once". A similar view was expressed by participant A who is at an executive level and who highlighted the importance of systems talking to each other as the key benefit of integration.

One of the responses to the question was that information is more accurate when there is the integration of SAP and FileNet. Another point in the responses highlighted the enhancement of compliance with the legislative framework and the knowledge of where the information is located. It was also noted from the responses that time reduction is expected as well as the completeness of the information. Integration of ERP into ECM is expected to improve the paperless environment and validity of records, according to all the participants. Participant K

said that *Keeping one truth is very important, for me.* The responses from the participants indicated that it is beneficial to have ERP into ECM integrated for several reasons, such as using less paper, improving productivity, having a central repository leading to compliance with legislative framework, keeping to one version of the truth that is complete, and accessibility of information will become immediate.

4.5 Value-add of integrating ERP into ECM at Rand Water

As mentioned in the first chapter, the integration of ECM and ERP enables the organisation to deliver according to its business objective or its needs for efficiency and productivity (Medina 2014). This was demonstrated by the participant's responses when asked about the benefits of the integration of ERP into ECM; these results are represented under the question about the key role player in identifying opportunities to integrated ERP into ECM. The results from the participants elevate the importance of integration of these two systems. Participant N highlighted the validity of records in systems to stand, for example, litigation purposes and ensuring that the validity of records is consistent in all systems where it exists.

The benefits as presented amplify the motivation of this study to assist the organisation to realise the positive impact of an integrated ERP into ECM. In addressing the first objective, the researcher identified the effects of running ECM and ERP independently. The researcher is satisfied that the participants shared their professional experiences of not having an integrated ECM and ERP, which in summation is less productive. As said by participant A again during the interview *You find that those systems are not talking to each other and are giving different results*.

Based on the results, the challenge of having to upload data from the meter reading process would be resolved with integrated systems, as per participant E. The same participant also emphasised that without this integration, there is no guarantee that the information will be accurate. It can be deduced that the value of information accuracy will be realised when these two systems are integrated. As phrased by participant L:
Keeping one truth is very important.

This simply means that the information in the organisation ought to be consistent throughout the systems it resides and moves across.

The reduced risk exposure is another value-add noted in the results as mentioned by participant A: *And even exposing the organisation to a risk in terms of information or results, they present.*

It can be understood as the organisation's inability to ensure that it sustains its financial, operational and legal reputation. Locating where the information resides becomes easier, according to participant N, in that the information repository is centralised and easier to manage and control with a right level of access to information. The results discussion on the value-add of integrating ERP into ECM at Rand Water leads to the next theme in line with the two objectives of this study. The next section discusses the theme: Success factors for an integrated ERP into ECM.

4.6 Stimulating and inhibiting factors for an integrated ERP into ECM at Rand Water

This theme presents the results of the third objective which is divided into two. These sub-objectives are: examining factors stimulating integration of ERP into ECM at Rand Water and examining factors inhibiting integration of ERP into ECM at Rand Water.

As highlighted in Chapter Two that stimulating and inhibiting factors focus on the key areas that influence the ERP into ECM integration to ensure that the business can flourish and the business objectives are realised. The ANT concepts (enrolment, interessement and focal global actors) are implied in the questions asked in line with objective four.

In line with the two sub-objectives relating to factors stimulating and inhibiting integration of ERP into ECM, the investigator asked questions to the participants and their results are presented below.

4.6.1 Factors stimulating the integration of ERP into ECM

The discussion under this theme covers objective number three and the sub-question on stimulating and inhibiting factors: "What opportunities exist for integrating ERP and ECM at Rand Water?" The investigator took the participants through a few questions to get their input to this objective. The results are presented in the below section.

4.6.1.1 The potential opportunities for integration of ERP into ECM

Chapter Two discussed that the stimulating and inhibiting factors focus on key areas, in this case, integration is the key objective. The question *What are the potential opportunities for the integration of ERP and ECM in your opinion? was answered in the below:*

i. Timeous opportunity, availability of accurate information enabling decision-making.
ii. Content-specific processes or workflow deemed as significant.
iii. Getting one version of the truth, meaning to be compliant with the different contracts to receive value for money when negotiating well in advance. Document control supporting the business during the audits.
iv. Organisational growth and moving away from existing standalone systems to more integrated systems as there is no support for old systems.
v. Breaking down of information silos in the company.
vi. Compliance with the legislative framework.
vii. The one opportunity also noted usage of less paper, making it much easier and saving a lot of time.

The participants' responses do indicate that they are aware of the opportunities available to have ERP and ECM integrated. The one version of the truth of electronic documents can be found in some of the responses from the participants such as D, while E sees a huge potential in having an integrated system that is beneficial to the organisation.

Next, the investigator sought to find who the key role players in identifying the opportunities for integrating ERP into ECM are as represented below. In line with the ANT concept of global focal actors, the question asked to the participants reveals who is deemed to be the key role players.

4.6.1.2 Key role players in identifying opportunities to integrate ERP into ECM

ANT concept of focal actor as mentioned identifies other actors and their interests and attempts to satisfy them while suggesting actor network roles for them. During the interview, the question "Who are the key role players in identifying the opportunities for integrating ERP and ECM in your opinion?" The statements below present the responses that were given by the

participants. They mentioned the following regarding the key role players in identifying the opportunities for integrating ERP and ECM:

i. IT practitioners, finance teams, SCM, legal and auditors are some of the key stakeholders. This agrees with one participant emphasising IT collaboration with business partners (e.g. IT and HR).
ii. Enterprise/ information architects.
iii. IT, supporting the various divisions/ departments in the company. External stakeholders, the board, the Department of Water Affairs and trade unions.
iv. Systems users, end users, representatives from different sections, departments and IT. Executives would mainly play a role in approving. The key people that would assist in identifying the opportunity would be the system users. People that are using the systems.
v. One of the participants mentioned the CE and the board since the non-integration of systems negatively impact on the organisation. This includes senior management since they have authority. It was also mentioned that although they are at the senior level, they need to understand the importance of content management of the organisation.
vi. The one participants said *I think it's IT, Records department of so they are the people that they are using the FileNet and other departments like procurement as we are dealing with their tenders most of the time and also Legal and HR.* This participant agreed with others that it is crucial to have collaboration with other parties in the organisation.

The participants identified the key role players in ensuring that integration of systems is achieved. Participant M summed it up by saying:
I think, all of us in the organisation, it's all our responsibility more particularly in relation to senior management and executives because they have the authority…

In some instances, most were specific about those that need to play a key role in identifying these opportunities, the most commonly mentioned among all is IT while one participant (L) mentioned the board and the CE.

Next, the investigator asked the participants about the influence of culture in the identification of the opportunities to the integration of ERP into ECM.

4.6.1.3 Organisational culture influence identifying opportunities to integrate ERP into ECM

Culture and change management were identified as stimulating and inhibiting (section 2.4). ANT concept refers to the enrolment of human and non-human enabled by inscription through the influence of culture to achieve integration the desired integration. The enrolment concept of ANT was revealed through change management enquiry. The question "To what extent can organisational culture influence the identification of opportunities to integrate ERP and ECM in the organisation?" was asked to the participants and the following were their responses:

i. Silo thinking and the resultant lack of collaboration are the most significant obstacles, as it results in a lack of business process integration, systems integration and an enterprise view of content.

ii. HR senior manager gave a proverbial answer to the question and said: *I think the proverbial phrase that says, culture can eat any strategy for breakfast. The participant continued to say: If people don't see the benefits to what you are introducing because it might bring a culture shock.*

iii. Culture can influence or derail. People who can engage are needed.

iv. It was mentioned that people fear change, but they should know that change is good and that things change. Now there is talk of globalisation, which might be left behind because of the organisational culture not wanting to change.

v. Another answer emphasised that there is a need for culture change, saying *the culture internally is that people tend to want to see physical things like a physical document.*

vi. Each organisation has a different culture, if you want to achieve integration between ERP and ECM, you need to understand how what are the weak and strong points of the organisational culture.

vii. It was agreed that there is a need to firstly change the culture. This was mentioned by a participant saying, *because anything you bring, if culture is not there, it won't fly, so it's quite critical for firstly to start with change management and obviously start with the leadership.* Because, for the success of ERP and this integration, it first has to be adopted by management, leadership must lead and it has to be done through change management.

viii. Organisational culture very big aspect. One participant said that *What I have seen in organisation is that there is a bit of slowness. A bit of rejection of new ideas.*

ix. There was an opinion that said that culture is the base of integration. If the culture is pro-IT, it becomes much easier.

x. The Records Administrator, in agreement with the sentiment that culture is important to achieving integration of ERP into ECM, highlighted that the current organisational culture impedes it because different departments work in silos and there is no or little collaboration between them.

One participant, being an executive in the organisation, responded by saying:
Channel utilisation of our systems must be embedded within the culture of the organisation as a tool for efficiency and productivity. So, when in our conversation we must have our culture as forward-looking, forward-looking culture, technologically in preparation for the 4th IR and beyond. We must and en-culture that in an organisation.

Based on the responses, the participants reflected their understanding by also mentioning examples related to their area of work and the organisation at large to what the influence of culture is on achieving an integrated ERP into ECM.

4.6.1.4 Other elements in the organisation influencing identification of opportunities to integrate ERP into ECM

The investigator wanted to know if there are any other elements in the organisation that the participants are aware of that would influence the identification of opportunities to the integration of ERP into ECM. The investigator asked a question "What are other elements in the organisation that have an influence in identifying the opportunities to the integration of ERP and ECM?" Some of the responses pointed to one element being the need to better satisfy stakeholders using technology to put confidence in the water bills given to the customers. The other elements noted in the responses were alignment to business needs, benchmarking (e.g. mobile app), the commitment of people or money and the tone from the executive level. It was also mentioned that there needs to be responsiveness to business needs, infusing of global trends, training, innovation and transformation.

One respondent from the audit area said, *It is important to continually review our processes, in our environment we always look at systems and the question is what system are we using?*

Participant K gave a very unique response by saying that *Corruption is one of those; resistance is one of those.* The response was quite different from others who responded to the question asked.

The other last responses pointed to Innovation Hub as an element that influences the identification of the opportunities to the integration of ERP into ECM. Another element had to do with believing in individuals' professions (educated or not) and experience, this is key.

The participants responded to this question to the best of their ability as it was meant to allow them to think more of any other contributory factor that they might be thinking of and have not mentioned in the previous responses. Since it was an open-ended question, their responses provided some level of richness in understanding influencers to the identification of opportunities to integrate ERP into ECM in the organisation. One that struck a chord as far as the researcher is concerned is the response of participant N:
IT Management dismisses them and they are not experts and it brings us back to that thing of people saying, 'please work within your space, work within your area of speciality, you are not an expert in that thing.'

This response is in the same as the response from participant M saying:
We need to believe in our professions, whether educated or not, we have the experience, we need to take them along all that we do.

4.6.2 Factors inhibiting integration of ERP into ECM

The discussion under this theme covers objective number three and the second research question: "What are the obstacles to integrating ERP into ECM at Rand Water? "This objective intended to examine factors inhibiting the integration of ERP into ECM at a Rand Water. The investigator took the participants through a few questions to get their input to this objective. The results are presented in the section below.

4.6.2.1 Obstacles from a technical side

The ANT concept of enrolment refers to the creation of a body of allies (human and non-human through a process of translating their interests to be aligned with the actor-network. The

investigator wanted to know the potential obstacles to integrating ERP into ECM from a technical side. The following statement from participants' answers to the question asked. This question "What are the potential obstacles to integrating ERP into ECM from a technical side?" was asked and the following responses were noted:

i. Incompatibility is still a theoretical risk or obstacle but is decreasing.
ii. Lack of desire and drive or strategic focus from our IT counterparts can be a drawback
iii. Lack of integration and working in silos.
iv. Technical people not taking the initiative to suggest systems that can assist users to do things better and more efficient.
v. Having technology that is not agile or you are buying or making decisions on ECM opportunities without considering the technical architecture of your ERP.
vi. From a technical side, skills, for example, removal of Autocad 2D and replace it with Rebit 3D people must now be upskilled on Rebit 3D to understand it can be an obstacle.
vii. Insufficient server capacity/ hardware.
viii. Servers that are not good and do not have sufficient storage. The network is not of an acceptable standard and the architecture is not well designed.
ix. Skillset is one of the biggest hindrances. One respondent said, "We need our people to be trained in modern ways".
x. Obstacles could be the fear of failure and not having the same platform, which leads to information not being shared. It could mean that there are no appropriate IT resources to perform these integration requirements.
xi. The vision was highlighted as important, particularly from leaders in the organisation. There is a lack of vision to automate systems such as SAP talent management system with end-to-end processes.

The responses were considered as addressing the aspect on the technical side, inclusive of the technical people and in some instances, they give the context in which they are answering the questions. Technical skills and lack thereof were noted in the responses, while participants such as manager in project control, records manager, IT project manager integration and records administrator were specific as to what technical obstacles they are aware of. They

mention servers, network, insufficient server capacity, hardware and not having the same platform.

4.6.2.2 Obstacles from a human side

The investigator proceeded to ask a question "What are the potential obstacles to integrating ERP into ECM from a human side?" The replies to this question indicated the following being the obstacles:

i. Lack of training is inadequate, insufficient and irrelevant.
ii. Silo thinking: as mentioned by one participant and supported by another, the silo mentality could be due to a lack of understanding of the company architecture.
iii. Lack of computer literacy.
iv. Change management for people using the system. They also might not be comfortable with a new integrated system. This is confirmed by the senior financial manager's words *I will need to look at our processes and procedures, especially the integration points. Because now lots of all processes must change to incorporate the tool.*
v. The statement by the manager in project controls highlighted an issue that relates to power: *The attitude must change definitely; System owners want power regardless of how things are done. They will tell you 'not here, not in my system'. I guess power runs to their head sometimes. They don't see good in changing or in integrating any system.*
vi. Lack of skilled people, skill set and attitude.
vii. Data duplication or throwing it out thinking that it is transferred to one system or the other. The comment by the audit manager emphasises this point by saying: *That there is a potential that you can actually not integrate well enough to have a continuous database. In some cases, you might find it difficult that you just say you start with this system. In some cases, you might find it difficult that you just say you start with this system. FileNet, Vault and SAP those are the ones we use.*
viii. Leadership not being supportive, corruption and culture. Two participants mentioned this.

The obstacles raised were in line with the critical success factors as highlighted in Tables 2.2 and 2.3 presented as opposites of what would be critical to achieving the success of ECM and ERP implementation.

4.6.2.3 Potential obstacles to integrating ERP into ECM from a non-technical and non-human

The investigator asked the question: “What are the potential obstacles to integrating ERP into ECM from a non-technical and non-human point of view?” It was noted that the question was not an easy one to answer as they sometimes referred to obstacles that are still technical and human in their responses. In line with ANT, the actors can be non-human and non-technical and still be able to form part of the integration network.

From their responses, it was noted that risk as cyber security extended to the operational technology (OT) side was highlighted as an obstacle towards achieving integration of ERP into ECM. The other potential obstacle mentioned was restrictive policies, compliance with policies, business processes, procedures and unaligned value chain, especially from the integration points. The other obstacle mentioned was compatibility of software, standards, organisational culture and lifetime licence issues.

Another potential obstacle mentioned was not an expected answer. The participants said that the was a serious human obstacle in that people fear change because they were scared they would lose their jobs. It was clear that some could not answer the question without thinking about technology or the human aspect. It was also mentioned that culture could play a role due to the love of power and the fear of IT.

It was interesting to note that participant B said the following:
Not having an enterprise-wide view of the digital technology and content landscape of the organisation, and not understanding it, not the value related to the integration of ERP and ECM across the organisation.

The participants emphasised the issue of culture, change, licence, standards and policies. The general manager: IT mentioned cyber security as an answer to the question relating to the non-human and non-technical obstacle. It is noted that the question was not easy for the participants to answer as they still mentioned some human elements in and technical issues in their responses.

4.7 Integration strategy for integrating ERP into ECM at Rand Water

This theme addresses objective four of the study. This objective intends to achieve the following in their order:

i. To determine the system resources for ERP and ECM integration at Rand Water.
ii. To examine the system architecture of the ERP and ECM at Rand Water.
iii. To determine compatibility and inter-operability of ERP and ECM at Rand Water.

Chapter Two discussed system resources for ERP and ECM, their architecture and compatibility from a literature review perspective. This section presents the results of the interview questions from the participants in line with this objective. The four ANT moments of translation (actors, interessement, enrolment and mobilisation) are observed in the responses given by the participants. The theme came through when one of the participants who mentioned during the interview that there is a need to have an integration strategy for integrating ERP into ECM in the organisation. This brought a consolidated thought on objectives (as opposed to the interview guide with six objectives, see Appendix A) of the study. The results are presented in this part of the discussion.

4.7.1 ERP and ECM resources for an optimally integrated system

The investigator wanted to know what technical resources are needed to operate ERP optimally to deliver the business objectives.

4.7.1.1 Technical resources needed to operate ERP and ECM optimally

The questions asked were “What are the technical resources needed in operating ERP optimally to deliver the business objectives?” and “What technical resources are needed to operate ECM optimally to deliver on the business objectives?” The participants gave the responses that referred to the storage, communication, infrastructure for both ERP and ECM. Best-fit technology that is current with an emphasis on good optimal network availability. Another participant mentioned that networking is in the form of fibre, cable and Wi-Fi which pose security risks.

Participant I said, *Sufficient resources like computers, printers and memories.* This is also supported by the records administrator mentioning scanners that will not break. The ICT

infrastructure, good servers, SAN drive, optimal database and mobility were also mentioned. One SAP participant stated that additional resources are needed in terms of expertise and modules. For ECM, it was also mentioned that document management is crucial when it comes to indexing and ease of searching.

> Participant D summed it up and said: *IT, skills, mixed with compliance, people must have compliance knowledge.*

The technical resources mentioned by the participants are in line with the resources mentioned in Chapter Two. For ERP there were IT assets, human IT infrastructure, shared IT services, and shared and standard applications (Karimi et al 2007). For ECM in Chapter Two, servers, databases, web servers, workflow, templating software for capturing and applying standard formatting were mentioned.

The participants responded to the resources for ECM and ERP in a similar manner. Their responses were in a storyline to try and express the significance of the resources for operating both ERP and ECM optimally. Infrastructure, servers, storage, communication, integration solution, Wi-Fi, fibre and scanners were mentioned as some of the resources needed to operate ERP and ECM optimally. There was also mention of fine-tuning applications such as SharePoint (participant N).

The investigator sought to find out which non-technical resources needed to achieve an integrated ERP into ECM.

4.7.1.2 Non-technical resources are needed to achieve an integrated ERP into ECM

The investigator asked this question to the participants: "What non-technical resources are needed to achieve an integrated ERP and ECM?" They responded in the following summarised points:

i. Trained staff with continuous training to them prepare for the advent of 4IR and the future.
ii. People who can communicate can use the system and buy-in, including the non-technical staff using the system.
iii. Skill, manpower, architecture and standards.

iv. Proper governance processes reviewed from time to time and data governance.
v. Reconsideration of policies, procedures, compliance, processes
vi. An understanding of IT architecture – there is a new way of thinking.
vii. Leadership is needed and a budget for what is needed.
viii. The integration strategy that is enterprise application integration consisted of content integration and application integration. It was also noted by one participant that the integration strategy would stand within the enterprise information management framework (EMF).

Participant E said:
You need people that can be able to use the system, utilise the information and utilise the data.
This was supported by D who said that:
We need people who can communicate, you can basically, create buy-in for instance for this system to work, you need somebody to attract people to report.

People repeatedly mentioned non-technical resources for integration.

4.7.2 System architecture of the ERP and ECM at Rand Water

The results under this objective are presented under the sub-sections system architecture of ERP and system architecture of ECM.

4.7.2.1 System architecture of ERP

The investigator wanted to know the system architecture of ERP in the organisation with this question: "What is the system architecture of the ERP in your organisation?" The responses referred to the best-fit technology strategy, using an envisaged service-oriented architecture to integrate ECM and ERP. The use of single integration solutions/ platform for ensuring integration between landscapes of best-fit systems.

The general manager/ executive in finance said that I*s complex, we don't only use SAP. SAP is the main one, but because we have a number of Solutions. So, the risk is integration.*

The manager in audit and records manager mentioned modules such as finance, project systems, MM module, payroll element and HR element of the SAP system. This was to describe the ERP architecture of the organisation. The manager in project control also mentioned that the ERP architect is made of various modules in SAP.

The manager in the office of the executive responded by saying *The architecture is the importance of that and talk of the physical layer who talk of the software layer we then have presentation layer, database layer, the GUI.* The other close answer came from the senior manager in records and knowledge management who said server then application, front end.

The IT ECM administrator said that architecture differs from company to company and *they have never defined a system architecture in the first place.* The participant referred to different reference models such as Gartner, TOGAF, Forrester and AIIM to give capabilities required.

The results presented below are for a similar question asked as the one above, with the exception that it relates to ERP instead of ECM as presented above.

4.7.2.2 System architecture of ECM

The investigator wanted to know what the system architecture of ERP in the organisation was and asked this question: "What is the system architecture of ECM in your organisation?" The participants gave the following responses:

The general manager of IT said: *Best fit technology strategy, with more than one physical content/ records repository for different types/ categories of content (web content, emails archive, records or archival management).*

The manager in the design office said: *So, in my understanding, each and every section has its own little ECM that is fit for that particular process of the section.* This is a similar response to that of the general manager in finance*: We have all these multiple systems.*

The manager in project control said: *The server, the database, the application and the frontend that's the user side.* This implies that the front end has two sides, being the capturing module and the records management module.

The records manager's response referred to space based on an approved file plan, database and application.

Lastly, the IT ECM administrator said this in response to the ECM architecture question: *In FileNet we do have what is called a process engine, which is like an advanced workflow engine, we also have Nintext, which is like a basic workflow thing. In addition to that, we have BizTalk, which is like an Enterprise Bus that has a process engine, rules engine.*

4.7.3 IT architecture roadmap would enable the integration of ERP into ECM

The investigator wanted to know the IT architecture roadmap and ask this question: "What is the IT architecture roadmap that would enable the integration of ERP into ECM?" The responses to this question indicated that the IT architecture roadmap points to service- or process-oriented architecture for an integrated technology landscape that is still the best-envisaged architecture, including the transactional processing / ERP layer and the ECM layer. ECM layer should include end-to-end process automation and integration, as well as a layer for capturing and preserving "a single version of the truth". Another mentioned voiding manual intervention among system while another mentioned that roadmap speaks to analysis, scanning of the environment and knowing which processes influence or affect each other. It was also deemed as the ability to search within the content; unstructured would be the best architecture roadmap. Firstly, there needs to be agreement on a classification scheme. In some instance, it mentioned that there need to be efficient servers, good network and there was no confidence about others such as a database. Online systems can easily integrate using common platforms, as these are great enablers. There was also a mention of Gartner reference model – that EIM would then enable the organisation to come up with a strategy to say, 'how will ERP be used and how is it going to integrate our ERP with other systems'. The investigator also wanted to know what IT architecture standards in the organisation are needed to support the integration of ERP and ECM in your opinion.

4.7.4 IT architecture standards to support the integration of ERP into ECM

This following question was asked: "What IT architecture standards in the organisation are needed to support integration of ERP and ECM in your opinion?" The answers were captured as follows:

i. *Governance is the responsibility of the board.*
ii. *Minimum interoperability standards. However, due to the convergence in technology and the improvement in data exchange protocols and technical gateways, the risk of incompatibility is decreasing, but still exists.*
iii. *If we want to say we are using the best-fit technology surely, we should have our growth strategy aligned to our needs and IT needs and architecture standards.*
iv. *Uniform classification system, servers, server standards, ISO standards, 9001 There are also information security standards, obviously records ISO standards.*
v. *Standards around system-to-system communication, so in terms of BizTalk which will be ESB, the standards will how do web services talk to each other.*

The question on architecture, standards and roadmap proved to be a challenge for the participants. One participant said in response *I am not clued up in IT architecture standards*. They tried to give responses and gave examples as responses. One said *We do have architecture standards, ICT policies*. In some cases, the researcher had to ask the participant to elaborate on their answer. There is a gap in users' understanding of the IT terms used, like architecture.

4.7.5 Compatibility and inter-operability of ERP and ECM at Rand Water

As mentioned in the literature chapter of this study, compatibility and inter-operability of the systems being integrated are key to ensuring that it is a success. This sub-section relates to objective four, as stated in the introduction (section 4.3). The ANT concepts guiding this objective are mobilisation and irreversibility. Mobilisation happens when the focal actor seeks to ensure that the actors work together towards ERP into ECM integration, with alignment and decision-making, as highlighted in Chapter Two.

4.7.5.1 Compatibility requirements for integrating ERP into ECM

The investigator sought to find out what the compatibility requirements are for integrating ERP into ECM, by asking the following question: "In your opinion, what are the compatibility requirements for integrating ERP into ECM?" The question was meant to be answered at a level where the technical compatibility requirements would be highlighted. Leikums (2012) summarised the integration of systems as the ability to exchange data. Matching of information is considered essential in the integration of separate systems (Abdulkadhim et al 2015).

The responses of the participants were as presented below:

i. *It must be able to exchange data with other systems.*
ii. *It will be something with the functionality of absorbing data from multiple sources.*
iii. *Need to feed information from one system and must integrate with the other.*
iv. *Maybe architecture standards will play a role in terms of influencing this compatibility of how these two systems eventually operate with one another.*
v. *Running the same platforms for ERP and ECM.* This was emphasised by another participant who said *So, say for example, I want to keep a DWG drawing then I would expect the ERP to also be able to keep that particular drawing in that format.*
vi. *Integrate where it can be possible. If not, all the detail in the invoice as example and maybe look at integrating the total amount in the invoice.*

Cautious responses were received to this question such as *Need to look at the costs of integrating the system versus configuration and the timelines to do each. Integration is very critical, because it has more advantages than disadvantages.*

The responses from participants as presented above pointed to information fed from one system to the other. One response also agreed with the statement of the ability to exchange data. It was also the opinion of one of the participants that *ECM vendor or the ERP vendor, do they give something to help you integrate or you have to do it yourself.*

4.7.5.2 Inter-operability requirements for integrating ERP into ECM

The investigator wanted to know the inter-operability requirements for integrating ERP into ECM and asked this question: "What are the inter-operability requirements for integrating ERP into ECM in your opinion?" The results are presented in the discussion below:

The two participants gave similar answers to a question relating to compatibility and these were the answers:
It must be able to exchange data with other systems.
You must only complete information into one system.

Participant G said:
I should be able to transfer that data easily, at least for a time, few months or years before. Maybe mapping of databases, improving the search function.

Participant L gave a different response and said:
It's dependent on our network, if our equipment is compatible. Even the application level

The participants' responses indicate clearly that they did their best to answer the question on the compatibility and inter-operability of the two systems. The need for the same platform is highlighted as one of the requirements, workflow that allows information flow from one system to the other, change management and vendor agreement between products. Participant E brought a requirement in question by asking *What we use the system for? How critical is the system, can you be without the system? What are the risks if the system crushes, can we extract the information from the system?*

Funding also surfaced as being a crucial part of ensuring the integration of ERP into ECM. In the results of the interviews, it is referred to as "sufficient fund", "resources in terms of funding" and also as budget linked to resources.

4.7.6 Governance of electronic content in ECM and ERP at Rand Water

The results from the interview had one of the participants highlighting the importance of compliance with the legal framework. The other contribution of ECM is to ensure governance

of information, content and records. This lead to a theme that discusses the legal framework of electronic content management (records). Through document analysis of the SA Constitution of 1996, Rand Water Records Management Policy and ECT Act 25 of 2002. It was important to note that each document was considered in the context of the governance of electronic content in ECM and ERP. The discussion covered the South African Constitution of 1996, the Rand Water Records Management Policy, the Electronic Communications and Transactions Act (Act No. 25 of 2002) from a legal framework and where the clause bearing governance of electronic content is mentioned.

Table 4. 2 Legal framework governing electronic content management

Compliance tool	Clause bearing governance of electronic content
SA Constitution, 1996, section 195	Provision of timely, accessible and accurate information. ECM and ERP to be accessible timeously and to contain accurate electronic content.
The NARSSA Act (Act No. 43 of 1996, as amended)	To determine the conditions according to which electronic records systems should be managed. ECM assists the organisation to be compliant with the Act.
The ECT Act (Act No. 25 of 2002)	According to the Electronic Communications and Transactions Act data, messages are legally admissible records, provided that their authenticity and reliability as true evidence of a transaction can be proven beyond any doubt. Electronic content with electronic records in ERP and ECM is considered valuable legally.
Rand Water Records Management Policy.	Ensure that adequate and effective general ICT controls and application controls are in place and operational. Ensure that adequate and effective cyber security measures, including access controls and disaster recovery, are in place and operational, in line with the ICT Security Policy, to do ensure the availability, integrity and confidentiality of digital records. This applies to the ECM and ERP and applies in the audit exercises as mentioned in the results of the participants.

The annual reports were also part of the document analysis in review of the compliance and evolution of electronic content management in the organisation. Table 4.3 below summarises the annual reporting related to records management and electronic content management.

Table 4. 3 Annual reports on electronic content management

Records management – in some of the Rand Water annual reports	The annual report of 2007 alluded to the adoption of the end-to-end integrated enterprise IT application architecture that includes business intelligence, systems integration and enterprise content management, including document management and records management, workflow and portals. In 2008, the organisation decided to focus on systems integration where business intelligence in its technological architecture includes enterprise content management, document and records management, workflow and portal. This was done through the roadmaps initiated: enterprise document management (EDM) and enterprise data warehouse (EDW). In 2011, it was confirmed that records management systems and electronic faxing solution were implemented. In the 2015/16 annual report, information and governance, Promotion of Access to Information Act, records management and archival policies were reported on as part of compliance in the protection of the information assets. In 2017, the emphasis in the report was on information management that covered records management and archival policy, Promotion of Access to Information Act of 2000, and the National Archives and Records Service of South Africa Act of 1996.

The history in the annual report reflected that there was a considerable effort to embark on end to end integration of different systems such as the enterprise IT application architecture that includes business intelligence, systems integration and enterprise content management, including document management and records management, workflow and portals. This observation reveals the progress made in a move towards the preparation of the realising integration of ERP into ECM at Rand Water. Consensus on what was said in the interviews and what was analysed in the document was noted which is agreeable to the literature discussed in Chapter Two and Three.

4.8 ECM and ERP architecture documents

Figure 4.1 summarises the existing ECM system and links it to other application systems. The focus of this study is to formulate a framework to integrate ECM and ERP. The red arrows symbolise what is to be.

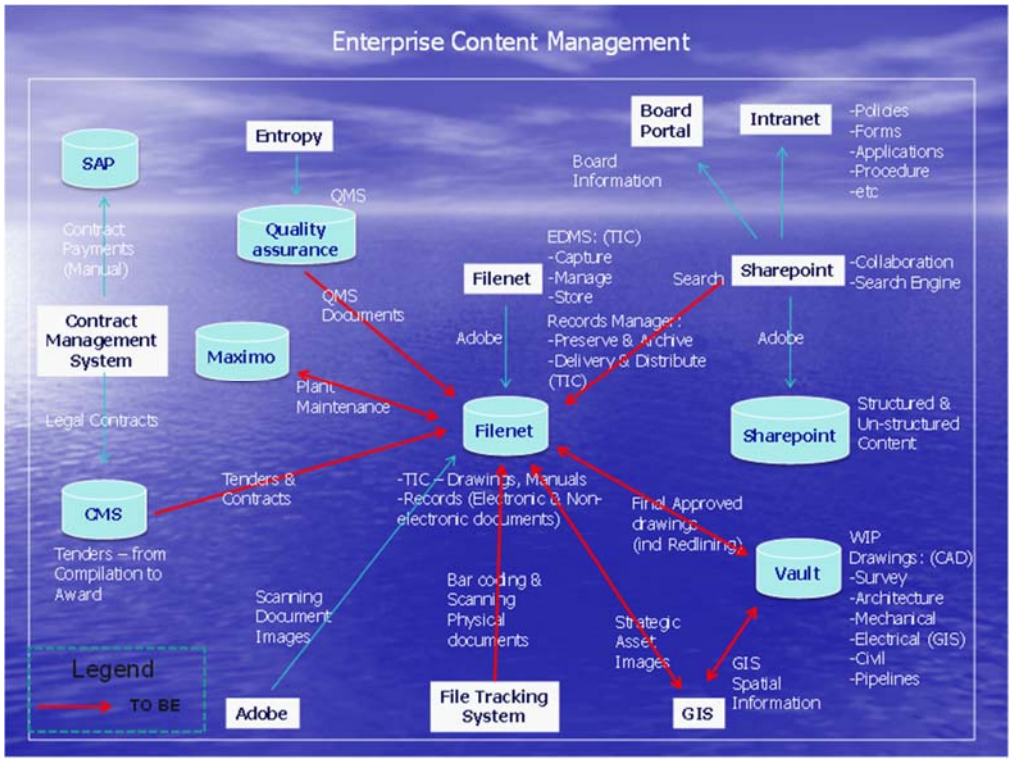

Figure 4. 1 Rand Water utility ECM architecture (taken from Rand Water records)

The organisation currently uses the IBM FileNet ECM solution as also mentioned by participants. This ECM solution manages two document life cycles, the first one being Electronic Document Management System (EDMS) functionality (i.e. storing, managing and tracking electronic images of paper based information captured) and the electronic records management functionality (i.e. capturing, managing, storage, preservation and archiving, delivery, distribution and disposal of all records). It was recorded that the ECM architecture consists of the following components: user interface, information governance, attributes and workflow.

The organisation currently uses SAP as its ERP system for daily transaction activities through the modules that enable the business unit's operational objectives. It is made up of a few modules such as those represented in Figure 4.2:

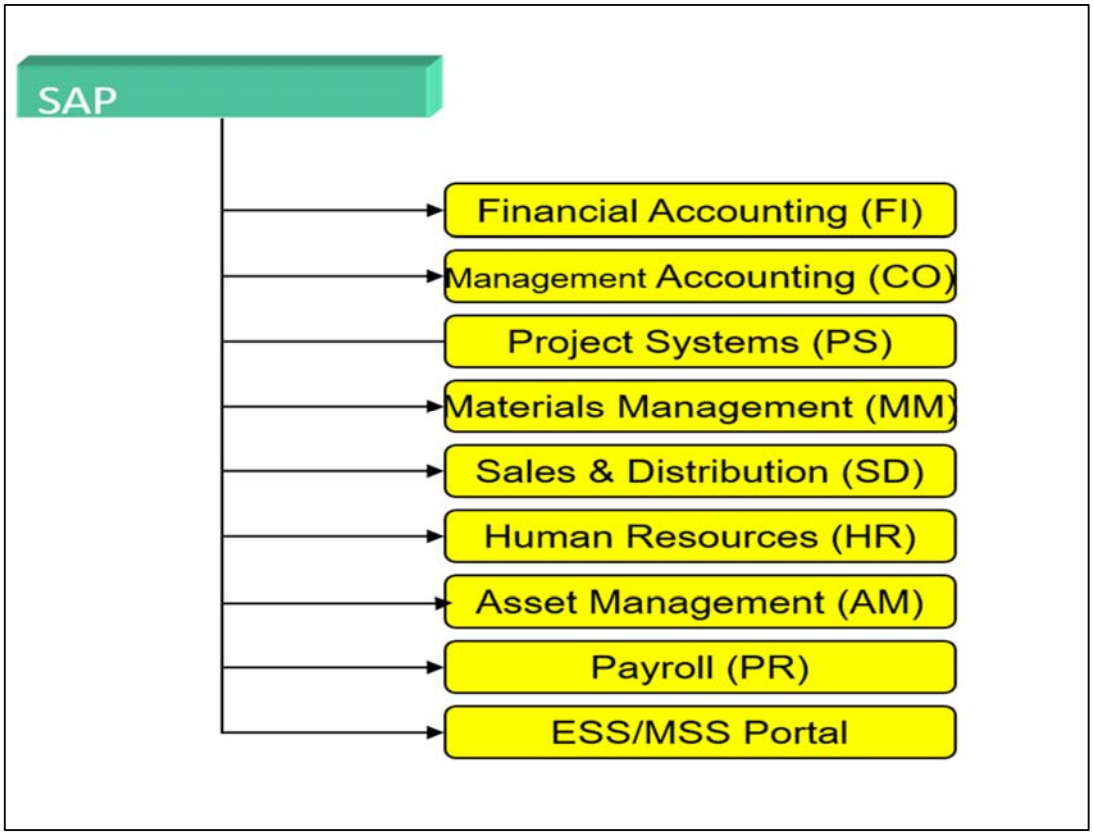

Figure 4. 2 Rand Water ERP Architecture (taken Rand Water records)

It was noted based on the interviews, system analysis and architectural documents analysed that electronic records and documents are scattered and duplicated in the ERP and ECM including several other applications depicted on Figure 4.1. The participants made some recommendations to the current architecture of the ECM and ERP systems. Their recommendations included following the Gartner or the TOGAF approach for the systems architecture of ERP into ECM. During the interview, participant M recommended that Rand Water should build an architecture reference model and highlighted that SAP talent management module will form part of SAP architecture. Participant H highlighted that on the ECM user's side there is a server, database and front end which show the capturing.

4.9 Summary

This chapter presented data collected via interviews and document analysis guided by the ANT translation concept (i.e. actor(s), actants, enrolment, interessement, inscription and mobilisation). Data on the effects of operating ERP and ECM independently, system resources and systems architecture for ERP and ECM, factors stimulating and inhibiting integration of ERP into ECM, and the compatibility and interoperability requirements for ERP and ECM were presented in themes. The results were obtained from participants in Rand Water. In reporting results from the interviews as well as document reviews, the following themes were used to address the main objectives of the study:

i. Impact of ERP and ECM on business operations at Rand Water.
ii. Value-add of integrating ERP into ECM at Rand Water.
iii. Stimulating and inhibiting factors for an integrated ERP into ECM at Rand Water.
iv. Governance of electronic content in ECM and ERP at Rand Water.
v. Integration strategy for integrating ERP into ECM at Rand Water.

Data obtained from the interview recordings were transcribed and grouped per the themes of the study in line with the main objectives. The actual words of the interview participants were used to express ideas when they responded to the interview questions. Data obtained through analysis of national policy documents, Rand Water internal architecture documents and ICT policies were presented under these subsections: Rand Water ECM and ERP architecture documents and governance of electronic content in ECM and ERP at Rand Water. It was acknowledged that integration of ERP into ECM is a requirement from business, remains a challenge to achieve it. It was noted that the value-adds of integrating ERP into ECM such as one version of the truth capture in principle, increased level of productivity on operations and human resources, the achievement of legal framework compliance and enrolment of human and non-human actors in an integrated network through mobilisation.

Stimulating factors for integrating ERP into ERP at Rand Water, in summary, were noted to be leadership support, skilled personnel with specialist knowledge as key and change management was critical. Inhibiting factors were identified as silo mentality and operational attitude, lack of IT and business collaboration to achieve business objectives, insufficient

capacity network, server, database and application, lack of understanding the purpose of integrating the two systems, organisational culture and lack of communication.

Strategy for integrating ERP into ECM at Rand Water was also explored. It was noted that technical resources were lacking, the organisation to adopt best-fit technology, compatibility and operability requirements were significant to achieving an integrated ERP into an ECM environment. It was established that the systems architecture of both ERP and ECM were not well known by the participants, the architecture roadmap and standards for integrating ERP into ECM were to be guided by the ICT team ensuring business involvement. It was also established that skill sets and training of people were lacking, policies, procedures, standards, Acts, and regulations were not fully known by the participants and yet it was also acknowledged that compliance with legislative framework remains non-negotiable. Funding and budgeting remain important to achieve the desired integration.

It was clear from the data collected that a defined approached to achieve an integrated ERP into ECM was lacking. In the review of the data presented, it was noted that with the application of ANT concepts, the integration of ERP into ECM was achievable. The next chapter interprets and discusses the results that were presented in this chapter.

CHAPTER FIVE
INTERPRETATION AND DISCUSSION OF FINDINGS

5.1 Introduction

The previous chapter analysed and presented the results of data obtained via the interviews and document analysis. This chapter provides the interpretation and discussion of the results. A discussion of findings entails the interpretation of the study's results in the context of the previous researchers and provides for theory, practice and governance principles. According to Creswell (2009), the process of data interpretation and analysis involves making sense out of the text and image data, representing the data, and making an interpretation of the larger meaning of the data. In discussing the findings, the perspectives will be drawn from the concepts of ANT, the theory that underpinned this study. In discussing the findings, it is important to evaluate and interpret the implications of the study to the research problem. This necessitates the researcher to examine, interpret and qualify the results, and draw an inference from them (Kothari 2004). The study was purely qualitative and data were generated from the focus of the individual interviews with the ten staff members at the organisation who were representative of different levels. These levels were executive, general management, senior management, middle management, IT ECM technical administration and records administration. These individuals were from different business units, which included shared services, ICT (ECM), HR, project control, audit, IT audit, records and knowledge management. Neumann (2009) highlights that to analyse data means to systematically organise, integrate and examine while searching for patterns or themes among specific details. This means that all responses addressing an objective were grouped. Thematic data analysis procedures are related to qualitative methods and are generally suited for interpretive phenomenology (Ngulube 2015). The study used NVIVO software to develop themes that were used to analyse the data to be presented in this chapter.

The interpretation and discussion of findings were based on the research objectives of the study, which consists of the following:

i. Examining the effects of operating ERP and ECM independently at Rand Water
ii. Examining the value-add of integrating ERP into ECM at Rand Water
iii. Examining the stimulating and inhibiting factors for integrating ERP into ECM at Rand Water

iv. Determining the integration strategy for integrating ERP into ECM at Rand Water

v. Proposing a framework for the integration of ERP into ECM at Rand Water

5.2 Effects of operating ERP and ECM independently

This theme addresses the first research objective that relates to the effects of operating ERP and ECM independently. This objective addressed the translation concept of the ANT with four moments being problematisation, interessement, enrolment and mobilisation. The interpretation and discussion of findings concerning the effects of operating ERP and ECM independently at Rand Water are presented according to the following sub themes:

i. ERP and ECM modules used in the work areas
ii. The usage of ERP and ECM at Rand Water
iii. Functional effects of ERP module(s) and ECM module(s) not integrated

5.2.1 ERP and ECM modules used at Rand Water

The concept of interessement became instrumental in the identification of modules used in the organisation as a result of actors being enrolled to achieve a collaborated objective in the utilisation of the modules in the ERP and ECM at Rand Water. ERP and ECM are deemed to be enterprise systems that organisations invest in to realise the benefits and return on investment. In the case of ERP, to achieve integration in business operations modules such as sales, finance, human resources, project management, logistics and marketing are some of the modules used (Rashid et al 2002). Although it may come at a high cost to have it implemented (Sharma & Rana 2013), ERP is all intended to reduce operational costs of the organisation by also increasing productivity and improvement of the customer services (Mandal & Gunasekaran 2003).

The interview results reflected that the participants revealed that the ERP SAP system was primarily used for functions such as HR functions, including leave, ESS\MSS, projects, procurement process, plant maintenance, PPM, CO and reduced turnaround time for recruitment and administration. Another participant as mentioned in Chapter Four; SAP is used for the financial activities and refers to efficiency in controls, reporting budget and budget

tracking. The concept of interessement reflected that human actors referred to what they only use in line with their role and required outcome. The use of SAP as the ERP by the human actors was limited to only their area of work without much interest in the other modules integrated into this enterprise system. In the case of the enrolment concept, it revealed that it was limited to the only area of responsibility by the human actors.

On the other hand, as initially discussed as well as in the literature chapter (Chapter Two), ECM also has modules that are integrated. These modules include the following although it is not limited to document and records management, workflow or business process management, collaboration, knowledge management and digital asset management. In comparison, according to Katuu (2012), South Africa's ECM implementation is the most advanced. In the case of ECM, being FileNet in the case of Rand Water, the participants mentioned that among the benefits of ECM are: management and governance of information, ability to make business decisions, ease of retrieval, publishing, sharing of information, preservation of information, disposal and information that can be archived for a long period. Responses by the human actors, further reveal that the FileNet as the ECM system were similar to those given on ERP which reflected that the interessement and enrolment were biased to the actors' benefit and usage of the module.

ANT aligned this objective to understand the actants or actors in the operation of the ERP system and applying the translation concept (Walsham 1997). The modules used by the participants differ and are in line with the area of work. Among the four moments of translation (i.e. problematisation, interessement, enrolment and mobilisation), interessement revealed that human actors had a view of only their area of work and not much concern about other modules and systems outside their area of responsibility. The enrolment of human actors was limited to usage of the modules and did not extend to others directly and indirectly linked modules in ERP or ECM systems.

5.2.2 The usage of ERP and ECM at Rand Water

The interessement concept was further elaborated through the identification of the usage of the ERP and ECM at Rand Water by human actors on the non-human actors (i.e. ERP and ECM). During the data collection through interviews (Chapter Four), it was also noted that participants mentioned the benefits of using ERP as a tool for efficiency as well as controls, reporting

budget and budget tracking. Participants also mentioned that ERP is beneficial for HR functions such as leave, projects, procurement reduced turnaround time for recruitment and administration. The ERP deployed in Rand Water is SAP. Organisations implement ECM to address the problem where the accessibility, consistency and publication control of content becomes tough in the case of locally stored files (Grahlmann et al 2011). It is also noted that ECM comes with other benefits such as integrated paper documents, data, reports, web pages, digital assets and cost savings realised when implemented in the organisation. It is also worth mentioning that the benefit is also realised on the server infrastructure with continuity measures and compliance with regulations, employee productivity being enhanced (Hullavarad et al 2015).

In some instances, there would be a participant who uses both the ECM and ERP, like participant L, who works as a procurement manager and is responsible for compliance support to the executive, said, *I work with both SAP and FileNet*. On the other hand, there would be those that use only ECM (FileNet) and in some instances, it would not be clear as to what specific system they use. Participant D being a senior manager in finance said, *Something to do with documents, normally we use SAP*. It was also noted that SAP in the technical area was used for projects and financial reporting, while FileNet was used for the actual project-related documentation. Another observation from participant C (an HR manager) was still waiting for ECM solution for their e-recruitment system. The e-recruitment system was meant to improve the management application that comes through from job applicants. Although the concern raised about IT's service was not part of the question, it was also important from an interpretive angle to link this as part of the actors to influence the usage of solutions that IT delivers to the business. To mitigate the effect of the delay by IT, a "stop gap" recruitment solution has been contracted.

SAP as the technical actor was identified by human actors to be beneficial to the actors in their respective area of work. The interessment and enrolment revealed that human actors understood their role and the usage of technological actors. It was also noted that their interests were limited to their level of usage of the two systems (i.e. ERP and ECM). It was however noted that enrolment was lacking in building interest in the usage beyond the human actors' area of work and responsibility. The respond by the actor from the human resources area expressed a concern of on the service offered by the IT area failing to fulfil the role of mobilising the actors to be enrolment and interessement achieved to yield a more collaborated

environment. It was therefore contributed to the lack of integration of the ERP into ECM objective. All actors needed to be aligned to ensure a consistent actor network that was integrated and benefits are realised.

5.2.3 Functional effects of ERP module(s) and ECM module(s) not integrated

Problematisation concept being the initial planning phase where a focal actor identifies problems and interest of other potential actors (Chapter One). It was one of the four moments of translation, it guided the identification of the functional effects of ERP and ECM modules that are not integrated at Rand Water. It was noted that organisations invest in ERP to achieve integration in business operations because it was an enterprise system for business management modules such as sales, finance, human resources, project management, logistics and marketing, to mention just a few (Rashid et al 2002). Organisations implement ECM to address the problem that the accessibility, consistency and publication control of content becomes tough for files that are stored locally (Grahlmann et al 2011). It was also noted that ECM comes with other benefits such as integrated paper documents, data, reports, web pages, digital assets and cost savings that are realised when implemented in the organisation. It was also worth mentioning that the benefits were realised on the server infrastructure with continuity measures and compliance with regulations, employee productivity (Hullavarad et al 2015). Though these were realised, there remained a need to ensure optimal collaboration of human and non-human actors with similar interests are enrolled to achieve an integrated ERP into ECM by the focal actor. It was noted that the focal actor was not identified by the human actors, however, there was a need to have the lack of integration addressed.

From the responses of the participants, it was noted that the functional effects of unintegrated ECM and ERP brought mixed responses. In some responses, participants mentioned issues of lack of efficiency, completeness, and trustworthiness. Another response pointed to the potential risk of data manipulation where manual interfacing becomes the solution. An information gap was also noted as well as the application of electronic destruction policy when ECM and ERP are not integrated. The human actors revealed an agreement to lack of integration on the non-human actors which brought instability in the potential actor network of an integrated ERP into an ECM environment. The lack of collaborated interests from all actors brought a negative impact on the organisational operations and integrity of data, information and records on the two systems. The focal actor was not identified by the actors in

their responses but IT came through at the actor to assume the role of being a focal actor to ensure that that mobilisation is achieved for an integrated ERP into ECM environment was realised.

As much as ERP and ECM are beneficial when implemented in organisations, they can be more beneficial when they are integrated into each other. In the context of this study, the focus is on the integration of ERP into ECM as supported by articles authored by Van Rooij (2013), Medina (2014) and OpenText (2014) which state that integrating these two systems add value to the organisation by affording the ability it to reduce cost, improve productivity and improve efficiency, visibility and compliance. However, it was noted that although it is beneficial to have them integrated, it is not the case in organisations such as Rand Water and others. Without the integration of the two, the benefits mentioned are therefore not realised (Maraba 2017; Medina 2014; Van Rooij 2013). Not all participants were in support of integration, with the reasons being the limitation of usage in line with the area of work. One participant stated that FileNet is the main tool and only the financial report on ERP system was required. The other participant was from the audit division and pointed out their system (Barnowl) (not FileNet) does not need to be integrated to fulfil the job requirement in the auditing area. This response disagrees with the discussion that supports the integration of ECM and ERP. Interessement concept revealed that there was a challenge in it being realised due to actors some actors who did not have the interest to have integration of the technical actors discussed in this study. The responses of these two participants point to the importance of the critical success factors (Tables 2.2 and 2.3) that were discussed in Chapter Two. Enrolment of actors by the focal actor would face a challenge with the conflict of interest of the actors. Through change management communication and the clear quantitative expected outcome could be some of the stimulating factors for ensuring that there is a buy-in from all the stakeholders, including system users through the concept of inscription where interests and values of actors are embedded into the technological artefacts. It would be observed that there could be some level of resistance among the actors and power challenges for integration of ERP into ECM to be realised based on the differing views from the human actors due to silo view on their area of work.

ANT equates the collaboration of all the actors (being human and non-human) as equally important to achieving a common goal. In this case, the integration of ERP into ECM (i.e. network) is the intended outcome. Critical success factor involves focal actors in the network who fulfil the role of enrolment of other actors motivated by organisational history, decision-

maker autonomy and distribution of knowledge and skill. In the case of integration of ECM and ERP, enrolment was critical in overcoming resistance to their integration by canvassing the stakeholders within the integration network. Enrolment and inscription by the focal actor would remain an evolving process and would result in a negotiated order and aligned actor network (Worrell et al 2006). Based on the literature discussed in Chapter Two and the data collection in Chapter Four, it was noted that the effects of operating ECM and ERP independently are not supported by most of the participants, who are also actors in the integration network of ECM and ERP. It can be concluded that integration of ECM and ERP remains a favourable option in consideration of the benefits to the organisation with a limited level of resistance influenced by lack of appreciation the benefits that are corporate than business unit level. The focal actor would need to ensure that all actors are enrolled and their interests are well inscribed to also ensure a stable network to achieve an integrated ERP into ECM system with enrolled actors helping to enrol news actors to the network.

5.3 Value-add of integrating ERP into ECM at Rand Water

This theme addresses the first research objective that relates to the effects of operating ERP and ECM independently. The concepts of interessement, enrolment and mobilisation were instrumental in identifying the value-add of integrating ERP into ECM for operational improvement and the benefits of an integrated ERP into ECM.

The interpretation and discussion of findings concerning the value-add of integrating ERP into ECM at Rand Water are presented according to the following sub-themes:

i. Operational improvement of integrating ERP into ECM at Rand Water
ii. Decision support to benefit of integrating ERP into ECM at Rand Water

5.3.1 Operational improvement of integrating ERP into ECM at Rand Water

The enrolment and interressement of actors in achieving operation improvement by integrating ERP into ECM. The view of improved efficiency and operations was endorsed by Mahrami and Hakro (2018). It was based on its integration capability that ERP is an attractive option to organisations as they benefit from improved management and efficiency of the business (Rothenberger et al 2010). In the first chapter of this study the benefits of integrating ERP into

ECM that can be realised are: reduced paper handling and reduced labour; reduced misplaced or lost invoices; reduced storage costs; increased processing speed; decreased errors (higher accuracy); fast, reliable, easy access to invoices using the familiar ERP user interface; on-time payments; more early-payment discounts; and auditable business processes with more visibility, which improves efficiency and automation and add efficiency to repetitive business processes; cost reduction and facilitate rapid decision-making and facilitating regulatory compliance can be realised (Motwani et al 2005; Medina 2014).

Results from the data collection through interviews and the operational improvement from an integrated ERP into ECM pointed to data quality improvement through the principle of capture and one point of access to information. More benefits are that information would be more accurate, enhanced legislative framework compliance and knowledge of where the information can be located when SAP and FileNet are integrated. It was also mentioned that there would also be an improvement in terms of the paperless environment. Participants K said *Keeping one truth is very important for me*. This refers to the reliability of the information (i.e. not scattered and duplicated in several applications) in an integrated ERP and FileNet. Another operational improvement noted during the interviews was the reduction of risk to Rand Water as mentioned by participant A who was an executive referring to the information or results they were presenting. It should also be noted that the organisation should be able to ensure that it sustains its operational, legal and financial reputation when SAP and FileNet are integrated. It meant that there would be some level of alignment of human and non-human actors through the enrolment, interessement and mobilisation to achieving operation improvement through the integration of ERP into ECM.

The other driver of operational improvement that is not avoidable was driven by the changing times and the growth of the organisation as per participant A (executive) and participant E (senior manager at general manager level). There was also a consideration of ensuring that integration is in line with the requirements and moving with the times to ensure that Rand Water does not leave IT behind as it moves in a certain direction. In a similar line of thought, participant G (audit manager) highlighted that analysis of processes will be important to ensure that ECMs in the Rand Water is integrated into the other business processes. Contrary to the popular view among the participants, participant I argued that it is not of high priority to have ERP and ECM integrated, since it has always been a way of operation. In the same breath, the

participant was not opposed to the potential advantages and benefits of the integration of the two systems.

ANT considered the operational improvement resulted from the integration of ERP into ECM due to actors aligned to an actor network. Changing times and organisation growth, reduction of risk are non-human actors that were identified in achieving a reduction of risk to operational improvement. Without ignoring the differing opinion did not consider integration being a priority and this seeks the engagement of the focal actor to inscribe the interests of the enrolled and those that were to be enrolled. The concepts of interessement, enrolment and mobilisation of human and non-human actors through the focal actor were relevant to the discussion of operational improvement due to an integrated ERP into ECM. The next sub-theme discuses in an elaborated manner, the decision support benefits due to an integrated ERP into ECM at Rand Water.

5.3.2 Decision support benefit of integrating ERP into ECM at Rand Water

From the interview results, participant A (at the executive level) posed a rhetoric question *How can we use records to support the decisions that we make?* This brought about a discussion of a decision support value of an integrated ERP and ECM in an organisation. The interview results highlighted that an integrated ERP and ECM can also bring monetary value in terms of having the ability to negotiate contracts well in advance. This was mentioned by the senior manager in financial planning. The other value highlighted in the same interview was the document control for integrity and audit purposes. This was not a direct question on the value but the factors stimulating the integration of ERP and ECM. The decision-making would be more effective when there was one version of the truth. This was also mentioned in the previous section. It was also important to have efficient decision-making in the case of employees from an HR function. It was highlighted by a senior HR manager that when the information is not integrated (i.e. ERP and ECM), it takes time to assist families in the case of death of an employee from the remote site.

In a procurement environment dealing with tenders, when ERP is into ECM, the tender information becomes solid documents as there would be responses and minutes with the resolutions taken at the committee level. According to participant M, it is unavoidable that decisions need to be made in an organisation and mastering the data in ERP and outside ERP

becomes important. Participant A emphasised that the timeous availability of accurate information will enhance the quality of decisions that are taken. The participant further mentioned that integrated systems at Rand Water would be a tool and an important mechanism. Another value in decision-making was from auditors' point of view was the benefit of data analytics from ERP into the ACL system used by auditors. In the case of ACL, it is considered to be a version of ECM as it keeps auditing electronic records.

In the literature, the benefits of an integrated ERP into ECM include decision-making capability, among many others, as listed in the first chapter discussion (Effah 2012). This benefit is also expressed as the ability to facilitate rapid decision-making by Motwani et al (2005) and Mahomed (2015). There is a correlation between the integration of ERP into ECM and rapid decision-making support and timeous, available and accurate information, as mentioned by participant A during the interviews. The decision-maker autonomy function, together with the enrolment of actors and distribution of knowledge and skill, among others, fulfils the role of a focal actor in the ANT concepts. Other actors with their interests and the actor network should be aligned to the focal actor (Johannesen et al 2012). It is the decision-making that is made possible through the mobilisation concept in the ANT concepts. As mentioned earlier in Chapter Two, it is through mobilisation that the focal actor seeks to ensure that human and non-human actors work together towards ERP into ECM integration, with alignment and decision-making. Based on the discussion thus far in this section, Rand Water stands to benefit in terms of decision-making that would be more efficient when ERP and ECM are integrated. The next section addresses the second objective and the related research questions.

5.4 Stimulating and inhibiting factors to integrating ERP into ECM at Rand Water

This theme addresses the third objective of determining the system resources for ERP integration into ECM at Rand Water. The enrolment, interessment, inscription and mobilisation of human and non-human actors by the focal actor were discussed in the interpretation and discussion of findings concerning this objective are addressed under the following sub-themes:

i. Factors stimulating the integration of ERP into ECM at Rand Water
ii. Factors inhibiting the integration of ERP into ECM at Rand Water

5.4.1 Factors stimulating integration of ERP into ECM at Rand Water

This section addresses the first research sub-question and the second research sub-question that relates to the factors stimulating the integration of ERP into ECM at Rand Water. Stimulating factors are key to ERP and ECM implementation and integration. As noted in Chapter Two, critical success factors focus on key areas that influence the success of ERP and ECM implementation in line with the business objective as per the initial business case (Hullavarad et al 2015; Lim et al 2016). Although the use of critical success factors is encouraged, Lim et al (2016) caution against their usage because as they are deemed to be not equally important.

As in Tables 2.2 and 2.3, critical success factors point to the actors, actor network, enrolment and focal actors that stimulate the integration ERP into ECM (Sidorova & Kappelman 2011). These are both human and non-human actors since users, top management, committed and informed executive sponsor, project management, project champion, vendors, appropriate IT staff, team work, stakeholders and executive sponsor are mentioned (Alalwan 2013; Alalwan & Weistroffer 2013; Grahlmann et al 2011; Haug 2012; Hullavarad et al 2015; Katuu 2015; 2016; Lim et al 2016; Sidorova & Kappelman 2011).

These human actors form part of an actor network as well as the non-human actors such as software design, software communication strategy, business process re-alignment, skills, data management and integration, organisational characteristics, financial resources, change management and culture, monitoring and evaluation of performance, ERP and ECM strategy, and implementation methodology, business plan/ vision/ goals/ justification, document access and procedures, training and certification, business process re-engineering (Alalwan & Weistroffer 2013; Alaskari et al 2012; Hullavarad et al 2015; Kale et al 2010; Katuu 2016b; Lim et al 2016; Ngai et al 2008; Rickenberg et al 2012; Sidorova & Kappelman 2011; Stefanou 2001; Vilpola 2009; Herbst et al 2014).

During the interviews, participants also listed their stimulating factors as potential opportunities for the integration of ERP and ECM, key role players to identify opportunities to integrate ERP into ECM, organisational culture influencing the identification of these opportunities and any other elements in the organisation that influence the identification of opportunities to integrate ERP and ECM. The results of potential opportunities point to

content-specific processes and workflow while participant A (at the executive level) mentioned that timeous availability of accurate information that enables decision-making is very important. Participant I mentioned the breakdown of information silos in the company as the potential opportunity. Another opportunity mentioned by participant D is motivated by having one version of the truth.

In terms of the key role players to identify opportunities for integrating ERP and ECM, the participants mentioned senior management, the board and the CE, IT, finance, SCM, legal, auditors and records department all form part of the focal actors in integration actor network. One summary as mentioned by participant M said that it was all of us in the organisation, with an emphasis on senior management and executives. Focal actors (i.e. senior management and leadership) both human and non-human enrolment and interessement formed the list of the stimulating factors.

In terms of the culture (i.e. non-human actor) that influences identification of opportunities to integrate ERP and ECM, a culture of forward-thinking, technology in preparation of the Fourth Industrial Revolution (4IR) (i.e. non-human) and beyond is encultured. It was also noted that the responses of the participants did not mention more of the positives related to the culture, but mostly the negatives of the culture, which can be considered as an answer to a question of what inhibits the integration of ERP and ECM. However, when asked about any other elements in the organisation that influence identification of opportunities to integrate ERP and ECM, confidence in the water bills using technology was mentioned. Responsiveness to business needs, infusing global trends, training, innovation and transformation were some of the elements in the organisation influencing the identification of opportunities to integrate ERP into ECM. Based on the results, the focal actor's role was to enrol the interests through inscribing to actors to achieve a mobilised actor network. The next discussion enriches the factors that inhibit the integration of ERP into ECM.

5.4.2 Factors inhibiting integration of ERP into ECM at Rand Water

This section addresses the second research sub-question that relates to the factors stimulating the integration of ERP into ECM at Rand Water. The ANT concepts considered were those similar to those factors that simulate that integration.

In response to the question on the factors stimulating integration of ERP into ECM at Rand Water during the interview (Chapter Four), several participants referred to factors that inhibit instead of those that stimulate. This was demonstrated when participant H (manager in project controls) mentioned that *If the business analysis was done, we would not be buying a system for HR, system for finance, system for records and systems for asset management*. This response further stated that it would mean having an integrated system that works with all the divisions in the organisation.

When it came to the actual set of questions that related to the obstacles that inhibit the integration of ERP into ERP in terms of technical, human and non-human, and non-technical actors, the participants mentioned mostly human-related factors even when the question was meant to get an answer that is on the technically inhabiting. This was demonstrated when the question was asked about the technical obstacles that inhibit the integration of ERP into ECM and the response from the participant mentioned *technical people not taking the initiative to suggest systems* (this was one of the responses). Where the answers were relevant, the participants pointed to incompatibility, a technology that is not agile or making decisions on ECM without considering the technical architecture of the ERP in the organisation. Technical skill was also given as a response to the question sought an answer related to technical obstacles. In summation, servers, network, insufficient server capacity and not having the same platform were mentioned as the technical obstacles that inhibit the integration of ERP into ECM.

The obstacles from the human side inhibiting the integration of ERP into ECM were mentioned as lack of training, meaning that its inadequate, insufficient and irrelevant; silo thinking; lack of computer literacy; change management for people using the system; leadership not supporting; corruption power and culture. The question on obstacles that inhibit the integration of ERP and ECM were asked in the context of the non-technical and non-human side (i.e. actors). The responses pointed to cyber security extended to operational technology (OT), emphasis on culture, change, licence, standards and policies. These were non-human and non-technical actors that were noted as inhibiting in achieving the integrated ERP into ECM. It became clear that there was a challenge in separating the non-technical from technical and non-human from human actors. They were viewed as equally important to achieving the desired integration outcome. As actors in the actor network, their enrolment, interessement, inscription and mobilisation offers greater insight into the integration of ERP into ECM objective.

The literature discussion covered in Chapter Two on the obstacles inhibiting the integration of ERP into ECM pointed to the opposite of the critical success factors that stimulate the integration. The factors that made implementation and integration of ERP into ECM necessary were related to the poor needs assessment that excludes a broad stakeholder pool, lack of good deployment plan, ineffective or lack of change management and executive support. The other obstacle in failing to benefit from the implementation of ECM in an organisation is the lack of a practitioner's guide to consolidating framework and database into the ECM framework (Salamntu 2016).

The application of the ANT in the SAP case study was justified, which pointed to the stability, technology and social order that are negotiated continually as a social process interest alignment. Despite actors having different interests, it would mean that stability rests on the ability to translate, which means reinterpreting, representing or appropriating other's interest to one's one. Actors that could result in being obstacles inhibiting integration of ERP into ECM include technical, human, non-human and non-technical, as mentioned in the second chapter of this study (Nandhakumar et al 2005). The factors that inhibit the integration of ERP into ECM were noted to be opposite of the stimulants which were both actors that were human, non-human, technical and non-technical.

The literature and the responses from interview participants do agree on most of the obstacles that inhibit the integration of ERP into ECM. The next section enriches the discussion of the integration of ERP into ECM by elaborating on the integration strategy to achieve it.

5.5 Integration strategy for integrating ERP into ECM

This theme addresses the second and third objective of determining the system resources for ERP integration with ECM at Rand Water. The ANT concept of human and non-human actors, enrolment, interessement, inscription mobilisation guided the discussion in this section. The interpretation and discussion of findings concerning this objective are addressed under the following sub-themes:

i. System resources for ERP and ECM at Rand Water

ii. Compatibility and inter-operability of ECM at Rand Water
iii. Governance of electronic content in ECM and ERP at Rand Water

5.5.1 System resources for ERP and ECM at Rand Water

This section addresses the fourth research objective and the first research sub-question that relates to the system resources for the integration of ERP into ECM at Rand Water.

The ERP investment made by organisations amounts to millions of dollars and resources in ensuring that its success is scarce, rare and unique. Karimi et al (2007) refer to how an organisation leverages its investment in resources as it integrates them to build systems that can influence the organisation's overall efficiency, effectiveness and flexibility as IT capability. These resources were listed as: IT components resources – IT assets, human IT infrastructure – includes knowledge resources, shared IT services – user specific IT capability, Shared and standard application (Karimi et al 2007).

ERP also consists of the following modules, among others, as per the article by Singhal et al (2011): accounting, financial, manufacturing, production, transportation, sales and distribution, human resources, supply chain, customer relationship management and e-business. Concerning Figure 2.5, with the use of the centralised common database management system (DBMS), modules are integrated and provide seamless data flow among the modules, thereby increasing operational transparency through standard interfaces. The other resources noted in Figure 2.5 include LAN/ WAN, server level, service application front office, back office, modules as well as central DB. Resources include servers to run software that centralises content into a database used for creating and storing virtualised and versioned components (media, text, formatting) of documents (web sites, newsletter, portal); templating software for capturing, and applying standard formatting to the text in unstructured documents; business rules and roles in workflow and web server (Iverson & Burkart 2007:6).

Feedback from participants during the interviews indicated technical resources and those that are non-technical (i.e. actors) for ERP and ECM. The technical resources mentioned were: ICT infrastructure, good servers, SAN drive, optimal database and mobility, storage, communication, infrastructure for both ERP and ECM, best-fit, modern technology with emphasis on good optimal network availability, fibre, cable, Wi-Fi and security risks.

Computers, printers and memories that were also mentioned by participants. SAP additional resources were considered needed in terms of expertise and modules, while for ECM, indexing functionality for ease of searching. ECM components were summarised as user interface, information governance (automation, policies, legal, regulatory and industry compliance), attributes (data archive, intelligent data, workflow, integration/ data processing, information disposal) and repository (Hullavarad et al 2015).

When it came to the non-technical resources (i.e. non-technical actors), the participants interviewed referred to: Trained staff that are geared for the fourth industrial revolution, People with communication skills, manpower with skills, architecture and standard, proper governance process reviewed from time to time, including data governance, IT architecture understanding with a new way of thinking, leadership and budget. As well as integration strategy on enterprise applications in the enterprise management framework (EMF)

The emphasis that came from the participant points to the reliability of system resources and people that are also well equipped to deliver according to the business objectives. Technical resources, non-technical resources (including people, skill, leadership, budget, communication, processes, standards, governance and architecture) are the resources for achieving integration of ERP into ECM. These were also mentioned as part of the critical success factors in Tables 2.2 and 2.3. All these system resources are actors in achieving integration ERP into ECM. This integrated network of ERP into ECM could be achieved through the interessement of actors and enrolment of other actors by focal actor, both technical and non-technical resources (Silva 2007).

This was emphasised by participant D saying *IT, skills mixed with compliance, people must have compliance knowledge*. It refers to the organisation's ability to coordinate a set of tasks, utilising internal resources to achieve the desired outcome. In terms of IT, it refers to organisation's approach to leveraging on its investment in resources and integrating them to build systems that influence the organisation's overall efficiency, effectiveness and flexibility (Karimi et al 2007). Therefore, an inference can be drawn that the participants agreed with the discussion of a reliable and well-resourced infrastructure and human resources that are efficient in execution. Participants responses potentially point to some level of improvement needed in the human, non-human, technical and non-technical actors in the environment. The focal actor has a major role to play in ensuring the human, non-human, technical and non-technical actors

are enrolled and their interests are inscribed and mobilised to achieve a common outcome. When resources are in place, it also important to have an architecture that delivers in line with the business objectives.

5.5.2 System architecture of ERP and ECM at Rand Water

This section addresses objective 3 and the second research question on the system architecture of ERP and ECM at Rand Water. The objective is informed by the enrolment and mobilisation of the ANT concepts. As mentioned in Chapter Two, architecture is a super actor which mainly enrols actors for the integrated network of integrating ERP into ECM (Effah 2012). Architecture components of ERP and ECM are actors in the actor network of integrating these two enterprise systems.

Enterprise architecture as defined by Winter & Fisher (2006) as the fundamental organisation of a system that is embodied in its components, their relationships with each other and the environment, and the principles governing its design and evolution. It is represented in layers as business architecture, process architecture, integration architecture (e.g. agility, cost efficiency, integration speed), software architecture (software services and data structures), technology architecture (infrastructure) (e.g. computing/ telecommunication hardware and networks). These levels were well depicted in Figure 2.6 as the general enterprise architecture: Business architecture, information systems architecture, operations architecture and cross-architecture disciplines. In consideration of ANT, the concept of actors and negotiations involves the translation concept (i.e. actors, enrolment, interessement, inscription and mobilisation) where in this case, interests of both the investor and entrepreneur are aligned. This alignment is achieved through the inscription into several artefacts such as business plans, a charter, a loan agreement, articles of incorporation. In terms of artefacts, little can be mentioned such as legal and governance structure and business model (i.e. core business processes, the reference to technology and personnel requirements). All these are actors in the enterprise actor network that grows and includes vendors, customers, suppliers, employees, production technology, information technology, contracts, annual reports and others (Sidorova & Kappelman 2011).

Feedback from the interview participants also pointed to the best fit technology strategy for ERP with service-oriented architecture that enables integration and the usage of a single

solution/ platform. At a module level of ERP, the participants' feedback highlighted the modules such as finance, material management (MM), payroll and HR in the SAP system. This was understood as being the architecture and it also referred to the software layer, database layer and the GUI layer. The ECM architecture also referred to best-fit technology with more than one physical content/ records repository for different types/ categories of content (web content, emails archive, records, archival management). In the architecture ECM, mention was also made of server, database, application and front end, including the file plan. In pointing to FileNet, an advanced workflow engine called process engine includes Nintext. There was also BizTalk, being the enterprise bus with a process engine and business rules. Focal actor in consideration of interests of non-human, technical and non-technical actors on the actor-network, are to inscribed while enrolment remains an ongoing process.

Participants also mentioned that service- or process-oriented architecture was the best-envisaged architecture, including the transactional processing/ ERP and ECM layer. ECM being more specific from the responses of the participants, it was said that ECM included end-to-end process automation and integration, as well as a layer for capturing "a single version of the truth" contents. There was also some feedback from participants on the IT architecture standards question that indicated governance as being the responsibility of the board and that interoperability standards and growth strategy aligned to our needs and IT and architecture standards. ICT policies were also mentioned in the roadmap standard. It was also noted that models and frameworks such as Gartner and TOGAF are recommended based on responses. This creates an opportunity for a potential opportunity to have them reinforced. Although the participants, in general, tried to answer the question on road map, architecture and standards, it was noted that there was a challenge in understanding what was in the literature. This seemed to suggest that at Rand Water, there would be a need to educate system users and management (human actors) on what terms such as 'architecture' mean in the whole picture of IT systems and integration. This is even though Bekker (2016) wrote about Rand Water enterprise architecture where the technical architecture and information architecture (application and data architecture) are presented. The awareness or change management was further discussed under the stimulating and inhibiting factors to integrating ERP into ECM. This discussion leads to the next objective that focused on compatibility and the interoperability of the ERP and the ECM system.

5.5.3 Compatibility and interoperability of ERP and ECM at Rand Water

This section addressed the fourth objective and the third research question in this objective. The question was on the compatibility and interoperability consideration for integrating ERP into ECM at Rand Water. The ANT concepts informing this objective are irreversibility and mobilisation. As mentioned in literature Chapter Two, irreversibility focuses on the degree to which it is not an option to reverse to where an alternative exists and mobilisation was when the focal actor seeks to ensure that the specific representative of actors was accepted as the main voice that represents all actors in an ERP into ECM heterogeneous integration network (Leikums 2012; Walsham 1997). The global actor in this instance plays the role of decision-making and has authority at the executive and divisional level in the context of the study (Effah 2012). In systems integration, data exchange and promotion of interoperability are some of the benefits, in this case, according to Leikums (2012). It is further explicated that integrated information systems must inter-connect and inter-communicate as a complex, complete and coherent system and all systems parameters interfere to ensure compatibility and combined inter-operability. Gradual integration is encouraged where possible as sometimes it can be mandatory integration (finance, HR and workflow systems), advisable integration (AD and CRM), ECM integration and optional integration (Leikums 2012).

Participants mentioned that it was important to have exchanged data from other systems, and that information was to be fed from one system and integrated into the other. A practical example was mentioned where a drawing was kept and ERP also keeps the same drawing format. On the other hand, there was an opinion that recommended only the focus on integrating invoices when integrating all the components appeared to be a challenge. There was also another opinion that suggested that the ECM or ERP vendor should be the one giving something to assist integration. It, therefore, revealed that there was an agreement that there is a need to have integration done to a level where participants as actors and systems as actors both require aligned and mobilisation while irreversibility application remains through the influence of the focal actor.

In the interoperability discussion, the participants mentioned the exchange of data and ease of use. Participant L in the interview mentioned that interoperability was dependent on the network if the equipment was compatible. In summation, same platform, workflow, change management and vendor agreement between products were mentioned by participants as being

the interoperability requirements. It was noted that these participants acknowledged that interoperability would involve internal and external resources, being human, non-human, technical and non-technical resource (i.e. actors). Their interests related to interoperability would need to be inscribed to ensure stable network and irreversibility.

Rand Water architecture documents (such as Figures 4.1 and 4.2) represent the links between different systems and modules of SAP. Based on Figure 4.1, there is an opportunity to integrate ERP into ECM in the context of this study. In line with the ANT as mentioned in the first chapter, system resources for ERP are the actors building the actor network for integrating ERP into ECM. The integration of ERP into ECM is the actual actor network formulated through the collaboration of the actors. The actor network is heterogeneous through the inscription concept, which refers to the embedding of interests and values of the actors into the technological artefacts (Effah 2012).

5.5.4 Governance of electronic content in ECM and ERP at Rand Water

The results from the interviews pointed to the importance of compliance with the legal framework. ECM contribution includes the governance of information, content and records. This discussion is relevant to be under the integration strategy of integrating ERP into ECM. In consideration of the Rand Water annual reports, few legislative compliances are mentioned such as the South African Constitution of 1996, section 195, the Water Services Act of 1997, the NARSSA Act of 1996 as amended, the ECT Act of 2002 and the Rand Water Records Management Policy. These Acts formed part of the document analysis in the compliance arena of discussion. These were the non-human and non-technical actors who had a direct impact on the integration of ERP into ECM objective and deserves to be part of the integration strategy. The governance of electronic content in both ECM and ERP at Rand Water forms part of the non-human actors in influencing the integration of ERP into ECM.

5.6 Summary

This chapter interpreted and discussed the findings of the study that were presented in Chapter Four, interesting them in the context of previous researches that were done in and outside South Africa, as discussed in Chapter Two. Furthermore, the ANT was discussed in Chapter One and as mapped in Chapter Two guided the interpretation of the findings. Comparisons were made

to identify similarities and differences between the current study and the previous studies, and reasons were advanced to explain the differences. An attempt was made to explain, corroborate and clarify the results. The findings were interpreted and discussed according to the objectives as presented in Chapter One of this study.

The discussion revealed that the organisation desires to have integration of the ERP into ECM to improve its operational performance. It was also noted that there would be a high level of productivity with these two enterprise systems integrated. Being a desired state of the two enterprise systems (ERP and ECM), the discussions revealed that it is not beneficial to have them operating independently from each other. Operating ERP and ECM independent from each other increases labour time, duplicates electronic records, increases storage cost, reduces the processing speed, compromises information harmony, affects customer service, compromises streamlining of processes, make business continuity more demanding and increases the risk of information compliance with regulations. This was evident in the responses from the interviewees when they highlighted the disadvantages of not having an integrated environment where business unit areas highlighted the weaknesses in ECM that is not integrated with ERP.

In summary, the findings indicated that operating ERP and ECM independently does not add any value to the organisation. The value-add of an integrated ERP into ECM was discussed and the findings confirmed the desire to realise the value-add.

From the findings, it was discovered that there are stimulating and inhibiting factors to ensure that the integration of ERP into ECM was made possible and done efficiently. This required collaboration and alignment of actors which are human and non-human. Human refers to organisational leaders, project managers, professional business unit professionals (such as in legal, finance, procurement, human resources, auditing) and stakeholders. Non-human refers to the technology, enterprise architecture, system architecture, systems resources, compatibility and interoperability requirements, policies, regulatory framework (such as the acts, laws and legal requirements) and the organisational climate, culture, communication, change management, training, funding and budget, and business processes alignment. While these factors stimulated the integration of ERP into ECM, it was also noted that there are also factors that inhibit the integration of ERP into ECM. The obstacles were noted to be primarily opposed to the stimulants.

It was also noted that a lack of integration has more negatives than the positives, while the integration of the ERP into ECM has more positives than negatives. Although it is encouraged, it does not come at a very low cost. In consideration of the return on investment, in this study it was demonstrated in the findings that it still a preferred option and in line with the changing times and technological advancement; 4IR and cloud technology being some of the examples mentioned in the study. Best-fit technology that is current was mentioned as key to the success of the integration of ERP into ECM. In this chapter, it was also noted that there needs to be an integration strategy to ensure success in implementing the integration of ERP into ECM as there still lacks an approach to integrate ERP into ECM. The approach or framework was proposed to be agile in that it caters for little to full integration of ERP into ECM. The next chapter provides conclusions, a summary and recommendations on the integration of ERP into ECM at Rand Water. Also, the chapter proposes a framework that might assist in achieving the integration of ERP into ECM.

CHAPTER SIX
SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

6.1 Introduction

The previous two chapters (four and five) provided data presentation, analysis, interpretation and discussion of the findings. This chapter provides a summary, conclusion and recommendations of the study, and possible areas for future research, based on the findings and interpretations that were presented in the previous two chapters and the literature review in Chapter Two. The conclusions and recommendations provided in this chapter were based on the research purpose, research objectives and the problem of the study discussed in Chapter One. This chapter also outlines the various implications of the study findings. According to the research methodology and literature discussed in this study, the chapter further proposes a framework that maps the integration of ERP into ECM to realise the benefit in optimised operations in the organisation.

These benefits that can be realised include the following: reduced paper handling and reduced labour; reduced misplaced or lost invoices; reduced storage costs; increased processing speed; decreased errors (higher accuracy); fast, reliable, easy to access invoices using the familiar ERP user interface; on-time payments; more early-payment discounts; auditable business processes with more visibility, improving efficiency and automation and adding efficiency to repetitive business processes; cost reduction; and facilitation of rapid decision-making and regulatory compliance (Medina 2014; Motwani et al 2005). It is also noted that there is currently a need to have an approach to ensuring that integration of the ERP into ECM is a success. The conclusions identify and provide further avenues of research arising from the study. The chapter was structured to include the following: a summary of the findings, conclusions, proposed framework and suggestions for further research. This is presented according to the objectives of the study.

The general purpose of the study was to develop a framework for integrating ERP into ECM at Rand Water with a view of improving productivity and efficiencies in operations. To fulfil the purpose of the study, the following research objectives guided the study:

i. Examining the effects of operating ERP and ECM independently at Rand Water

ii. Examining the value-add of integrating ERP into ECM at Rand Water
iii. Determining the stimulating and inhibiting factors for integrating ERP into ECM at Rand Water
iv. Determining the integration strategy for integrating ERP into ECM at Rand Water
v. Proposing a framework for the integration of ERP into ECM at Rand Water**.**

6.2 Summary of the findings

This section presents a summary of the findings according to the research objectives.

6.2.1 Effects of operating ERP and ECM independently

In the case of Rand Water, these ERP and ECM systems exist but remain not integrated to fully benefit Rand Water in its business objectives (Maraba 2017; Medina 2014; Van Rooij 2013). ERP and ECM are made up of modules that are for different functionalities required by the business. ERP modules at Rand Water are financial accounting (FI), management accounting (CO), project systems (PS), materials management (MM), sales and distribution (SD), human resources, asset management (AM), payroll (PR) and ESS/ MSS Portal). These modules are also in line with the business processes and its operations as well as ECM on the electronic records management (Rashid et al 2002) (Katuu 2012). ERP has an integrated design in the configuration of its modules and the same applies to ECM. Based on the findings at Rand Water, it was noted that ERP has modules used for different business functions as well as ECM. ERP at Rand Water is in the form of SAP as the product and ECM in the form of FileNet as a product. Integration of these two systems allows an organisation to reduce cost, improve productivity, improve efficiency, visibility and compliance (OpenText 2014; Medina 2014).

Not all participants were in support of integrating SAP and FileNet, but still not discounting the benefits of integrating the two systems. Depending on the area of work and the level of interaction with other business units, integration might not be deemed as a high priority by some of the members in an organisation. Most of the participants in the study were proponents of the integration of SAP and FileNet in the case of Rand Water. It can, therefore, be expressed that the effects of operating ERP and ECM are not more positive than operating them in an integrated manner. Therefore, it was the conclusion that it is not beneficial to operate ERP independent of the ECM based on the literature and the feedback from the interview

participants during the interviews. To guide the research study, the ANT was used through the application of its concepts. To understand the effects of operating ERP and ECM, the problemitisation concept was applied to reflect the challenge of ERP that is not integrated to ECM and not benefiting from all the positive impacts for the organisation through the enrolment of other actors.

This study reveals that there is a reason to consider the integration of ERP (being SAP) and ECM (being FileNet) at Rand Water. Without the integration, it was revealed that there would be a lack of efficiency, completeness and trustworthy. There are risks associated with the absence of integration of ERP into ECM such as data manipulation where manual interfacing becomes the solution. Information gap was also noted as another disadvantage resulting in the application of electronic destruction policy being a challenge when SAP and FileNet are not integrated at Rand Water.

6.2.2 The value-add of integrating ERP into ECM at Rand Water

Integrating ERP into ECM improves efficiency and operation (Mahrami & Hakro 2018). The value derived when ERP and ECM are integrated brings about improved management and efficiency in the business (Rothenberger et al. 2010), such as reduced paper handling and reduced labour; reduced misplaced or lost invoices; reduced storage costs; increased processing speed; decreased errors (higher accuracy); fast, reliable, easy access to invoices using the familiar ERP user interface; on-time payments; more early-payment discounts; and auditable business processes with more visibility, improving efficiency and automation and add efficiency to repetitive business processes; cost reduction and facilitate rapid decision-making and facilitating regulatory compliance can be realised (Medina 2014; Motwani et al 2005).

This study reveals that data quality improvement can be realised when ERP and ECM were to be integrated by applying the principle of once-off capturing and one point of access to information. The information would be more accurate with enhanced compliance with the legal framework and knowledge of the information location when SAP and FileNet are integrated. One version of the truth was also highlighted, which will result in a reduction of risk to Rand Water operations. It was also noted that the changing times and advancement in technology,

influenced by the organisational growth, justifies the reasons for a call to integrate the two systems at Rand Water, as discussed thus far in the study.

It was further revealed that the integration of SAP and Filenet enables effective and efficient decision support in instances such as being able to negotiate contracts well in advance which can result in a monetary value benefit to the organisation. The consolidation of electronic records with integration enables document control where munites with resolutions are taken at the committees such as procurement tender committee. As with any organisation, Rand Water's quality decision-making is unavoidable and is enabled by timeous, available and accurate information from the integration of SAP and FileNet. In the case where auditors using ACL as an ECM fulfil their audit objectives, integration between these two will also be beneficial when conducting data analytics.

The study also considered the application of the ANT concepts for the value-add as interessement, enrolment and mobilisation. These concepts are applied to both human and non-human actors in this study at Rand Water (Effah 2012).

6.2.3 Stimulating and inhibiting factors to integrating ERP into ECM at Rand Water

Stimulating factors presented as critical success factors are key to ensuring an accomplishment in both the implementation and integration of ERP into ECM in line with the business objectives (Hullavarad et al 2015). Critical success factors are to be applied in the context of the business as caution should be exercised at they are not equally important in all circumstances (Lim et al 2016). Critical success factors to be considered in the case of integration of ERP into ECM relate to both human and non-human actors where focal actors are responsible for ensuring the fulfilment of the desired integration (Sidorova & Kappelman 2011). These stimulating factors for human actors' role include users, top management, committed and informed executive sponsor, project management, vendors, appropriate IT staff, team work and stakeholders for the human actors. For the non-human actors, these success factors include software design, software communication strategy, business process re-engineering, skills, data management, organisational characteristics, financial resources, change management, training and business process re-engineering (Alalwan & Weistroffer 2013; Alaskari et al 2012; Hullavarad et al. 2015; Kale et al. 2010; Katuu 2016b; LIM et al.

2016; E W T Ngai et al. 2008; TA Rickenberg et al. 2012; Sidorova & Kappelman 2011; Stefanou 2001; Vilpola 2009; Herbst, et al. 2014).

From the present study, it was discovered that among the stimulating factors such as the business need requirements, key role players and culture were identified, among others. In terms of key role players, the following were identified: senior management, board, the CE, IT, finance, SCM (procurement), legal, auditors and records managers in Rand Water. Reliability, availability and accuracy of information to enable quality of decision making with one version of the truth.

This study revealed that culture such as the information silos culture at Rand Water, ought to be broken down for the organisation to realise the potential opportunity of integrating ERP into ECM. Culture in this context influences the identification of opportunities to integrate ERP into ECM, forward thinking, forward-looking, technology preparation for the 4IR and beyond. Other stimulating factors identified to be some of the elements in the organisation to influence the identification of opportunities to integrate ERP into ECM were responsive to business needs, infusing global trends, training, innovation and transformation were noted.

This study also revealed obstacles that inhibit the integration of ERP into ECM as a lack of training (i.e. inadequate, insufficient and irrelevant), silo thinking, computer illiteracy, a lack of change management for people using the systems, a lack of leadership support, corruption and power. It further noted that cyber security extended to OT, the challenge in licences, and a lack of appropriate standards and policies.

Guided by the ANT, human and non-human actors' collaboration and lack thereof determine the success or failure of identifying the opportunities to integrate ERP into ECM. Actors in an actor network have different interests and therefore the stability rests on the ability to translate which means re-interpreting, represent, or appropriate other's interest to one's one. It also noted that actors, being human and non-human, could be obstacles inhibiting the integration of ERP into ECM (Nandhakumar et al 2005). As revealed in the study as human and non-human actors through the ANT, literature and the study findings are aligned in this discussion.

6.2.4 Integration strategy for integrating ERP into ECM as Rand Water

To achieve integration of ERP into ECM there needs to be an identification of system resources, compatibility and interoperability and governance of electronic content approach. An organisation such as Rand Water uses IT to leverage its resources as it integrates them to build systems to influence the organisation's overall efficiency, effectiveness and flexibility (Karimi et al 2007). These resources include ERP (SAP) modules not limited to only accounting, financial, manufacturing, production, transportation, sales and distribution, human resources, supply chain, centralised common database management system to increase operational transparency through the standards interface as well as LAN/WAN, server level, service application from office, back office. Resources for ECM (FileNet) include servers running software that centralises content into a database creating and storing a virtualised and version component (media, text, formatting) of documents (web site, newsletter; portal), templating software for capturing and applying standard formatting in unstructured documents, business rules and roles in workflow and web server (Iverson & Burkart 2007: 6).

The current finding of the study identified resources that were technical and non-technical. The technical ones include ICT infrastructure (includes for ERP and ECM), good servers, SAN drive, optimal database, mobility, computers with memory and printers. Modern best fit technology with optimal network availability, fibre, cable, Wi-Fi and security risks. Indexing functionality for ECM and SAP additional resources on expertise was also included. ECM components (user interface, information governance, automation, policies, legal, regulatory and industry compliance), attributes (data archive, intelligence data, workflow, integration/ data processing, information disposal) and repository (Hullavarad et al 2015). The non-technical resources included trained staff that are geared for the fourth industrial revolution, people with communication skills, manpower with skill, architecture and standard, proper governance process reviewed from time to time, including data governance, IT architecture understanding with a new way of thinking, leadership and budget. Lastly the integration strategy on enterprise applications in the EMF.

All these system resources are actors in achieving integration into ECM. This integrated network of ERP into ECM is achieved through the interessement of actants and enrolment of other actors in both technical and non-technical resources (Silva 2007).

Enterprise architecture is the fundamental organisation of a system that is embodied in its components, their relationships to each other and the environment, as well as the principles governing its design and evolution (Winter & Fisher 2006). The study revealed that best-fit technology strategy for ERP (SAP) with service-oriented architecture that enables integration and usage of a single platform to be what is required. For ECM (FileNet), best-fit technology is needed with more than one physical electronic records repository for different categories of content (web content, emails archive, records, archival management), server, database, application and front end, including the file plan, advance workflow engine (Nintext) and BizTalk as enterprise bus with a process engine and business rules. IT architecture standards, interoperability standards, growth strategy aligned to the business needs, and ICT policies in the road map remain the responsibility of the board. The ANT concept of enrolment and mobilisation is applied in the system architecture of integrating ERP into ECM at Rand Water.

In systems integration, data exchange and promotion of interoperability are some of the benefits, in this case, according to Leikums (2012). The findings of the current study indicated that data exchange of ERP into ECM should ideally be fed from one and integrated into the other. Integration of invoices or drawings in one system and keeping a copy on the other means retrieving without duplicating the copy. To achieve this data exchange, interoperability is dependent on the network of the equipment that is compatible. This means the same platform, workflow, change management and vendor agreement between SAP and FileNet for their interoperability requirements. As mentioned in the study, the integration of ERP into ECM is the actual actor network formulated through the collaboration of the actors. The actor network is heterogeneous through the inscription concept, which refers to the embedding of interests and values of the actors into the technological artefacts (Effah 2012).

The present study's findings further showed that it is important to ensure that relevant legislative compliance is achieved when integrating ERP into ECM at Rand Water. The legislative framework includes but is not limited to: South African Constitution 1996, section 195, Water Services Act of 1997, NARSSA Act of 1996 (as amended), ECT Act of 2002 and Rand Water Records Management Policy (Rand Water Annual Reports). Legislative framework compliance is an actor in the actor network of achieving integration of ERP into ECM at Rand Water.

6.3 Conclusions

This section provides the conclusions organised according to the objectives of the study as presented in sections 6.3.1 to 6.3.4. In addition to that, a proposed framework is presented and discussed in section 6.4 of this study.

6.3.1 Effects of operating ERP and ECM independently

In the case of Rand Water, these ERP and ECM systems exist but remain not integrated to fully benefit Rand Water in its business objectives (Maraba 2017; Medina 2014; Van Rooij 2013). This study concludes that as much as Rand Water has invested in the ERP (SAP) and ECM (FileNet), the two systems remain not integrated and not affordable. The effects of operating ERP and ECM independently result in a lost opportunity to leverage the potential benefits that would be realised if integration was to be considered.

Two of the participants who were not in support of the integration either due to the satisfaction of the status quo or due to being able to perform their role without the integration of the two systems.

The study concludes that Rand Water is not in any better position operating ERP and ECM not integrated. It would be more beneficial to consider integration as opposed to no integration. That being the proposal for the ERP and ECM in existence in Rand Water, there remains a gap in terms of how to achieve a successful integration. It is without a doubt that each system has its roles and functions that add value as standalone systems from each other. However, in the study, it was concluded that there would be much value for Rand Water in integrating these two systems. It is therefore proposed that although there is no comprehensive approach to ensure that adequate or complete integration is achieved, there is a need to propose a framework to be used to achieve this potential. In using the ANT to guide the research, its concepts point to the two systems and all their other related dependencies as actors that also collaborate to achieve this integration.

6.3.2 The value-add of integrating ERP into ECM at Rand Water

In this study, the benefits of integrating ERP into ECM were noted as reduced paper handling; reduced labour; reduced misplaced or lost invoices; reduced storage costs; increased processing speed; decreased errors (higher accuracy); fast, reliable, easy access to invoices using the familiar ERP user interface; on-time payments; more early-payment discounts; and auditable business processes with more visibility, improving efficiency and automation and add efficiency to repetitive business processes; cost reduction and facilitate rapid decision-making and facilitating regulatory compliance (Motwani et al 2005) and (Medina 2014).

The study concludes that operational improvement in the integration of ERP into ECM at Rand Water is to be realised through data quality improvement because of the principle of capturing once and one point of access to information, which stands to be more accurate in enhancing compliance with the legislative framework and information that can be easily located as the location is well known. It is further concluded in the study that risks are minimised as those empowered to make decisions are enabled to sustain the organisation financially, operationally and legally while ensuring a good reputation financially due an integrated ERP into ECM. Effective decision-making is enabled as there is one version of the truth, which is beneficial to the organisation and the employees. Integration of ERP into ECM also offers an opportunity to also benefit in terms of monetary value when contracts can be negotiated well in advance.

In the present study, it is also concluded that IT should not be left behind by business as the times are changing and advancement in technology is unavoidable, this is the case with the integration of ERP into ECM. Therefore, the information must be timeous, available and accurate for rapid and good quality decision-making as there is a correlation between the integration of ERP into ECM (Motwani et al 2005; Mohamed 2015). In line with ANT, it is concluded that decision-maker autonomy functions together with the enrolment of actors and that the focal actor fulfils the distribution of knowledge and skill among other actors. In the interest of other actors, the actor network of integrating ERP into ECM aligns to that of the focal actor (Johannesen et al 2012).

6.3.3 Stimulating and inhibiting factors to integrating ERP into ECM at Rand Water

The present study concludes that the stimulating and inhibiting factors are key to the integration of ERP into ECM at Rand Water in line with the business objective. Some factors stimulate and inhibit the integration of ERP into ECM. These factors that stimulate or inhibit the integration as desired are both and non-human. In line with the ANT critical success factors that point to the actors, actor network, enrolment and focal actors that stimulate the integration of ERP into ECM (Sidorova & Kappelman 2011).

In the study it was concluded that the following stimulating and inhibiting factors involve human and non-human actors: users, top management, committed and informed executive sponsor, project management, project champion, vendors, appropriate IT staff, team work, stakeholders and executive sponsor, software design, software communication strategy, business process re-alignment, skills, data management and integration, organisational characteristics, financial resources, change management and culture, monitoring and evaluation of performance, ERP and ECM strategy and implementation methodology, business plan/ vision/ goals/ justification, document access and procedures, training and certification, business process re-engineering (Alalwan & Weistroffer 2013; Alaskari et al 2012; Hullavarad et al 2015; Kale et al 2010; Katuu 2016b; Lim et al 2016; Ngai et al 2008; Rickenberg et al 2012; Sidorova & Kappelman 2011; Stefanou 2001; Vilpola 2009; Herbst et al 2014).

It was further concluded in the study that at Rand Water, the key role players are senior management, the board and the CE, finance, IT, SCM, legal, auditors and records areas. Culture influence is key in achieving the integration of ERP into ECM, it is to be managed through change management. Change management should be used as a tool to drive forward-thinking and to prepare for the coming of the 4IR and beyond in line with the business needs, global trends innovation and transformation. It was also concluded that the obstacles that inhibit achieving a successful integration of ERP into ECM are noted to be a lack of training, insufficient and irrelevant training, silo thinking, lack of computer literacy, change management for people using the system, leadership not supportive, corruption power, culture, standards, policies, incompatibility and data complexity.

6.3.4 Integration strategy for integrating ERP into ECM

From the present research findings, the researcher concludes that the integration of ERP into ECM requires identification of the suitable architecture in line with the enterprise, system resources, compatibility and interoperability, and governance of electronic content approach. Rand Water should use IT to leverage its resources as it integrates them to build systems to influence the organisation's overall efficiency, effectiveness and flexibility (Karimi et al 2007). These resources include ERP (SAP) modules not limited to accounting, financial, manufacturing, production, transportation, sales and distribution, human resources, supply chain, centralised common database management system to increase operational transparency through the standards interface as well as LAN/WAN, server level, service application from office, and back office. Resources for ECM (FileNet) include servers to run software that centralises content into a database creating and storing a virtualised and version component (media, text, formatting) of documents (web site, newsletter, portal), templating software for capturing and applying standard formatting in unstructured documents, business rules and roles in workflow and web server (Iverson & Burkart 2007: 6).

Findings of the study articulated the resources as ICT infrastructure (includes ERP and ECM), good servers, SAN drive, optimal database and mobility, computers with memory and printers. Modern best fit technology with optimal network availability, fibre, cable, Wi-Fi and security risks, indexing functionality for ECM and SAP additional resources on expertise. ECM components (user interface, information governance (automation, policies, legal, regulatory and industry compliance), attributes (data archive, intelligence data, workflow, integration/data processing, information disposal) and repository (Hullavarad et al 2015). The non-technical resources include trained staff that are geared for the fourth industrial revolution, people with communication skills, manpower with skill, architecture and standard, proper governance process reviewed from time to time including data governance, IT architecture understanding with a new way of thinking. leadership and budget. As well as integration strategy on enterprise applications in the EMF.

The findings of the study revealed that a best-fit technology strategy for ERP (SAP) with service-oriented architecture that enables integration and usage of a single platform should be what is required. For ECM (FileNet), best-fit technology would be more than one physical electronic records repository for different categories of content (web content, emails archive,

records, archival management), server, database, application and front end, including the file plan, advance workflow engine (Nintext), and BizTalk as enterprise bus with a process engine and business rules. IT architecture standards, interoperability standards, growth strategy aligned to the business needs, and ICT policies in the road map remain the responsibility of the board. The ANT concepts of enrolment and mobilisation are applied in the system architecture of the integrating ERP into ECM at Rand Water.

The current findings of the study indicated that data exchange of ERP into ECM should ideally be fed from one and integrated into the other to promote interoperability (Leikums 2012). To achieve this data exchange, interoperability depends on the network of the equipment that is compatible. This means the same platform, workflow, change management and vendor agreement between SAP and FileNet for their interoperability requirements. In line with ANT, the study concludes that the integration of ERP into ECM is the actual actor network formulated through the collaboration of the actors. The actor network is heterogeneous through inscription concept which refers to the embedding of interests and values of the actors into the technological artefacts (Effah 2012).

The findings of the present the study concludes that it is important to ensure that relevant legislative compliance is achieved when integrating ERP into ECM at Rand Water. The legislative framework includes but not limited to: South African Constitution 1996, section 195, Water Services Act of 1997, NARSSA Act of 1996 (as amended), ECT Act of 2002 and Rand Water Records Management Policy (Rand Water Annual Reports). Legislative framework compliance is an actor in the actor network of achieving integration of ERP into ECM at Rand Water.

6.4 Recommendations

This study proposes the following recommendations to address each of the research objectives of the study and these are covered in sections 6.4.1 to 6.4.4. The proposed recommendations have both electronic governance and practical implications and they are drawn from the findings of the study.

6.4.1 Effects of operating ERP and ECM independently at Rand Water

The effects of operating ERP and ECM independently at Rand Water are discussed below in line with the recommendations:

i. Organisations like Rand Water having invested in ERP and ECM should review the initial intention of having invested in the two enterprise systems. The organisation should further review the effects of operating ERP and ECM independent from one another without the integration. This is established to measure the benefits of no integration versus having ERP and ECM integrated. Based on the outcome, the organisation should intentionally review the return on investment when integrated versus when not integrated. It is also important for the organisation to identify the lost opportunity to have leveraged on the potential benefits that would have been realised if integration were to be considered.

ii. Through the results of the study, it was established that although the benefits of integration are acceptable and appreciated by most of the participants. However, it was noted that two participants did not agree with the integration, stating that they are happy with the status quo. This points to the importance of change management in integrating ERP into ECM.

iii. The study established that Rand Water would be more efficient and would achieve high productivity in its operations when ERP (being SAP) and ECM (being FileNet) are integrated. The recommendation provided by the researcher is that the benefits should be listed to justify the reason to intentionally build a business case to support the integration of ERP into ECM in the organisation. The functions of each of the system should be fully articulated to identify what each of the systems offers to the organisation when not integrated and what benefit in the function it will offer if integrated. This is done as the first part that will assist in expanding the role of the organisation and its contribution to the potential efficiencies that ERP and ECM will offer when integrated versus when it is not. The ANT concept should be used to assist in identifying the actors that would need to collaborate to achieve an integration of ERP into ECM.

6.4.2 The value-add of integrating ERP into ECM at Rand Water

The value-add of integrating ERP into ECM at Rand Water is discussed below in line with the recommendations:

i. The value-add of an integrated ERP into ECM at Rand Water in the study identified the benefits as reduced paper handling; reduced labour; reduced misplaced or lost invoices; reduced storage costs; increased processing speed; decreased errors (higher accuracy); fast, reliable, easy access to invoices using the familiar ERP user interface; on-time payments; more early-payment discounts; and auditable business processes with more visibility, improving efficiency and automation and adding efficiency to repetitive business processes; cost reduction; facilitating rapid decision-making and facilitating regulatory compliance.

ii. From the present findings, it was discovered that the operational improvements in the integration of ERP into ECM were in the improvement of data quality due to the principle of capturing once and one point of access to information. It was established that information captured once and accessed at one point without further manipulation stands to be more accurate and enhance the compliance with the legislative framework and location of where the information is stored.

iii. The findings of the study identified that when information is accurate, organisational risks are minimised because those responsible for making decisions at the executive level will be well empowered to sustain the organisation financially, operationally, and legally, while ensuring the good reputation of Rand Water. In the study, it was established that effective decision-making is enabled by one version of the truth to benefit the organisation when ERP and ECM are integrated at Rand Water.

iv. The results of the study also established that IT should not be left behind by the business due to the changing times and the advancement in technology which is unavoidable. Time, availability and accuracy of rapid decision-making are key, as it is further enabled by the integration of ERP into ECM.

v. It is, therefore, the recommendation by the researcher that based on the benefits identified that the value-add of an integrated ERP into ECM should be categorised in the category of operational improvement and quality of effective decision-making and importance of timeous, available and accurate information to Rand Water business. It is also recommended that the ANT concept of enrolment, actors and focal actor be used together with the decision-maker autonomy. Further to the recommendation stated, the focal actors should fulfil the role of distributing knowledge and skill among actors in line with their interest of achieving integration of ERP into ECM and the technological advancement and changing times.

6.4.3 Stimulating and inhibiting factors to integrating ERP into ECM at Rand Water

The stimulating and inhibiting factors to integrating ERP into ECM at Rand Water are discussed below in line with the recommendations:

i. The study identified the critical success factors to achieving an integrated ERP into ECM at Rand Water in line with the business objectives. These critical success factors were noted as factors that stimulate and those that inhibit the potential integration of ERP into ECM.

ii. From the study, the researcher recommends that the following stimulating factors involving human and non-human actors should be among the critical success factors for integrating ERP into ECM: users, top management, committed and informed executive sponsor, project management, project champion, vendors, appropriate IT staff, teamwork, stakeholders and executive sponsor, software design, software communication strategy, business process re-alignment, skills, data management and integration, organisational characteristics, financial resources, change management and culture, monitoring and evaluation of performance, ERP and ECM strategy and implementation methodology, business plan/ vision/ goals/ justification, document access and procedures, training and certification, and business process re-engineering.

iii. The researcher further recommends from the study that the key role players for driving the integration of ERP into ECM should be identified as senior management, the board and the CE, finance, IT, SCM, legal, auditors and records areas. The issue of change

management should be used as a tool to drive forward thinking, forward-looking and preparation for the coming 4IR and further technological advancement in line with the business needs, global trends innovation and transformation.

iv. It was also established that the obstacles inhibiting the integration of ERP into ECM are lack of training, insufficient and irrelevant training, silo thinking, lack of computer literacy, change management for people using the system, leadership not being supportive, corruption power, culture, standards, policies, incompatibility and data complexity.

v. It was established that these critical success factors involve human and non-human actors in line with the ANT concepts such as actor network, enrolment and focal actors to stimulate the integration of ERP into ECM (Sidorova & Kappelman 2011).

6.4.4 Integration strategy for integrating ERP into ECM

The elements of a strategy for integrating ERP into ECM at Rand Water are discussed below in line with the recommendations:

i. From the present research findings, the researcher recommends that the integration of ERP into ECM requires identification of the suitable architecture in line with the enterprise, system resources, compatibility and interoperability and governance of electronic content approach. Rand Water should use IT to leverage its resources as it integrates them to build systems to influence the organisation's overall efficiency, effectiveness and flexibility (Karimi et al 2007).

ii. Based on the findings from the study, the researcher recommends that the following ERP and ECM resources should be identified when considering the integration of these two systems: Technical resources include ICT infrastructure (includes for ERP and ECM), good servers, SAN drive, optimal database and mobility, computers with memory and printers. Modern best fit technology with optimal network availability, fibre, cable, Wi-Fi and security risks, indexing functionality for ECM and SAP additional resources on expertise. ECM components (user interface, information governance, automation, policies, legal, regulatory and industry compliance), attributes

(data archive, intelligence data, workflow, integration/data processing, information disposal) and repository (Hullavarad et al 2015). The non-technical resources are among others: trained staff that are geared for the fourth industrial revolution, people with communication skills, manpower with skill, architecture and standard, proper governance process reviewed from time to time, including data governance, IT architecture understanding with a new way of thinking, leadership and budget.

iii. From the study findings, it was established that the best-fit technology strategy for ERP (SAP) with service-oriented architecture that enables integration and usage of a single platform. The best-fit technology for ECM (FileNet) is a technology with more than one physical electronic records repository for different categories of content (web content, emails archive, records, archival management), server, database, application and front end, including the file plan, advance workflow engine (Nintext) and BizTalk as enterprise bus with a process engine and business rules.

iv. The findings in the study established that data exchange of ERP into ECM should ideally be fed from one and integrated into the other to achieve interoperability (Leikums 2012). In data exchange, interoperability depends on the compatibility of the network of the equipment. This means the same platform, workflow, change management and vendor agreement between SAP and FileNet for their interoperability requirements.

v. It is recommended from the findings that the architecture standards, compatibility interoperability standards and growth strategy of Rand Water should be aligned to the business needs, ICT policies and the road map to be ultimately the responsibility of the board.

From the findings of the study, the researcher recommends that the relevant legislative compliance should be achieved when integrating ERP into ECM at Rand Water. The legislative framework includes, but is not limited to South African Constitution 1996, section 195, Water Services Act of 1997, NARSSA Act of 1996, as amended, ECT Act of 2002 and Rand Water Records Management Policy. In line with the findings of the study, the researcher recommends that the ANT concepts of enrolment and mobilisation be applied in the system architecture of the integration of ERP into ECM at Rand Water.

6.5 Proposed framework

The fifth objective of the study was to propose a framework for the integration of ERP into ECM at Rand Water**.** This section presents and discusses the proposed framework (see Figure 6.1) which is based on the findings of this study presented in Chapter Four and Chapter Five, as well as the review of literature as discussed in Chapter Two of this study. This framework can be adopted by organisations that are integrating ERP into ECM.

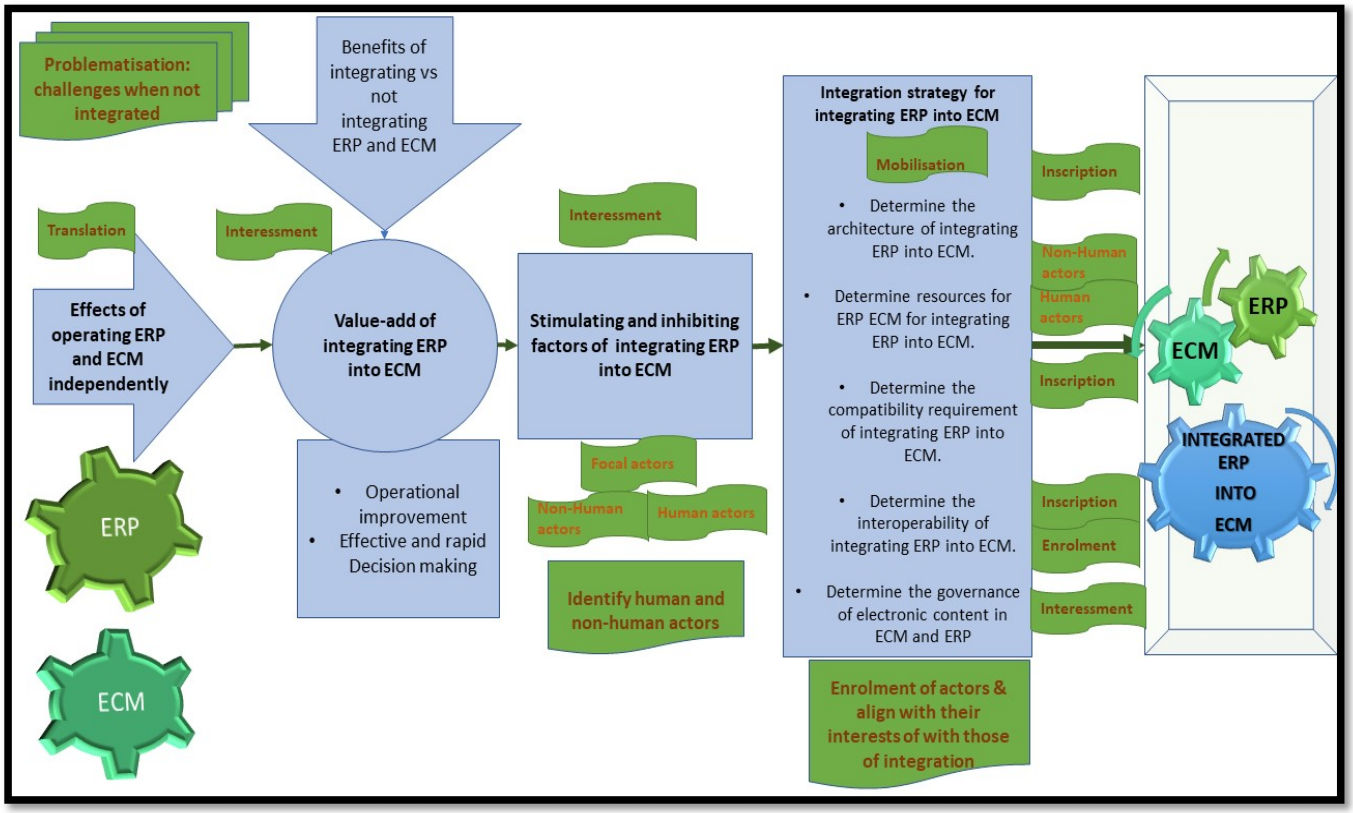

Figure 6. 1 Framework to integrate ERP into ECM at Rand Water (Researcher 2019)

The paragraph below explains the suggested framework.

i. Effect of operating ERP and ECM independently

There is a need for integration. As illustrated in Figure 6.1, the organisation through the appropriate team should determine the effects of operating ECM and ERP independently. The

determination is done in line with the business objective and operational performance. Still, at this stage, there needs to be a determination of the potential benefits that could be realised if the ERP and ECM were to be integrated. As an example, at the focus could be the challenges dealing with the right version of an invoice in the FileNet and one in the SAP system and the duplication of electronic records. This is where problematisation and translation commence.

ii. Value-add of integrating ERP into ECM

The actors, being IT and business, determine the value that will result in a return on investment when ERP is integrated into ECM. At this stage, the determination of time takes to process a transaction when there is no integration. Consideration of how long it takes to make a payment as an example in line with the business objectives. The assessment of the processes being followed with and without integration to review and potential cost saving if the integration of ERP into ECM was in place.

While still at this stage, two determinations must be done, they are the operational improvement of an integrated ERP into ECM for the organisation. The next one is to determine the operational improvement and how fast the decision-making process would be in the case where SAP and FileNet are integrated. There is also a consideration of how interested the potential participants are and getting all to see the value-add of having an integrated ERP into ECM at Rand Water.

iii. Stimulating and inhibiting factors

When executives deciding to integrate ERP into ECM would like to ensure that it is a success, it is important to understand what would make it a successful project. It is also important to know what could also make the project fail or negatively impact its progress. The stimulating and inhibiting factors are key in ensuring that the implementation of ERP and ECM is in line with the business objective. All those involved and all the technology, architecture, policies, project management, communication, change management and technical staff, together with the users of the system. are identified to ensure success in the implementation of ERP into ECM integration at Rand Water.

The other part of this stage is to determine the potential obstacles that would impact the success of the integration of ERP into ECM. Organisational culture and resistance to change are some of the issues to be considered. These are sometimes the opposites of the ones that have a positive impact on the integration of SAP and FileNet.

iv. Integration strategy for integrating ERP into ECM at Rand Water

This stage is where the enterprise architecture is reviewed in line to integrate ERP into ECM. This involves reviewing the technical resources and non-technical resources required to ensure that the integration of ERP into ECM is a success. The resources for each system should be determined adequately for their purpose. Additional resources are to be determined if necessary to achieve this integration.

To list a few from the technical architecture, there would be ICT infrastructure, good servers, databases and mobility. There could be modern best fit technology with optimal network availability, fibre cable, Wi-Fi and security risks. Electronic content indexing functionality should also be one of the technical resource considerations.

Human resources should also be included in the resource aspect; in this case, it is important to review the trained staff to fulfil the project objective. The communication skills of the people are also architecture and standards knowledge will be imported. Leadership, budget and proper governance process are some of the issues to consider on the non-technical resource consideration.

Compatibility and interoperability issues are also important to be considered in the integration strategy. There compatibility issues that could arise need to be identified and addressed accordingly to ensure that this does not become an obstacle to achieving integration of ERP into ECM. The same would apply to the operability of the two systems to enable data exchange between these two enterprise systems. Vendor agreements are some of the examples to consider and involve the solution supplier.

Electronic content governance is also important and crucial when in the process of integration. Compliance with the legislative framework is important and the relevant regulations, laws and acts are a must to be considered. As an example, for Rand Water, the Water Services Act, the

National Archive Services of South Africa Act and the ECT Act are parts of the legislative framework for which compliance is a requirement.

Actors, actor network, focal actor, enrolment, interessement and inscription are the ANT concepts applied in this stage, although they would be applied at an earlier stage because the enrolment of the actors is a continuous exercise until the integration is established with all actors collaborating to achieve the same goal.

6.6 Implication for theory, governance and practice

When undertaking a research study, one is trying to provide a solution to a problem identified and give some recommendations. This entails that when the recommendations provided in this study are implemented, there might be a huge improvement in achieving integration of ERP into ECM solutions. The current study identified the challenges organisations should deal with to ensure successful integration of ERP into ECM at Rand Water using the Actor Network Theory. The idea of a developed approach to integrating ERP into ECM has not been explored fully based on the literature. Therefore, there was a need to develop a framework to integrate them. The study is critical and necessary to improve the chances of achieving success when integrating ERP into ECM at Rand Water.

The study is expected to influence the importance of electronic content governance in organisations such as operating ERP and ECM. The study is also expected to encourage adherence to the relevant legal framework to achieve compliance in line with the auditors' standard of operation and expectation. The introduction of governance of electronic content is to ensure that clear knowledge, practice and empowerment support compliance with the legal framework. Electronic records management's legal requirements, together with the ICT technological solutions, assist the organisation to avoid unnecessary findings from the auditors or compliance professionals. Organisations should have electronic content governance in place to ensure compliance with the legislative requirement.

This study proposes the framework for integrating ERP into ECM at Rand Water. The framework offers an approach that is to be considered by organisations that have ERP and ECM installed and operating independently but would like to leverage the benefits of the integration of the two systems. The suggested framework might help organisations to have a

well-thought-out approach to integrating the two systems to the benefit of the organisation in line with its business objectives.

6.7 Suggestions for further research

This study took a more specific approach to adopt Actor Network Theory to guide the development of a framework to integrate ERP into ECM at Rand Water. There is a need for a study of holistic digital transformation in an organisation and outside.

This study has established that Rand Water has implemented some form of ECM since 1991 migrating to different products over the years. A further study on data lose and recoverability during migration to the different ECMs is recommended. Furthermore, it has been 20 years since Rand Water implemented ECM. In terms of archival legislation in South Africa, records of enduring value are supposed to be transferred to archives repository after 20 years. This has not happened with the digital records of Rand Water as the national archives repository did not have the infrastructure to ingest electronic records into archival custody (Ngoepe 2017). As NARS is in the process of implementing Archivematica and Atom, for preservation and access of digital records, a further study on the transfer of digital records to the national archives repository is recommended.

6.8 Final conclusion

This chapter provided a summary of the study, the conclusion and recommendations. The chapter also provided implications of the findings for the theory, practice and further research. The conclusions of the study were presented in line with the research objectives. This study was organised into six chapters. Chapter One put the study into perspective with the introduction of the Actor Network Theory (ANT) which was the theory underpinning this study. Chapter Two reviewed literature regarding the background knowledge of ERP and that of ECM and their integration to understand the opportunities and challenges highlighted by the latest literature guided by the ANT concepts involving human and non-human actors. Chapter Three presented the research methodology. The methods were explained in detail concerning the study so that the reader knows exactly what data were collected, from where and how it was collected to allowing a reasonable replication of the study. Chapter Four presented the results of the study from data collection via personal interviews. Chapter Five provided a

discussion of the findings, which offers a broader interpretation of the results. According to the research methodology and literature discussed in this study, the chapter proposed a framework for integrating ERP into ECM at Rand Water.

The ANT translation concept with different moment phases was instrumental in identifying the actors that were equally acknowledged as crucial to achieving an integration of ERP into ECM at Rand Water. Due to its non-discriminatory categorisation of human and non-human actors, technical and non-technical actors, it offers a rich lens in identifying the influence and contribution of each in achieving a stable actor network outcome. It further exposes internal and external factors such as resistance, power, political, social and economic that have a direct and indirect impact on the desired integration of ERP into ECM outcome. The ANT guided the objectives of this study and has been successful ensuring that the actors that both human and non-human are identified together with the focal actor who through enrolment, interessement, inscription and mobilisation builds a stable actor network. It further assisted in revealing the irreversibility of the established actor networks that need to be aligned to achieve a stable actor network that is in-line with the desired objective. In the case of this study, the enrolled ERP actor network and ECM actor network were identified with their interests aligned and inscribed to achieve a stable actor network that is mobilised to achieve an integrated ERP into ECM environment at Rand Water. Therefore, ANT was a fitting theory for this study to proposing a framework to integrate ERP into ECM.

The study concludes that if the proposed framework is adopted, it might assist the organisations that have invested in an ERP solution and ECM solution to integrate ERP into ECM to the extent that they might need in line with their business objectives. Failure to integrate systems will lead to unrealised efficiency, productivity and return on investment on ERP and ECM in the organisation.

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APPENDIX A: INTERVIEW GUIDE FOR THE STUDY

Covering Letter for the Interview

Dear Participant,

I am doing a PhD at University of South Africa (Unisa) in the department of Information Science. I am seeking assistance in my research project.

The purpose of this study is to explore the integration of Enterprise Resource Planning integration into Electronic Content Management at a South African water utility in order to propose a framework for integrating ERP into ECM. The project will not only be beneficial to this organisation but any other organisation with both ERP and ECM enterprise systems. It will also contribute to enriching the body of knowledge in this area of study.
My research topic is: "**A Framework for integrating ERP into ECM in South African Water Utility"**.

Please be assured that all responses will be kept confidential and only be used for the purpose of this research. Data will be presented only in aggregate and responses will be attributed to particular respondents. This research is conduct with the clearance from Unisa's ethics committee and will adhere to the ethics policy of the university.

I also wish to mention that your time is highly appreciated and will ensure that when the interview is done, the process is as effective as possible.

Thank you for agreeing to participate in this research interview for my study. Participation is voluntary and you can withdraw from the research at any time without giving any reason.
Should you have any queries about the study, please do not hesitate to contact the student Mr Vincent Mello @ vmello@randwater.co.za or promoter Prof Mpho Ngoepe @ ngoepem@unisa.ac.za

Thanking you in advance for your corporation.

Interview Questions

Question 1- 3 is to gather the area of operation the candidate is operating from.

1. Which of the following represent your level of operation?

Executive level	
Senior Management level	
Middle Management level	
System technical level	
Administrator/ user level	

2. What portfolio (Executive Portfolio) do you work in the organisation?

Group Shared Services	
Group Finance Portfolio	
Group Human Capital Portfolio	
Group Operation Portfolio	
Group Strategy Portfolio	
Any other:	

3. What division (General Manager's division) do you work in the organisational structure?

IT division	
Asset Management division	
Procurement division	
Human Resource division	
Legal division	
Scientific Services division	
Operations division	
Other:	

4. What department do you work in the organisation?

5. Between ERP and ECM which system do you work with or do you work with both?

Objective 1: To examine the effects of operating ERP and ECM independently
Questions: 1. Which module(s) of ECM are you using in your area of work? 2. What are components in the ECM module that are being utilised? 3. What does this ECM module/ these ECM modules help with in your area of work?

4. Which module(s) of ERP are you using in your area of work

5. What does this ERP module/ these ERP modules help with in your area of work?

6. What are the functional effects of working with ERP module(s) not integrated with ECM module(s)?

7. How will integrating ERP module(s) to ECM module(s) benefit your area of work?

Objective 2: To determine the system resources for ERP and ECM integration at Rand Water

Questions:

1. What technical resources are needed in operating ERP optimally to deliver the business objectives in your opinion?

2. What technical resources are needed in operating ECM optimally to deliver the business objectives in your opinion?

3. What non-technical resources are needed to achieve an integrated ERP and ECM?

Objective 3: To examine the system architecture of the ERP and ECM at Rand Water

Questions:

1. What is the system architecture of the ERP in your organisation?

2. What is the system architecture of the ECM in your organisation?

3. What IT architecture roadmap would enable the integration of ERP into ECM?

4. What IT architecture standards in the organisation are needed to support integration of ERP and ECM in your opinion?

Objective 4: To identify opportunities for integrating ERP and ECM at a Rand Water

Questions:

4 What are the potential opportunities for integration of ERP and ECM in your opinion?

5 Who are the key role players to identifying the opportunities to integrating ERP and ECM in your opinion?

6 To what extend can the organisational culture influence the identification of opportunities to integrate ERP and ECM in the organisation?

7	What are other elements in the organisation that have an influence in identifying the opportunities to the integration of ERP and ECM?

Objective 5: To identify the obstacles to integrating ERP into ECM at a Rand Water
Questions: 1. What are the potential obstacles to integrating ERP into ECM from a technical side? 2. What are the potential obstacles to integrating ERP into ECM from a human side? 3. What are the potential obstacles to integrating ERP into ECM from a non-technical and non-human?

Objective 6: To determine compatibility and inter-operability of ERP and ECM at Rand Water
Questions: 1. What are the compatibility requirements for integrating ERP into ECM in your opinion? 2. What are the inter-operability requirements for integrating ERP into ECM in your opinion? 3. What are other human elements that would be important in ensuring that the compatibility and interoperability of ERP and ECM is achieved? 4. What are other non-human elements that would be important in ensuring that the compatibility and interoperability of ERP and ECM is achieved?

The candidate's participation will adhere to the ethical requirements as per the Unisa's ethics code of conduct.

APPENDIX B ETHICS APPROVAL CERTIFICATE FROM UNISA

UNISA university of south africa

DEPARTMENT OF INFORMATION SCIENCE ETHICS REVIEW COMMITTEE

22 November 2018

Dear Vincent Malesela Mello

LIS Registration #: Rec-221118
References #: 2018-DIS-0005
Name: VM Mello
Student #: 61952265

Decision:

Ethics Approval from 22 November 2018 to 20 November 2023

Researcher(s): Vincent Malesela Mello

Supervisor(s): Prof Mpho Ngoepe

A framework to integrate enterprise resource planning into electronic content management in a South African water utility company.

Qualifications: PhD

Open Rubric

University of South Africa
Preller Street, Muckleneuk Ridge, City of Tshwane
PO Box 392 UNISA 0003 South Africa
Telephone: +27 12 429 3111 Facsimile: +27 12 429 4150
www.unisa.ac.za

Thank you for the application for research ethics clearance by the Unisa Department of Information Science Research Ethics Committee for the above-mentioned research. Ethics approval is granted for five years.

The ***low risk application*** was reviewed and expedited by the Department of Information Science Research Ethics Committee on 22 November 2018 in compliance with the Unisa Policy on Research Ethics and the Standards Operating Procedure on Research Ethics Risk Assessment. The proposed research may now commence with the provisions that:

1. The researcher(s) will ensure that the research project adheres to the values and principles expressed in the UNISA Policy of Research Ethics.
2. Any adverse circumstances arising in the undertaking of the research project that is relevant to the ethicality of the study should be communicated in writing to the Department of Information Science Ethics Review Committee.
3. The researcher(s) will conduct the study according to the methods and procedures set out in the approved application.
4. Any changes that can affect the study-related risks for the research participants, particularly in terms of assurances made with regards the protection of participants' privacy and the confidentiality of the data should be reported to the Committee in writing, accompanied by a progress report.
5. The researcher will ensure that the research project adheres to any applicable national legislation, professional codes of conduct, institutional guidelines and scientific standards relevant to the field of study. Adherence to the following South African legislation is important, if applicable: Protection of Personal Information Act, no. 4 of 2013; Children's Act no. 38 of 2005 and the National Health Act, no. 61 of 2003.
6. Only de-identified research data may be used for secondary research purposes in future on condition that the research objectives are similar to those of the original research. Secondary use of identifiable human research data requires additional ethics clearance.
7. No field work activities may continue after the expiry date of **20 November 2023**. Submission of a completed research ethics progress report will constitute an application for renewal of Ethics Research Committee approval.

Note:

*The reference number **2018-DIS-0005** should be clearly indicated on all forms of communication with the intended research participants, as well as the Committee.*

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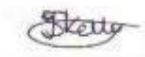
Yours sincerely



Dr Isabel Schellnack-Kelly
Department of Information Science: Ethics Committee

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APPENDIX C PERMISSION TO USE RAND WATER AS A CASE STUDY

RAND WATER

MEMORANDUM

To: Dr. Fawcett Ngoatje (GSSE)

Cc: Mairne Chakane (M: I&O), Dr. Thinus Bekker (GM:IT&KM, Altus Van der Merwe (Portfolio Support Manager), Gregg Mulzack (Corporate Comm Manager)

From: Vincent Mello (Manager: System Administration & Risk Management)

Date: 12 December 2017

RE: Request to use Rand Water as a Case Study for the PhD research study

1. Purpose

The intended purpose of this memo is to request a permission to use Rand Water as a case study for my PhD research study at Unisa forming a contribution to the InterPares Africa Team project. The topic accepted and approved for my proposal is "**A Framework for integrating Enterprise Resource Planning into Electronic Content Management at a South African Water Utility**".

2. Background

This topic is applicable and makes Rand Water a most suitable candidate due to its rich records management, electronic content management, archiving and ERP system history. An award-winning article written by Prof Mpho Ngoepe supports the observation that Rand Water's electronic records development is leading and worthy to be mentioned for the benefit of the academic and industrial development. The article mentioned Rand Water as an example without detailing the confidential information of Rand Water business and details except what is found in the public space (such as Annual Reports, presentations, Internet etc.).

3. Motivation

The proposed research study for the PhD degree requirement is under the supervision of Prof Mpho Ngoepe (Unisa) who is a renowned academic in the Information Science area of study. In terms of confidentiality compliance requirement of Rand Water to its employees, this serves to confirm that no confidential information will be accessed or used in this research study. The approach taken in this research is qualitative using questionnaires, interviews, system analysis and electronic records management analysis. Rand Water's confidential business information does not form part of the research but the systems analysis and purposive sampled team in the IT, Records Management and business people who work with the systems mentioned in the research topic and proposal. It is also to be noted that the topic refers to a South African Water Utility. Rand Water features in the discussion when it comes to the context and the suitability of a research candidate for the case study with the intention to propose a framework to integrate the ERP into ECM for organization with similar systems.

4. Recommendation

That permission be granted to commence/proceed with the research study on **"A Framework for integrating Enterprise Resource Planning into Electronic Content Management at a South African Utility"** using questionnaire, interviews, electronic management approach observation and system analysis be permitted as part of the data collection to ensure completion and submission of the PhD Thesis.

That the final Thesis will be presented for final consideration by Rand Water on completion.

Vincent Mello — 12/12/2017 — Date

Manager: System Administration & Risk Management

Supported:

Maime Chakane — 12/12/17 — Date

Manager: IT Infra & Ops

Dr. Thinus Bekker — 2017/12/12 — Date

GENERAL MANAGER IT & KM

Alois Van der Merwe — 12/12/17 — Date

PORTFOLIO SUPPORT MANAGER

Gregg Mulzack — 12/12/17 — Date

CORPORATE COMMUNICATIONS MANAGER

Approved

Dr. Fawcett Ngoatje — 13/12/17 — Date

GROUP SHARED SERVICES EXECUTIVE