Document management system in owner companies during project execution

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Dissertation submitted in fulfilment of the requirements for the degree *Master of Engineering* at the Potchefstroom Campus of the North-West University, South Africa

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May 2010

ACKNOWLEDGEMENTS

I would like to thank the following important contributors to my research and convey my sincerest gratitude:

My Creator, for blessing me daily and for helping me to complete this research.

My research supervisor, Prof Harry Wichers, for believing in me and for his continuous enthusiasm, inspiration and mentorship.

Prof Piet Stoker for his role in supporting me to pursue this qualification and for his efficient and professional approach to the research field.

The Management of Sasol Technology for the endorsement to conduct my research.

My colleagues for all the information provided.

My friends, family and my daughter Anette, for all their encouragement.

My husband Ian, for proof-reading my research and for all his patience, support and advice. Also for his good sense of humour! Thank you for loving me unconditionally and for being my best friend!

To my Dad, for sustaining me in his prayers and whom I always want to make proud.

And last but not least, in memory of my passed away mother.

ABSTRACT

Owner companies should consider all elements of Document Management during a project's life cycle, identify shortcomings and address them successfully to ensure successful completion of projects and ultimately to also ensure legal compliance as stipulated by contractual agreements. Proper governance during the execution of projects involves, amongst others, the establishment of structures and processes, with appropriate checks and balances built into these structures and processes, to enable all stakeholders to be in a position to have access to relevant documentation. Executing projects makes a huge demand on the flow and management of project related documentation through the different phases of these projects.

The research, as documented in this dissertation, investigates and evaluates whether Sasol Technology, as the project execution agent for the Sasol Business Units, has efficient governing Document Management processes and procedures in place to support the successful execution of capital projects. Sasol Technology uses a stage gate model, associated with project life cycles, as a systematic approach for the execution of capital projects. Document Management is a new business function that was established in 2008. Not all the functions involved in the life cycle of project execution are fully aligned with the central function managing documentation. There is thus a need for a fully integrated Document Management System, involving all the functions of Sasol which are involved during the different phases of project execution.

The literature study analyses existing world best document management and records management practices and procedures and points out that meticulous and strict document and records management practices form the backbone of organisational authentic evidence compliance.

The research design method that was chosen to authenticate the research question is an Exploratory Qualitative Approach, combined with a Descriptive Approach. Results are obtained from a combination of three methods. Published and available existing data of how documents are managed in Sasol was gathered and secondary findings are established. Focused and structured interviews were then conducted with experienced team members from the different functions involved in project execution and lastly, e-mail administrated questionnaires were developed and distributed to relevant project team members within Sasol Technology to assess the current system and to determine additional requirements for an enhanced Document Management System, specifically applicable to owner companies in the project execution environment.

Whereas the scrutiny of the secondary sources provides a background and the progress

made with regard to setting requirements for a standardised Document Management System for the execution of projects in the Sasol Technology and some of the other Sasol Business Units, the primary data findings indicate how the project team members perceive the existing Sasol Technology Document Management System to be.

Key findings include, that documentation life cycle management is not fully developed and needs to be addressed in the Sasol Technology project execution environment. Furthermore, integration of the documentation management of the various departments, functions and structures in Sasol will enable better and improved management of project documentation.

The specific output of this dissertation is the recommendation of an improved Document Management System to allow the different functions within Sasol Technology and some other Sasol Business Units to have access to an integrated system, included in it all relevant documentation requirements during the life cycle of projects. An added deliverable is a framework of requirements to be included in a document management philosophy, not only for Sasol, but also for other owner companies during project execution.

Keywords:

Business Deliverable and Implementation Model
Document Control
Document Controllers
Document Management
Document Management System
Electronic Document Management System
Electronic Records Management System
Front End Loading
Governance
Livelink System
Live Cycle Management
Metadata
Owner Company
Project Execution
Project Management
Records Management
Records Management System
Sasol Technology

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List of Acronyms

ALA	American Library Association
ACRL	Association of College and Research Libraries
AECI	African Explosives Chemical Industries
AFPM	Approved Fundamentals of Project Management
AIA	Authorised Inspection Authority
AIIM	Association for Information and Image Management
ALIA	Australian Library and Information Association
AS	Australian Standard
ASAIB	The Association of Southern African Indexers and Bibliographers
BA (IS)	Bachelor of Arts Information Science
BD&I	Business Development & Implementation (Model)
BEE	Black Economic Empowerment
BO	Beneficial Operation
BSI	The British Standards Institute
BU	Business Unit
CD	Compact Disk
CENSA	Collaborative Electronic Notebook Systems Association
CILIP	Chartered Institute of Library and Information Professionals
CRM	Certified Records Manager
CSIRO	Australia's Commonwealth Scientific and Industrial Research Organisation
CTL	Coal-To-Liquids
DC	Document Controller
DCMI	Dublin Core Metadata Initiative
DIOs	Document-like Information Objects
DLM	Document and Information Lifecycle Management
DM	Document Management
DOD	Department Of Defense
DVD	Digital Versatile Disc or Digital Video Disc
EBLIDA	European Bureau of Library, Information and Documentation Associations
EC	Engineering Contractor

ED	Engineering Documentation
EDC	Engineering Data Centre
EDI	Electronic Data Interchange
EDMS	Electronic Document Management System
EEP	Engineering Execution Plan
EGTL	Escravos-Gas-To-Liquid
EIE	Engineering Information Enablement
EoJ	End of Job
EPCm	Engineering, Procurement and Construction management
ERMS	Electronic Record Management System
EU	European Union
FAQs	Frequently Asked Questions
FEL	Front End Loading
FT	Fischer-Tropsch
GIF	Graphics Interchange Format
GTL	Gas-To-Liquids
GUIDs	Globally Unique IDs
HTML	Hypertext Mark-up Language
ICA-ISDF	International Counsel of Archives- International Standard for Describing Functions
IDA	Interchange of Data between Administrations
IDABC	Interoperable Delivery of European eGovernment Services to public Administrations, Businesses and Citizens
IM	Information Management
IQPC	International Quality and Productivity Center
IPA	Independent Project Analysis
IRMT	International Records Management Trust
ISAAR(CTF)	International Standard Archival Authority Record for Corporate Bodies, Persons, and Families
ISAD	International Standard Archival Description
ISAD(G)	General International Standard Archival Description
ISO	International Standards Organisation
IT	Information Technology

ITI	Information Technology and Informatics
JPEG	Joint Photographic Experts Group
JSE	Johannesburg Stock Exchange
JVs	Joint Ventures
KM	Knowledge Management
LIASA	The Library and Information Association of South Africa
MARA	Master of Archives and Records Management degree programme
MC	Managing Contractor
METS	Metadata encoding and transmission standard
MoReq	Model Requirements for the Management of Electronic Records
NAA	The National Archives of Australia Recordkeeping Metadata Standard
NARA	The National Archives of Australia Recordkeeping Metadata Standard
NAS	Network Attached Storage
NEC	New Engineering Contract
NSB	UK's National Standards Body
NWT	Natural Working Teams
OAIS	Open Archival Information System – Reference model
OCLC	Online Computer Library Center
OCR	Optical Character Recognition
OSALL	Organisation of South African Law Libraries
PC	Personal Computer
PDF	Portable Document Format
PEP	Project Execution Plan
PhD	Philosophiae Doctor (doctor of philosophy)
PMBOK	Project Management Body Of Knowledge
PMI	Project Management Institute
PSM	Process Safety Management
Q-ERPS	Quality Electronic Records Practices Standards
QMS	Quality Management System
RFC	Ready For Commissioning
RFO	Ready For Operation
RFQ	Request For Quotation
RLG	Research Libraries Group

RM	Records Management
RMAA	Records Management Association of Australasia
ROI	Return on Investment
SAN	Storage Area Network (system)
SANS	South African National Standard
SAOUG	Southern African Online User Group
SAP	Systems Application Projects
SAS™	Sasol Advanced Synthol™
SBU DM	Sasol Business Unit Document Management
SGML	Standard Generalized Mark-up Language
SLC	Service Level Commitment
SLIS	Special Libraries & Information Services
SMMEs	Small, Medium and Micro Enterprises
SP	Sasol Procedure
SPIRs	Spare Part Interchange-ability Records
SQL	Structured Query Language
TIFF	Tagged Image File Format
TRAC	Trustworthy Repositories Audit and Certification
UK	United Kingdom
USA	United States of America
UUIDs	Universally Unique Identifiers
VIPs	Value Improvement Practices
WfMC	Work-flow Management Coalition
WORM	Write Once, Read Many
WSIS	World Summit on Information Services
XKMS	XML Key Management Spec
XML	Extensible Mark-up Language

CHAPTER 1 INTRODUCTION

1.1 Introduction

Document Management lays the foundation by ensuring good governance throughout a project's life cycle, leaving a footprint of decision making and accountability. Proper governance during the execution of projects involves, amongst others, the establishment of structures and processes, with appropriate checks and balances built into these structures and processes, to enable all stakeholders to be in a position to have access to relevant documentation. Executing projects places a huge demand on the flow and management of project related documentation through the different phases of these projects.

Researching any identified problem or hypotheses equips enterprises and business managers with knowledge and skills required to resolve challenges in a fast paced decision making environment. It is required that businesses and industries respond to social and political accountability, continuous technological growth and innovation. The increased complexity trend facing managers leads to higher risk associated with decision making, and project execution is no exception. The vehicle to alleviate the risks for owner companies in the execution of projects is to establish principles of good governance through proper document management. The Owner Company (also referred to in contractual terms as the Client or Employer) in this research is the ultimate and long term owner of the business solution and has legal control and title to products and services brought about by the execution of a project.

Cooper and Schindler (1998:5-6) compiled a list of factors which characterise the complex business decision making environment. These factors, which can be applied to the execution of projects, require managers to have more and better information on which to base decisions and include the following decisive factors:

- There are more variables to consider in every decision.
- More knowledge exists in every field of management.
- Global and domestic competition is more vigorous, with many businesses downsizing to refocus on primary competencies, cost reduction and making competitive gains.
- The quality of theories and models to explain tactical and strategic results is improving.
- Organisations are increasingly practising data mining, i.e. learning to extract meaningful knowledge from volumes of data contained within internal databases. Computer advances have allowed businesses to create the architecture for data warehousing, electronic storehouses where vast arrays of collected, so that integrated data are ready for mining.

- The number and power of tools used to conduct research have increased, commensurate with the growing complexity of business decisions.
- Communication and measurement techniques within research have been enhanced.

Sharon Caudle (1990:521) stated the following after evaluating the priority businesses assigned to managing their information and resources: "While the current focus remained on information technology management, particularly computerized data processing and communications, it was clear that management trends included better management of information itself as a resource." All stakeholders who take a beneficial interest in a project have certain rights to project information and stakeholders outside the owner company also have rights in terms of the Promotion of Access to Information Act as amended (Act 66 of 2008). A company should be in a position to allow its stakeholders to assess whether a departure from a recommended practice during the execution of projects is, or is not, seen to be in the best interests of the project and company.

There are different levels of accountability during a project's life cycle and proper governance and control can only be achieved with a proper functioning Document Management System (DMS) in place. Kimberly Barata and Pipers Cain (2001:248) state "There is potential conflict between the objectives of providing efficient access on the one hand and supporting accountability on the other."

1.2 Problem Statement

The management of documents and records is not new in the execution of projects but the globalisation of owner companies executing projects, poses new challenges to this very important aspect of control in projects. From a commercial, legal and a risk perspective the lack of efficient Document Management (DM) or Records Management (RM) can potentially have a detrimental effect on an organisation if failure in the execution of projects can be attributed to poor DM. Companies should consider all the aspects of DM during a project's life cycle and identify all shortcomings and address them successfully to ensure successful completion of projects and ultimately also legal compliance. DM entails well managed documents and records that provide an essential contribution to accountability and transparency by means of a documented audit trail.

Sasol is an integrated global energy and chemical company with operations in about 30 countries. The Sasol group of companies is made up of a number of businesses who all contribute in making Sasol a respected global enterprise. Sasol Technology manages the engineering management and implementation of capital projects for all Sasol businesses. The functions within Sasol Technology's Business Development and Implementation

Department ensure that there is a sustainable capital programme implementation capability for Sasol. An important deliverable of this department is also to oversee the integration and alignment of systems to ensure sustainability and continuous improvement of processes in the project's execution life cycle.

DM is a new business function that was established in 2008 and resides under the Project Management and Control function within the Business Development and Implementation Department. The management and control of project documentation prior to the establishment of the new function was executed by the project managers themselves, with the assistance of secretaries. Not all the functions involved in the life cycle of project execution joined and bought in the paradigm shift towards a central function managing documentation. There is therefore a need for a fully integrated DMS, involving all the functions during the different phases of executing projects.

It is therefore prudent to assess the processes of the newly established Sasol Technology DM model against world best practices. *This research will investigate and evaluate whether Sasol Technology, as the project execution agent for all Sasol Business Units, has efficient governing DM processes and procedures in place to support the successful execution of capital projects.*

1.3 Research Question and Objectives

1.3.1 Research Question

Cooper and Schindler (1998:44) affirm that "researchers often use a research question rather than a descriptive hypothesis." In view of the above problem statement, the research question for this study can be formulated as:

What should be done to improve and integrate DM in the Project Environment for Sasol Technology as the owner company to effectively govern and manage all project related documentation to the satisfaction of all project stakeholders?

1.3.2 Specific Research Objectives

The specific objectives of this research are:

1. To quantify what is considered as best DM practices by recognised DM and RM institutions.

2. To determine how Sasol Technology as the project execution agent manages project documentation.

3. To develop a DMS Framework of Requirements for owner companies, which can also be tailored to suit specific Owner Companies' needs, thereby enabling it to alleviate the risks associated with the management of documentation in the execution of projects by the implementation of proper and improved document management processes

4. To validate the findings of the Sasol Technology DM practices against those identified in the literature study as consolidated into a Framework of Requirements.

5. To provide Sasol Technology with recommendations for an improved and integrated DMS.

The intent of this dissertation is not to formulate a rigid process, but to provide Sasol Technology and the other Sasol Business Units with recommendations for an integrated system whereby they can manage and have access to the huge number of documents generated, distributed and eventually archived during the life cycle of projects.

1.3.3 Why Document Management over the life cycle of projects

Operations and projects differ primarily in that operations are ongoing and repetitive while projects are temporary and unique. A project can thus be defined in terms of its distinctive characteristics as described by the Project Management Body of Knowledge (PMBOK) "a project is a temporary endeavour undertaken to create a unique product or service. Temporary means that every project has a definite beginning and a definite end." (PMI, 1996:4) The end of a project is when the project's objectives have been achieved, or when it becomes clear that the project objectives will not or cannot be met and the project is terminated. The duration of a project is finite; projects are not ongoing efforts and can be categorised in different phases during the life cycle of the project.

A project can be divided into two major stages. Firstly the project has to be defined, the scope developed and the project viability to meet the market needs determined. In order to ensure that the right projects are chosen for further development and that these projects are executed in the best possible way, it is very important to define and scope the project correctly. This initial scoping and definition phase is called the project front-end loading phase. Front-End Loading (FEL) is a structured, upfront process for developing a detailed definition of the scope of a capital project to meet business objectives. It is the

process by which a company develops a detailed definition of the scope of a capital project to meet a given business need.

Once it has been established that the project is viable the detailed design work can commence and the facilities constructed and put into operation. This is called the project implementation stage.

Successful FEL entails development and integration of:

- "A Business & Operations Plan.
- A Facility defined to meet the business need.
- A Project Execution Plan" (Sasol, 2009b).

Whereas FEL is the beginning of the project life cycle, the close-out of a project, at a point where all business partners are satisfied with the outcome of the project, should be seen as the end of the project life cycle. At this stage all project documentation should be in place.

Going hand in hand with the importance of integration from FEL to project close-out, is the importance of management of documents during the entire life cycle of a capital project (Sasol, 2009b). Although projects are, as per the PMBOK definition, temporary, it does not necessarily mean short in duration; many projects last for several years and integration of all aspects will determine the success of the project objective. In addition, most projects are undertaken to create a lasting result and therefore the documented footprint of the journey to create the result is of the utmost importance when we move into the next phase, which is Operation.

Other important criteria for owner companies to consider for all functions are cost and time management. Compulink Management Centre reports that the average office

- " makes 19 Copies of each document;
- spends $20 on labour to file each document;
- loses 1 out of 20 office documents;
- spends $120 searching for every misfiled document;
- spends $250 recreating each lost document;
- spends $25,000 to fill a four drawer file cabinet and $2,000 annually to maintain it."

"The volume of paper documents that organizations must process has increased tenfold in the last five years. Increase in paper volume drives the cost of paper handling higher, which

generally reduces profit margins.

"A recent PriceWaterhouseCoopers study reports that the average worker spends 40% of their time managing non-essential documents, while the Independent Data Corporation estimates that employees spend 20% of their day looking for information in hard copy documents and that 50% of the time, they can't find what they need." (Laserfiche, 2007:5.)

1.3.4 Research Outputs and Deliverables

The specific output of this dissertation is the recommendation of an improved DM model to allow the different functions within Sasol Technology and the other Sasol Business Units to have access to an integrated system, including all relevant documentation throughout the life cycle of projects. The implementation of the improved model should address inadequacies in the existing systems within Sasol.

Although the dissertation will concentrate on the verification of the existing Sasol DMS, and recommendations for an enhanced DMS, the deliverable will be *a Framework of Requirements to be included in a DM philosophy,* not only for Sasol Technology, but also for other owner companies during project execution.

1.4 Overview of Dissertation

Chapter One summarises the need for this research by defining the problem statement as well as the research objectives and deliverables.

Chapter Two presents a literature survey which analyses the crux of DM/RM. The chapter provides insight by reviewing existing document related definitions and practices used in the execution of projects worldwide. This chapter also reviews and reports on the various international standards, procedures and guiding principles and tools relating to DM/RM. The processes and procedures used to make up various document systems are presented and a critical appraisal of the different systems is given. The reference work was chosen to include the underlying principles and procedures of proper DMS in owner companies during the project's life cycle.

Chapter Three consists of the empirical investigation. To achieve the stated objective of providing Sasol with recommendations for an improved DMS, the existing processes of the Sasol Technology project management and DM environment in the implementation of

projects are investigated.

Chapter Four summarises the secondary findings of how documents are managed to understand the environment and organisational interfaces in which projects are executed in Sasol, as the owner company. The aim is to grasp the essence of the associated required DM support. The chapter provides insight into the development of the DMS within Sasol Technology and the progress made with regard to setting some requirements for a standardised DMS for the execution of projects throughout the entire life cycle of a project.

Chapter Five focuses on the results of the primary findings of the research. It explores how the various role players and functions interact and conduct their business within the Project Environment of Sasol Technology as the owner company. The current DM practices and procedures are determined by means of interviews conducted and also an e-mail survey to determine how to optimise and integrate a better DM service to all the role players in the execution of projects.

Chapter Six presents a framework of significant requirements for a well designed DMS. The framework consists of high level trigger points to be included when designing, optimising or implementing a DMS. Data from the primary and secondary findings of the Sasol DMS is verified against the framework of requirements to validate that the research question has been resolved.

Chapter Seven consists of conclusions and recommendations and the document is concluded with a list of the sources referred to and appendices in support of the work covered in this research.

1.5 Limitations and Key Assumptions

- Focus will primarily be on Sasol Technology in the Sasolburg area, although recommendations derived will be applicable to the whole Sasol Technology DM Department.
- Focus will be on the Sasol Technology DMS processes and not those residing within the other Sasol Business Units. Only the integration required between Sasol Technology and these businesses in the execution of projects will be addressed.
- The owner company will be projected on Sasol Technology's Project Management and Control function, acting as the project execution agent for Sasol Business Units.
- The term 'Document Management (System)' in the Sasol Project environment shares many requirements of a 'Records Management (System)' as stipulated in this research. Chapter Two explains the differences and synergies of these

terminologies.

- This dissertation will assume that maintenance work will be executed by the different Sasol businesses with their own internal DMSs and all operational and maintenance work and projects that are not executed by Sasol Technology, are excluded.
- The documentation processes of all supporting functions not directly involved in the execution of projects, which include Human Resources, Finances, etc. is excluded.
- This dissertation does not explore Information Management principles or Information Technology processes.
- The document flow and system alignment between contractors/consultants and the owner company, as well as the systems used by these external contractors and consultants, are excluded from this research.

1.6 Conclusion

Chapter One sets the scene of the dissertation with a brief background description, problem statement and the formulation of a research question to address five specific research objectives.

This dissertation explores best project DM and RM practices for the owner company during project execution. The existing DMS in Sasol Technology is investigated as a case study and recommendations are made for an improved DM model for implementation by Sasol and other owner companies.

CHAPTER 2 LITERATURE STUDY

2.1 Introduction

The purpose of this chapter is to analyse existing DM and RM practices and procedures. It gives a brief overview of records, documents, various systems, specifications and the management thereof, by reviewing existing document related definitions and practices used in the execution of projects. The aim of the literature study is to give emphasis to the underlying principles and procedures of proper DMS in owner companies during the project's life cycle. A research of the various international standards, procedures and guiding principles signifies the importance, benefits and key success factors that an effective DMS can hold for owner companies.

The title of the dissertation relates to a DMS and was chosen for a good reason. It is, however, important to realise the relationship between records and documents and how they relate to the life cycle of the execution of capital projects. This chapter scrutinises both RM and DM theories and practices.

The literature study covers a wide range of topics to ensure that the research objective (to provide recommendations for an improved DMS throughout the life cycle of projects) is accomplished.

2.2 Defining Records and Documents

To set the scene for the literature study, it is prudent to start off and scrutinises the definitions and further explanations given on records and documents as given by various institutions.

A useful description to start off with is given by The National Archives of Scotland (2005) who defines a document and a record and clearly indicates the differentiation.

- "A document is any piece of written information in any form, produced or received by an organisation or person. It can include databases, websites, e-mail messages, word and excel files, letters, and memos. Some of these documents will be ephemeral or of very short-term value and should never end up in a records management system (such as invitations to lunch).

- Some documents will need to be kept as evidence of business transactions, routine activities or as a result of legal obligations, such as policy documents. These should be placed into an official filing system and at this point, they become official

records. In other words, all records start off as documents, but not all documents will ultimately become records."

Emery reported in an article that according to the United States (U.S.) Federal Records Act of 1950, a record is, "recorded information, regardless of medium or characteristics, made or received by an organization that is evidence of its operations and has value requiring its retention for a specific period of time." (Emery, 2005.) This classification is confirmed by various literatures and is still valid today, although the act is sixty years old and we moved into the electronic age.

The U.S. National Archives and Records Administration (NARA) state that records include, "… all books, papers, maps, photographs, machine-readable materials, or other documentary materials, regardless of physical form or characteristics, made or received by an agency of the U.S. Government under Federal law or in connection with the transaction of public business and preserved or appropriate for preservation by that agency or its legitimate successor as evidence of the organization, functions, policies, decisions, procedures, operations, or other activities of the Government or because of the informational value of the data in them."

The International Organisation for Standardisation ISO 15489-1 (2001:3) defines records as "information created, received, and maintained as evidence and information by an organization or person, in pursuance of legal obligations or in the transaction of business".

The South African National Standard (SANS 15489:2004) is the identical implementation of ISO 15489 of 2001, and is adopted with the permission of the International Organisation for Standardisation. The use of ISO 15489 of 2001 is therefore in accordance with the South African Standards (SANS 15489:2004) and will be referenced in this dissertation.

"In many cases, documents that are set aside, or captured, become records by being bound to a business process, for example as happens in a workflow. For example, when an invoice is raised it should automatically cause a record to be captured. In other cases there may be a policy that every document relating to a business matter must become a record, even if it does not formally participate in a business process. In yet other circumstances however, the process of capture will be initiated selectively by a user. Determination of which documents should be captured into a records system should be based on an analysis of the regulatory environment, business and accountability requirements and the risk of not capturing the records."(MoReq, 2001:12.)

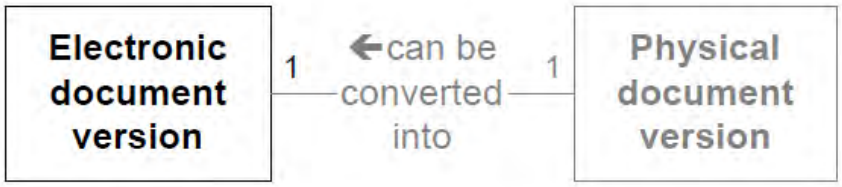

Figure 2.1: From Physical Document to Electronic Document

(MoReq, 2001:13)

The update of the specifications which is captured in MoReq, named MoReq2, states the following on Records: "At the heart of the system lies the most important entity, the records. These are the reason for the entire records management infrastructure, as they form the account of the organisation's activities. *Records are made from documents*. Each record can comprise one or several documents; and each document can appear in several records.

"Records are assigned a record type. This is used to indicate, and to allow the electronic records management system (ERMS) to manage, the records in certain ways. Examples of record type might include 'invoice' and 'web page'.

"Each record and document is made up of at least one component; some are made up of more than one. For example, a simple web page may consist of only one component – an HTML 'file' in IT terms – while a more complex web page may consist of dozens – an HTML 'file', GIF 'files', JPEG 'files' and so on." (MoReq2, 2008:176.)

The IRMT(2009e:34) defines a record as the following:
"documents, regardless of form or medium, created or received, maintained and used by an agency, organisation (public or private) or individual in pursuance of legal obligations or in the transaction of business, of which they themselves form a part or provide evidence."

Documents are defined according to IRMT (2009e:14) as "information or data fixed in some medium, which may or may not be considered in whole or in part an official record."

Records are the gauge of organisational compliance to regulatory guidelines. Ambrose, (2008:145) stated that "increasingly, regulated industries keep comprehensive records…the data and reports showing compliance with regulatory needs must be robust and come from an unimpeachable source".

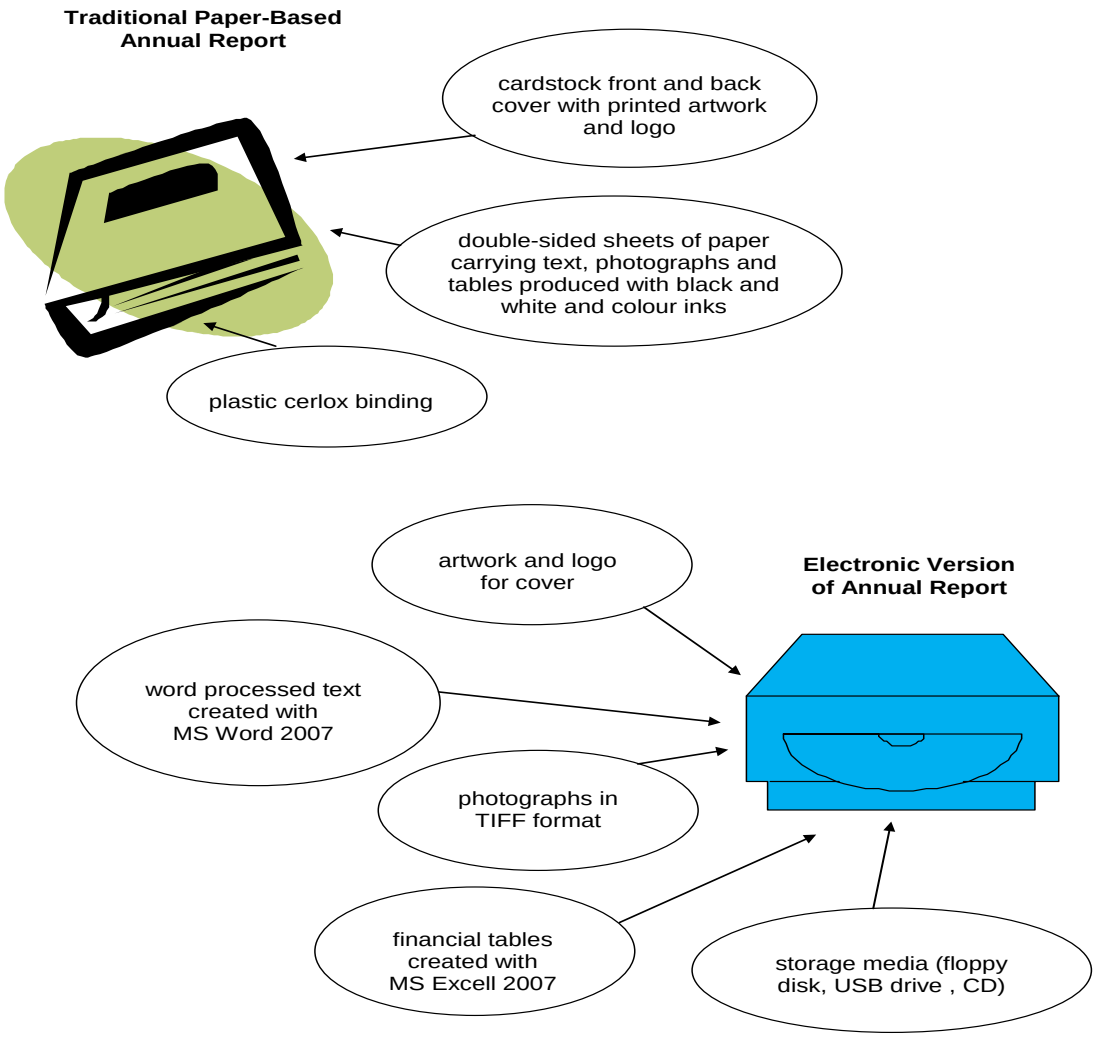

Figure 2.2: The Different Parts of Paper and Electronic Records

(IRMT, 2009a:25)

'Records' may also generally be distinguished between *operational* and *vital* records. Vital records are necessary in an emergency and used to guard an organisation's legal and financial status. Operational records have essential components of continuity but vital records are considered the backbone of an organisation (Kenny, 1989:54-57.)

By reviewing these various sources and literature it seems it is easier said than done to accurately define a record, since the usage of the record may change as practices are added or discontinued. Zawiyah and Chell (1998:95) confirmed this by stating that "the definition of a record changes as it evolves."

For the purpose of this research the following conclusion is therefore derived from the available literature as illustrated in Fig 2.1.

Documents are created throughout the life cycle of a project. Some documents are only required for a short period of time, typically for a certain phase of a project, and can be disposed of within the project's life cycle. Other documents, however, are required for a longer duration and have a retention period that might extend over a few phases of a project and even beyond the project's life cycle. These documents then become records. The concept of a record may thus be considered as 'controlled information and evidence'.

This deduction can graphically be explained as illustrated in Figure 2.3.

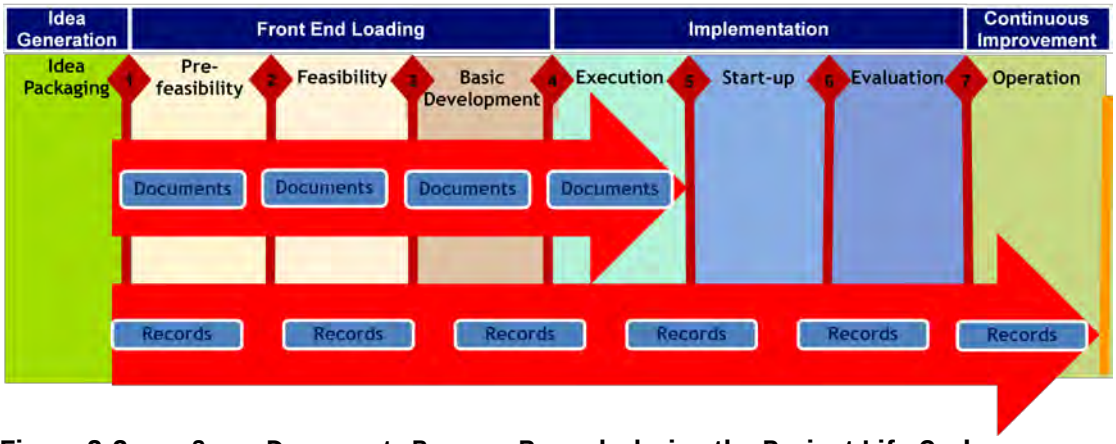

Figure 2.3: Some Documents Become Records during the Project Life Cycle

2.3 Framework of Document Management over the Project Life Cycle

2.3.1 Introduction

Documents get generated through the life cycle of a project. These documents need to be controlled in such a way that it supports the project manager who needs to be completely in touch with all aspects of cost, progress, performance, expectations, issues, etc. An owner company will need to have well defined procedures in place for efficient project support by guiding and setting up standard methods of obtaining information from various sources.

From the start of a project the project team members need to understand precisely what documentation deliverables are required of them and why they are important and valuable to comply with them.

Charvat (2002) reported in an article that "an Australian CSIRO survey of some 351 companies found that a decline in documentation contributed towards a decline in project efficiency. In cases where hardly any documentation existed, projects had an average cost overrun of 11%".

The project manager needs to maintain the equilibrium between information and time, effort and cost of gathering and collating the data so as to realise optimal advantage from the process.

The Document Controller (DC) is responsible for managing the process of proactively obtaining, registering and distributing all required and identified documents through the different phases of the project's life cycle. The process may typically involve electronic methods of communication such as:

- using a project support tool set operating through the network;
- allocating access and access control;
- placing data onto shared server;
- registering official communication;
- using e-mail and
- Version control.

Effective and applicable project documentation directs project team members to think about what they are supposed to be achieving, and whether they are expected to improve or not. It also provides the basic information required to monitor progress, to demonstrate to senior management and external third parties (auditing) that the project is being properly managed, and to justify and support any specific or required reporting.

2.3.2 Phases of the Project's Life Cycle

The project's life cycle is determined by identifying the beginning and the end of a project. The PMBOK elaborated on this by explaining how the project's life cycle definition can be used to link the project to the ongoing operations of the performing organisation. It states "that the project life cycle definition will also determine which transitional actions at the end of the project are included and which are not." (PMI, 1996:12.) Care should however be taken to distinguish the *project* life cycle from the *product* life cycle.

In project management literature project life cycles have similar phase names with similar deliverables but few are identical and there are numerous variations. The majority of project life cycle models have four or five phases, but there are some with even nine or

more. The phase sequence defined by most of these models usually have some form of deliverable and technology transfer or hand-over such as requirements to design, construction to operations, or design to manufacturing. Deliverables from the preceding phase are usually approved and officially signed off before work commences on the following phase.

Wallace (1999-2007) illustrated the definition of a project as a business need that can, with a shared understanding of its purpose, objective, scope, funding and mandate, translate into an adequate project definition. Once there is a proper project definition a project can go into execution.

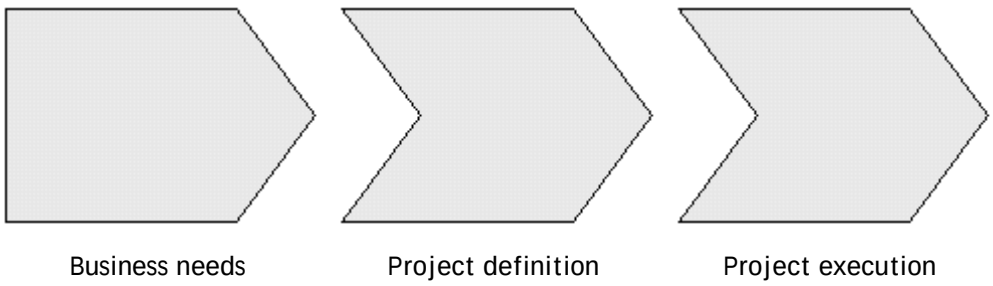

Figure 2.4: Summary of how a Project Starts

(Wallace, 1999-2007)

Morris (1981:412) describes a construction project life cycle as illustrated in Figure 2.5:

- Feasibility: project formulation, feasibility studies, and strategy design and approval. A go/no-go decision is made at the end of this phase.
- Planning and design: base design, cost and schedule, contract terms and conditions, and detailed planning. Major contracts are let at the end of this phase.
- Production: manufacturing, delivery, civil works, installation, and testing. The facility is substantially complete at the end of this phase.
- Turnover and start-up: final testing and maintenance. The facility is in full operation at the end of this phase. (Morris, 1981:410-414)

Although the work of Morris is almost 30 years old, the basic concept is still applicable today and used by other researchers and in publications.

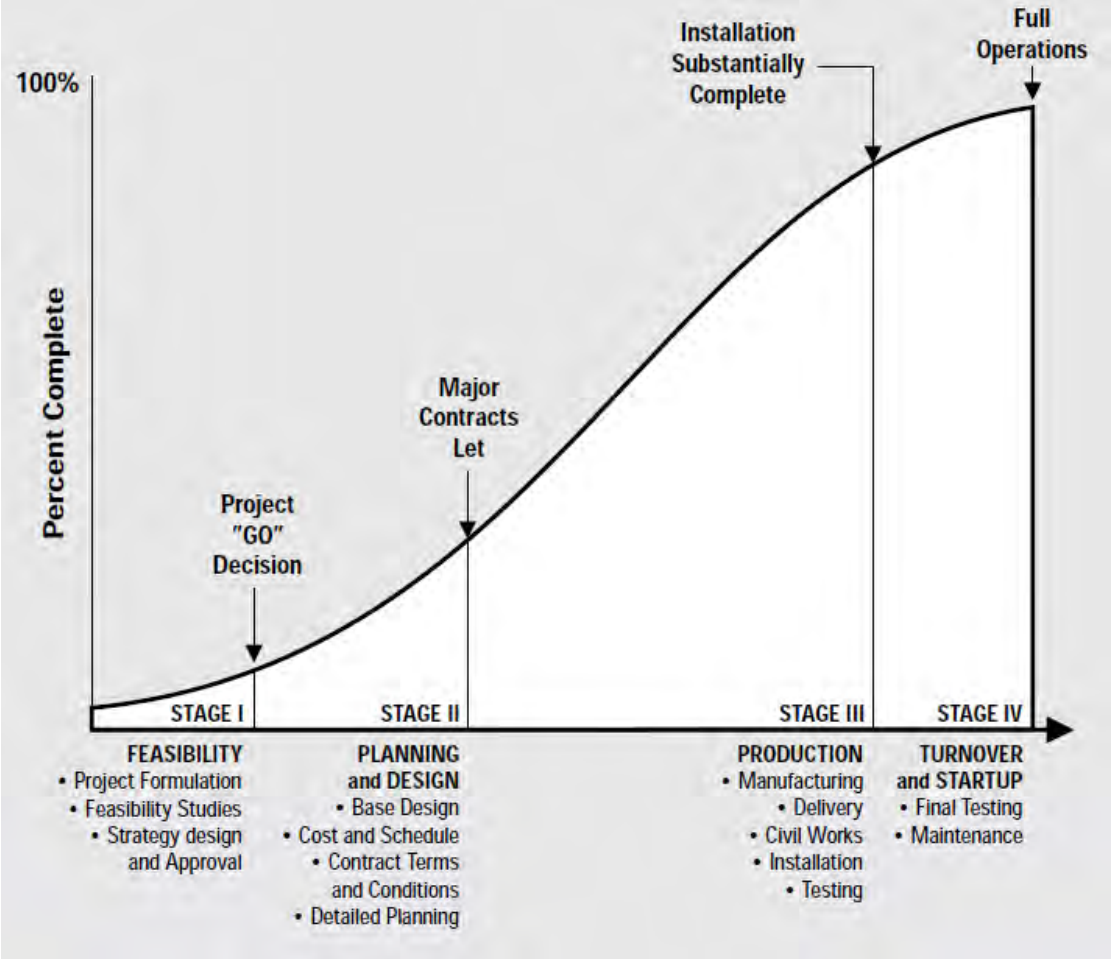

Figure 2.5: Representative Construction Project Life Cycle

(Morris, 1981:412)

Wallace cleverly summarised and illustrated the project life cycle in three stages, containing the phases with the following explanation and graphical illustration in Figure 2.6.

- "There are three main stages:
  - agreeing the conceptual design,
  - building the solution, and
  - operating that solution. (Wallace, 1999-2007).

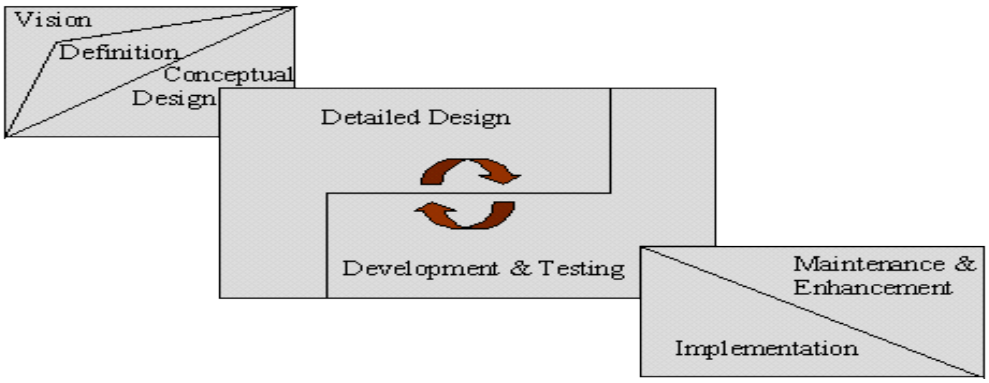

Figure 2.6: Three stages of a project

(Wallace, 1999-2007)

"The first stage delivers a conceptual design

- Early focus is on defining and agreeing the vision for this undertaking. These thoughts continue to evolve up to the finalisation of the conceptual design.
- Once the initial vision is substantially in place, attention then moves to defining how the project should achieve it.
- In turn, as this becomes clear, work increasingly focuses on producing the overall conceptual design.

"The second major stage delivers the working solution. It is a much larger amount of work and a longer timescale.

- An iterative prototyping approach will be used, so design work and development work are interlocked.
- Around 'live date' the final formal testing and acceptance will take place."

Stage three - "At the same time, the project team and user community are preparing intensively for implementation and live running.

- We are also building up for routine operation, maintenance, support and enhancement." (Wallace, 1999-2007.)

Figure 2.7 is used as an introduction to the ePMbook and illustrates the different knowledge areas of project management superimposed on the different phases of a project. Behind this simplistic illustration are a number of document requirements and document flows required as a support function to the project management team.

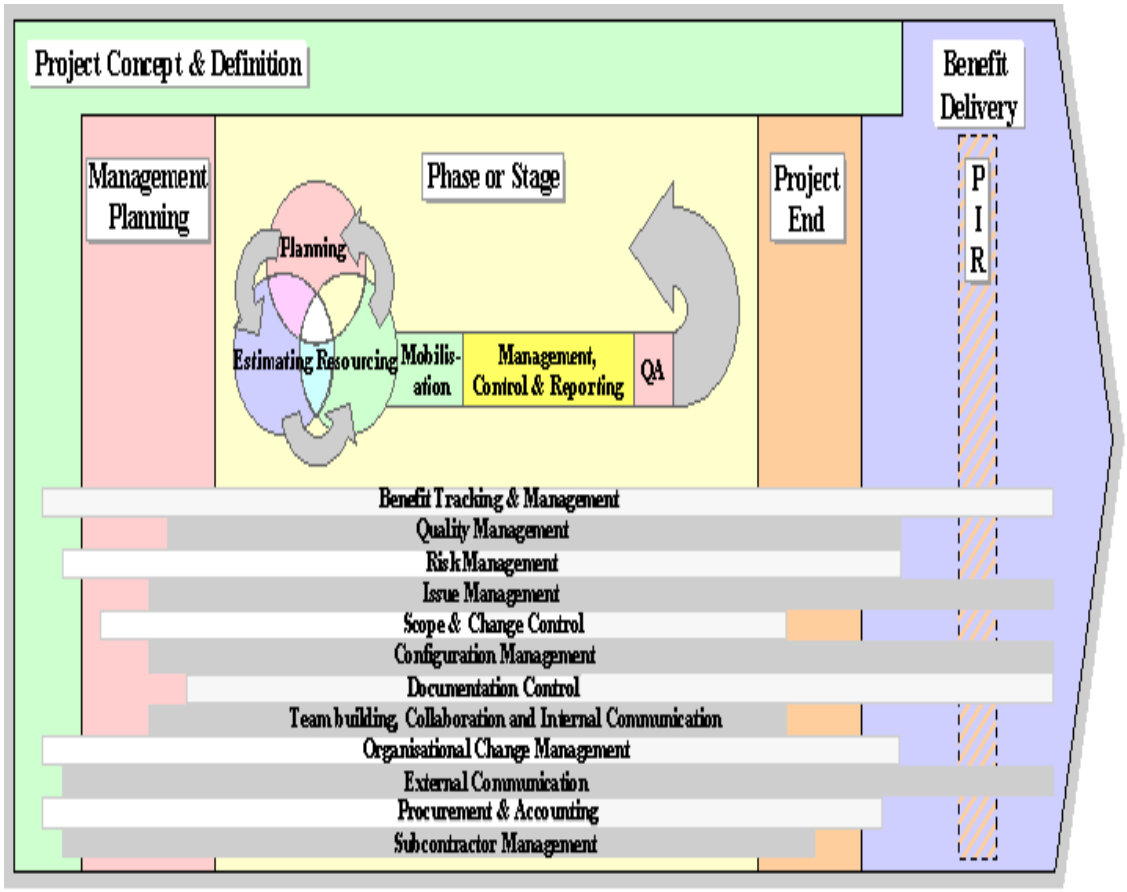

Figure 2.7: Overview of Project Management

(Wallace, 1999-2007)

2.3.3 Document Management throughout the Project Life Cycle

It is advisable to follow a document phase deliverable approach to set up and manage the required output of documents through the different phases of the project life cycle. It is beneficial to validate the flow of documents by following a planned approach.

The DC will assist the project manager by tracking the status of documents. By using the project programme, a DC can proactively plan and schedule reminders and actions to ensure that the appropriate phase documents flow on time by prompting team members on a regular bases.

There needs to be a process in place to manage and maintain permanent documentation (which will then become the records) with clear guidance in place indicating what should be retained/captured and archived for re-use, subject to ownership or confidentiality issues.

The trail of interaction with clients, users, vendors and project team members needs to be well documented and managed throughout the different phases of the project's life cycle. Charvat (2002) illustrates the importance of creating and managing the correct documents the first time and how to deal with project documentation from various sources throughout the project life cycle. Charvat emphasises that project documentation should focus and guide the project team and readers to:

- "Define the aim and background of the project.
- Identify key deliverables and dates.
- Document the technical parameters and technologies to be used.
- Address the manner in which items will be built or deployed.
- Assess items such as quality, scope, resources, risk, training, and cost.
- Document any back-out or contingencies that could occur.

Proper documentation is critical to a project's success. Project managers should anticipate the time required for developing such documents and update them whenever a change occurs." (Charvat, 2002.)

Section 2.6.8 describes the essential components required for an effective DMS over the life cycle of projects.

2.3.4 Conclusion

This brief overview of the project life cycle demonstrates the importance of having a proper DMS to ensure continuity through the different phases of a project. It is critical to know and understand the document requirements for each unique project. Project managers and document administrators need to realise that projects must be classified into groups in order to determine which documents each project needs. The size and complexity of the project, as well as the current phase have some bearing on the document deliverables.

2.4 Role Players and Stakeholders in Document Management

The identification of role players in DM is in relation to all the role players in the life cycle of a project. As a project progresses through the different phases, different parties need to contribute towards the development and integration of deliverables to fulfil the objective of the project. All project related documentation and communication produced from the FEL to the close-out of projects should be administered by the DMS. It is therefore clear

that although the project management team and DMS administrator are perceived to be the key role players, the working of a document system is not limited to only them but everyone involved in the life cycle of a project. This obviously points towards the huge number of role players implementing and using the DMS as well as other stakeholders, each of course with a different role, responsibility and accountability.

It is therefore safe to assume that all stakeholders in a project are also in some degree role players in the DMS. The following simplistic example used in the PMBOK illustrates the development in the engineering of a project and illustrates the number of different potential role players:

"A chemical processing plant begins with process engineering to define the characteristics of the process. These characteristics are used to design the major processing units. This information becomes the basis for engineering design which defines both the detail plant layout and the mechanical characteristics of the process units and ancillary facilities. All of these result in design drawings which are elaborated to produce fabrication drawings (construction isometrics). During construction, interpretations and adaptations are made as needed and subject to proper approval. This further elaboration of the characteristics is captured by 'as built' drawings. During test and turnover, further elaboration of the characteristics is often made in the form of final operating adjustments." (PMI, 1996:5.)

The project management team must identify the stakeholders, determine what their needs and expectations are, and then manage and influence those expectations to ensure a successful project. By analysing the example by PMI the key role players in most capital projects, and by default the DMS, should include the following:

- Sponsor - the individual or group who provides the financial resources for the project.
- Customer - the individual or organisation that will use the final project product.
- Project Manager - the individual responsible for managing the project.
- Project Management Team – the team members from the owner company responsible for the execution of the project. In typical projects a DMS administrator will form part of this team.
- Contractors - involved in doing the work of the project.

2.5 Importance of Document and Records Management

2.5.1 Introduction

Document and records management governs the practices of all the stakeholders who create or use documents during the life cycle of a project. This section is scrutinising some of the important owner company requirements during the execution of projects that have a direct influence on the management of documents and ultimately records. It is therefore beneficial for organisations to follow an integrated approach to address both DM and records management practices.

2.5.2 Regulatory Requirements and Organisation Procedures

It is very important that all owner companies identify the regulatory conditions that affect project execution activities and the legal requirements to document these activities.

The Electronic Communications and Transactions Act of 2002 facilitates and regulates electronic communications and transactions. It provides for the development of national e-strategy and promotes universal access to electronic communications and transactions via SMMEs. It also provides for human resource development in electronic transactions to prevent abuse of information systems to encourage the use of e-government services; and to provide for matters connected therewith.

ISO 15489-1 (2001:5) further emphasises that the nature of the organisation and the sector to which it belongs will determine which regulatory elements (individually or in combination) are most applicable to that organisation's records management requirements. These regulatory elements can include the following:

- Statute and case laws, and regulations governing the sector-specific and general business environment, including laws and regulations relating specifically to records, archives, access, privacy, evidence, electronic commerce, data protection and information.
- Mandatory standards of practice.
- Voluntary codes of best practice.
- Voluntary codes of conduct and ethics.
- Identifiable expectations of the community about what is acceptable behaviour for the specific sector or organisation.

The IRMT (2009a) includes the following aspects that should be considered from a legal environment:

- *Protection and compliance of electronic documents/records as legal evidence.*
  It is of great importance to have on-demand access to reliable and authentic information that mirrors accurately the trail of activity. Efficient record capturing can aid in proving that these documents be considered accurate, reliable and authentic.

- *Adhering to audit requirements.*
  An audit is a formal process that reflects how effectively an organisation operates. It reviews the work done by the organisation and measures compliance to legal, regulatory and other obligations. Documents and records are essential for the conduct of any audit, and the inability to produce the required documents or records during audit reflects poorly and hinders the audit process.

  It is common for auditors to comment on the quality of a DMS by providing findings and making recommendations in the audit report. It is of the utmost importance for a DC to understand and adhere to the specific requirements and standards. The records practitioner or DC should take ownership and acknowledge the responsibility to exercise capture of quality records/DM operations to support audit requirements by considering the following:

- *Identify and develop applicable DM policies and procedures.*
  It is imported that a DC understands and influences the policies and procedures developed of how records are created, used, shared and preserved, in other words, managed.

- *Understanding Organisational Culture.*
  Understanding which work, tasks and functions are essential to the business unit and how to best manage the information flow and documents /records generated to support the business and functions. Functional requirements are usually very specific and measurable. For example, many guidance materials indicate that ERMSs must provide auditing capabilities. However, simply stating in the guidance document that 'the software must audit the use of records' is not enough. A blanket statement does not provide a computer programmer or software developer with sufficient information to provide the technical instructions necessary to allow the computer to support the audit process. Instead, the functional requirements need to detail every element in the audit process, along with any specific needs or exceptions.

- *Understand and examine the role of record keeping according to approved standards and guidelines.* (IRMT, 2009a:39-45)

2.5.3 Support Business Requirements for Successful Project Execution

It may often be the perception that DM or RM is considered as a tedious, boring and an onerous business function of organisations. Few people understand what document and records management is, making it easy to malign the importance of the function. There is a significant relation between the business context and technological content in organisations. Only by understanding the organisation's cultural and operational requirements can effective DM/RM strategy be developed and implemented. Organisations have to comply with legal and organisational policies to govern business activities. Wallace (2007) listed the following advantages of DM which includes an interesting mix of soft issues and project issues:

- Facilitates team development.
- Clarifies issues the project team may have.
- Identifies what the project is and is not.
- Is considered a pivotal communication medium.
- Prevents delays and rework.
- Allows for standardisation of projects.
- Provides traceability of what was said.

The National Archives of Scotland (2005) summarise the necessity of RM in owner companies as follows:

- "Records management is the systematic control of an organisation's records, throughout their life cycle, in order to meet operational business needs, statutory and fiscal requirements, and community expectations. Effective management of corporate information allows fast, accurate and reliable access to records, ensuring the timely destruction of redundant information and the identification and protection of vital and historically important records.

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- "Legislation is increasingly underlining the importance of good records management, in addition to being sound business practice.

- "Organisations are also producing increasingly large amounts of information and consequently greater volumes of records, in both paper and electronic form. It is essential that information is captured, managed and preserved in an organised system that maintains its integrity and authenticity. Records management facilitates control over the volume of records produced through the use of disposal schedules, which detail the time period for which different types of record should be retained by an organisation.

- "The growth in electronic communications and data, from e-mails to databases, presents new challenges, but can be managed by the same records management principles that are applied to paper documents. Sound records management is also an essential basis for the transition to EDRM (Electronic Document and Records Management) that many organisations are embracing.

- "Systematic management of records allows organisations to:
  - know what records they have, and locate them easily;
  - increase efficiency and effectiveness;
  - make savings in administration costs, both in staff time and storage;
  - support decision making;
  - be accountable;
  - achieve business objectives and targets;
  - provide continuity in the event of a disaster;
  - meet legislative and regulatory requirements, particularly as laid down by the Freedom of Information (Scotland) Act and the Data Protection Act protect the interests of employees, clients and stakeholders.

- "The dangers of corrupted records management have been illustrated in recent years through scandals such as those at Enron in the USA, which involved the destruction of vital records. Poor records management, with the unintentional loss of documents, has caused embarrassment to organisations from government departments to small businesses.

- "The importance of records can be put in context by events in South Africa where records of the proceedings of the Truth and Reconciliation Commission's hearing against President Botha about his actions during the period of apartheid have been

destroyed, and therefore details of this historically important event lost forever in their original form." (The National Archives of Scotland, 2005.)

Audit is the tool management in owner companies uses to assess whether the execution of projects is within the mandate given to the project team and procedures set by the company. "The audit trail shows whether business rules are being followed and ensures that unauthorised activity can be identified and traced". (MoReq2, 2008:45).

The IRMT (2009e:7) defines the concept "Audit Trail" in the following way:
"In a records and archives environment, a record showing the transactions within an information management system providing evidence of activities, such as who has accessed a computer system and when, what operations he or she has performed during a given time and the resulting changes to records or information"

The following extract from MoReq2 stipulates the requirements in an ERMS with regard to auditing of electronic records:

- "The ERMS must keep an unalterable audit trail capable of automatically capturing and storing information about:
  - any action taken on any record, any aggregate or the classification scheme.
  - the user undertaking the action.
  - the date and time of the action.

  The term 'unalterable' in this requirement means that it must be impossible for any user or administrator to change or delete any part of the audit trail. The level of assurance needed will depend on the organisation; the level of assurance that can be achieved will depend on the level of security of the underlying operating system and system software.

- Where the ERMS supports the transfer of audit trail data to offline storage, the ERMS must support secure processes for managing the offline data and demonstrate how offline data can be brought back online as and when required; and the ERMS must ensure it is not possible for this mechanism to be used as a means of bypassing the controls imposed by the ERMS (for example, by simply moving audit trail data out of the ERMS and changing or deleting it externally to the system).

- The ERMS audit trail parameters must be configurable so that administrative roles can configure which actions are automatically logged.

- All changes to audit trail parameters must be audited in the audit trail.

- It should never be possible to turn off the auditing of changes to audit trail parameters; the ERMS should always keep a record in the audit trail of which person made changes and when.

- Once the audit trail parameters have been set, the ERMS must track actions automatically and must log information about them within the audit trail.

- The ERMS must maintain the audit trail for as long as is required by the organisation's records policy.

- This often will be at least for the life of the records to which the audit trail refers. However, there may be situations in which other policies apply, for example periodic scrutiny of the audit trail followed by its destruction and replacement by a certificate of scrutiny.

- The ERMS must log in an audit trail all actions performed on records, volumes, sub-files, files, classes and retention and disposition schedules, regardless of whether the action affects one or more of them.

- The ERMS must log in an audit trail all changes to metadata values that apply to the metadata elements listed in the MoReq2 metadata model.

- Any annotation of or amendment to a record must be logged within the record's audit trail.

- The ERMS must automatically log in an audit trail all changes made to administrative parameters. For example, if an administrative role changes a user's access permissions or reconfigures the audit trail.

- The ERMS must ensure that audit trail data are available for inspection on request, so that a specific event can be identified and all related data made accessible.

- The ERMS must include features that allow all authorised users, including those who have little or no familiarity with the system, to search for information in the audit trail. This is an ease of use requirement. The users may be external to the organisation, such as external auditors. Nonetheless, from the ERMS perspective, they will be users.

- The ERMS must allow users to search audit trails for specified events, objects (classes, records etc.), users, groups, roles, times, or time intervals.

- The ERMS must be able to export audit trail data for specified records, volumes, sub-files, files and classes without affecting the audit trail stored by the ERMS in any way save for the addition of an audit trail of the export process. This functionality is to enable, for example, external auditors to examine or analyse system activity.

- The ERMS must be able to capture and store, where applicable, any attempted violations of access control mechanisms (i.e. a user's attempts to access a record, volume, sub-file or file to which he is denied access)." (MoReq2, 2008:45-47.)

2.5.4 Turn-around times during project execution

The key driver for any project is to improve the return on capital and through the years different best practices were adopted to try and achieve this. Some owner companies responded by reducing in-house capital spending by out-sourcing the engineering and execution of projects. This resulted in a reduction in the size of many engineering organisations. Other owner companies retained the engineering competency but outsourced only the construction or execution parts of the projects. Some tailored the engineering function to only retain key engineering activities during the early phases of the project and to outsource the remainder of the engineering. Many owner companies restructured and the engineering function became a separate business unit from the operating/production business itself.

In a White Paper from The US Business Roundtable (1997:4-5), the changing role for owner engineering was spelled out. "In the 1970s, it was quite common for detailed engineering work to be performed by in-house engineering organizations. Some major manufacturers even had their own construction forces. For major companies, engineering department staffs were numbered in the thousands. Today, only a few companies in the process and allied industries in the United States maintain the ability to perform detailed engineering in-house.

"The trend toward engineering out-sourcing started in the U.S. and has spread to much of the European industry as well. The out-sourcing of detailed engineering and construction work began a process of down-sizing in-house engineering staff that continues in many companies. Many of the companies that eliminated in-house detailed design capability originally intended to maintain the forces required to do the definition work which is so critical to project success. Today, almost half of all projects have substantial contractor involvement in project definition. The out-sourcing of engineering is appealing in many ways. The cyclical nature of capital programmes at most process industry companies has

meant that the large in-house forces carried substantial cost penalties in periods of minimal work. Engineering contractors with a large client base are more flexible in adapting to this changing workload." (The Business Roundtable, 1997:4-5.)

For successful project execution owner companies should realise the importance of cooperation between all the stakeholders. The amount of interfaces between all the role players in a project is vital and if we also take into consideration the different phases of projects, the impact of turn-around times can determine the success of projects.

At an IQPC Turn-around conference held in London on 22 September 2003, Narayan Joshi did a presentation where he proclaimed that the average profit loss from a one day delay for a turn-around varies from US $200,000 and up, depending on the type of a plant (Joshi, 2003:1). Joshi explained how turnarounds can be defined as those that cost less or take less time than the industry average for a maintenance project to shut down, execute the project and start up again. This can however be applied to the execution of capital projects as well. In the analysis done (that includes more than 200 projects), Joshi found a significant difference between the top quartile and the bottom quartile (which is the difference between the best and worst turnarounds). "Although the turnarounds in the Best group on average cost 15% less and were 10% faster than industry average, the turnarounds in the Worst group, on average, cost 30% more and were 35% longer than industry average. A turn-around that has better than industry average definition well in advance of the shut-down date results in more predictable cost and schedule outcomes. In addition greater accuracy, better Front–End Loading (FEL) results in more effective cost and schedule performance. Thus improving FEL early leads to more predictable a more effective turn-arounds as shown in Figure 2.8.

The analysis revealed that the practices employed by the project teams in defining and executing the turn-arounds are what really set the best and worst samples apart. One of the best turn-around practices identified was integration and integrated teams and it is a fair statement to include the importance of a proper DMS as part of this finding. By incorporating the DMS function as an integral part of the integration of projects, the project will realise cost and schedule benefits. Joshi (2003:4) illustrates the benefits of team integration in Figure 2.9

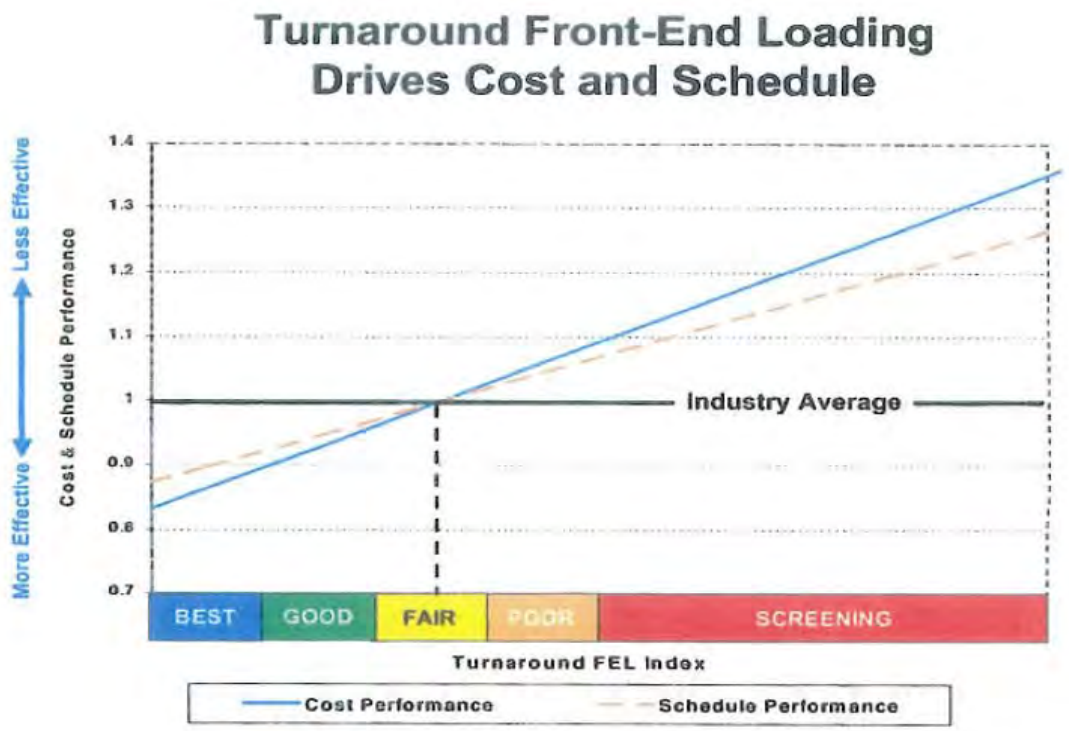

Figure 2.8: Turn-around Front-End Loading Drives Cost and Schedule

(Joshi, 2003:1)

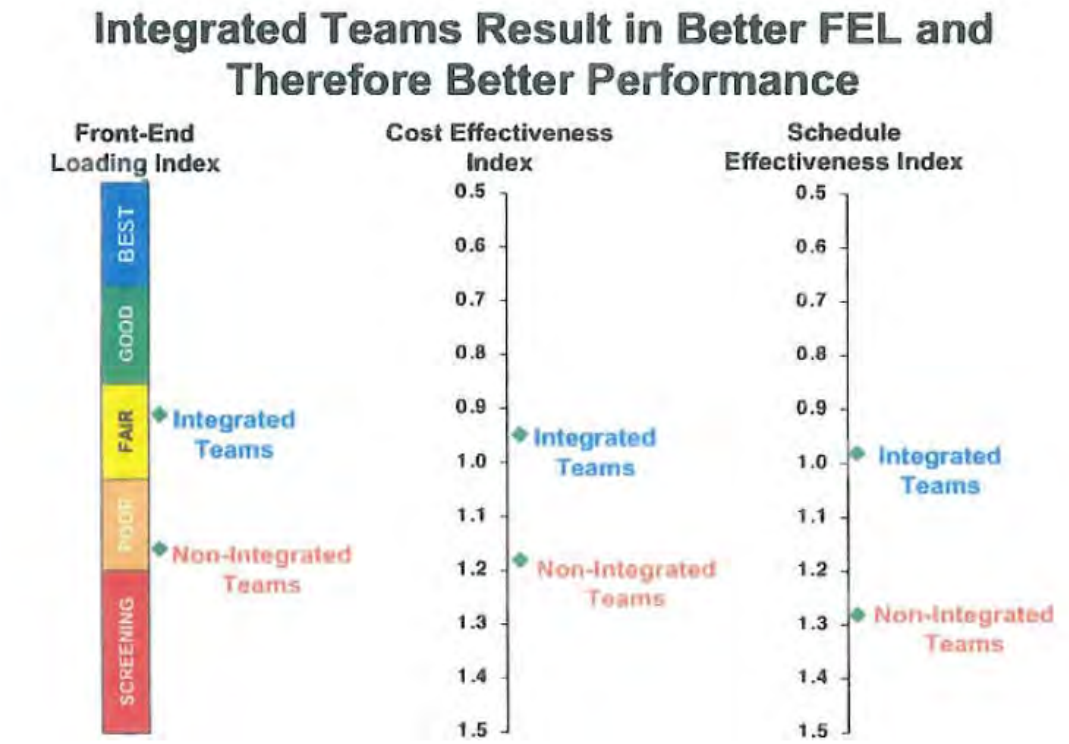

Figure 2.9: Turn-around Management Practices

(Joshi, 2003:4)

2.5.5 Adhering to the Archival Code of Ethics

A number of the documents that need to be archived as records have confidential information of some sort and the owner of this information needs reassurance that such information will not end up in the wrong hands. The IRMT (2009a) reports and summarises the following regarding archival code of ethics. "Aside from adhering to standards, records professionals have an obligation to adhere to professional standards of practice." The International Council on Archives first issued a code of ethics for archivists in 1996, which articulates the core standards of conduct for archives professionals.

The IRMT (2009a:51-53) includes codes of conduct issued by "several national professional associations to guide the work of archivists and records professionals in their jurisdictions." Several of the principles articulated in ethics codes are of particular importance for archivists dealing with electronic records. For instance, of the ten requirements outlined in the ICA code of ethics, seven take on heightened meaning in the digital environment, where the authenticity and integrity of electronic records can so easily be impaired. These seven are duplicated below, with a commentary following in italics about the importance of the requirement in an electronic environment.

- "Archivists should protect the integrity of archival material and thus guarantee that it continues to be reliable evidence of the past. *Protecting integrity in the electronic environment requires effective management of records and the technology used to create them.*

- Archivists should appraise, select and maintain archival material in its historical, legal and administrative context, thus retaining the principle of provenance, preserving and making evident the original relationships of documents. *Preserving the context of electronic records creation – including capturing metadata – is essential to demonstrating original relationships.*

- Archivists should protect the authenticity of documents during archival processing, preservation and use. Processing and preserving electronic records involves active intervention, and protecting authenticity is more difficult when processing electronic records than when processing paper-based records.

- Archivists should ensure the continuing accessibility and intelligibility of archival materials. The ability to access and use electronic records depends on active

intervention in the preservation of both the digital objects and the technologies used to create them.

- Archivists should record, and be able to justify, their actions on archival material. Documenting all work done with electronic records, as part of the metadata captured about the records, is essential to ensuring archivists can justify and explain their actions.

- Archivists should promote the widest possible access to archival material and provide an impartial service to all users. In an age of instant communications, promoting 'the widest possible access' can take on a new meaning, as archivists are faced with making archives available digitally as well as in original manual form.

- Archivists should respect both access and privacy, and act within the boundaries of relevant legislation. Respecting privacy is a greater challenge in a digital environment, where widespread access to information is common and desirable and personal and organisational privacy is too easily breached." (IRMT, 2009a:57-58.)

2.5.6 Conclusion

In order to comply with legislation and support accountability and for the DCs to appropriately manage the records, it is important to identify and familiarise themselves up-front of all legislation and corporate regulations that can influence the creation and retention of the documents and ultimately records. Cognisance of the business needs, the importance of turnaround times and sensitivity and confidentiality of documentation and records, illustrates how the document function is a vital part of the project team that can determine the success of capital projects.

The general importance of DM/RM (Emery, 2005) can be summarised effectively as follows:

"The purpose of RM is to promote economies and efficiencies in recordkeeping, to assure that useless records are systematically destroyed while valuable information is protected and maintained in a manner that facilitates its access and use. "it's not only making sure that what needs to be kept as a record is retained but also prescribing how long it should be kept, where it should be stored, who has access to it and when it should be destroyed (if ever)." (Emery, 2005.)

2.6 Document and Record Management in Practice

2.6.1 Introduction

DCs in organisations today are self aware, high on demand professionals. They assist companies to have readily available registered and organised access to (electronic) data, records and documents required in a digital information system (electronic system). A digital information system involves people and technology to be able to produce records, activities, products and instructions.

In the late 20th century Jay Atherton highlighted from an administrative (archival) view that:

- "the ultimate purpose of records management is the permanent preservation of 'historically valuable' material in the archives"
- "System should concentrate on efficient administration of current records, ensure systematic disposition procedures, and what remains is archives" (Atherton, 1971:44).

To preserve paper base records entails basically the placing of paper records in acid free containers and to have even and low temperature control in the storage area to ensure the documents do not discolour and become brittle.

In the 21st century Makhura reports on records and DM from a continuity perspective:

- "the main purpose of records management is to manage and control the flow of records with the necessary information within an organisation." (Makhura, 2001:22.)

In 2006 Gilchrest expanded on the above perspectives by adding control schedule accountability. His view was that DC should:

- "keep the chronological stories of transactions and other activities in order to meet the demands of accountability and to impose retention and disposal schedules." (Gilchrest, 2006:25.)

DM in practice is best described by Priscilla Emery, president and founder of e-Nterprise Advisors: "A professional discipline that is primarily concerned with the management of document-based information systems. The application of systematic and scientific controls

to recorded information required in the operation of an organization's business. The systematic control of all organizational records during the various stages of their life cycle: from their creation or receipt, through their processing, distribution, maintenance and use, to their ultimate disposition." (Emery, 2005.)

This section is an incursion through the essence of document and RM in practice during the life cycle of capital projects.

2.6.2 Global Information Statistics

For those interested in statistics, the following question might have crossed their minds: how much information is there to store? If we wanted to store "everything," how much storage would it take? The information and growth in these statistics are taken from 3 studies done since 2000. Professor Roger Bohn of the University of California, San Diego, is the co-leader of the most recent program and explains that "as the costs per byte of creating, storing, and moving data fall, the amounts rise exponentially. We know that overall information technology increases productivity and human welfare, but not all information is equally valuable." (Mathematics and Economics, 2008.) Bohn's co-leader, Dr. James Short, note that recent industry studies have reported larger and larger amounts of information being produced and stored in networks, companies and homes. "How information works is about measuring and counting the uses and applications driving the massive increases in networking and data growth, allowing businesses and consumers to use information more effectively to make better decisions." (Mathematics and Economics, 2008.)

Two professors from the School of Information Management and Systems at University of California, Berkeley, Prof Peter Varian and Prof Hal R. Lyman (Lyman & Varian, 2000) have conducted a study in 2000 (How Much Information, 2000) to try answering the question of how much information is created in the United States and the world. They have estimated yearly US and world production of originals and copies for the most common forms of information media. In 2003, Lyman and Varian extended their earlier study with an update (How Much Information, 2003) where they added a new section on the Internet, sampling the World Wide Web to estimate the size of the surface web and to determine the source and content of Web pages. (Lyman & Varian, 2003). Researchers at the University of California, San Diego, launched a 3 year research study in 2008 (How Much Information 2009) to quantify the amounts and kinds of information being produced worldwide (Bohn & Short, 2008). A good decision regarding the study is that updates on the research will be announced over the course of the next three years, with the initial report published at the end of 2009. Lyman and Varian report on World and U.S. information totals for calendar

years 1999 and 2002 whereas the San Diego study reports only on the U.S. for calendar year 2008. The researches by Lyman and Hal Varian analyze the quantity of original content created and the San Diego study measure what is consumed.

The table below indicates the numbers quoted underneath and gives an indication of the magnitude of information created in the world.

Table 2.1: Counting very large numbers

Byte (B)	=	1 byte	=	1	=	One character of text
Kilobyte (KB)	=	10^3 bytes	=	1,000	=	One page of text
Megabyte (MB)	=	10^6 bytes	=	1,000,000	=	One small photo
Gigabyte (GB)	=	10^9 bytes	=	1,000,000,000	=	One hour of High-Definition video, recorded on a digital video camera at its highest quality setting, is approximately 7 Gigabytes
Terabyte (TB)	=	10^{12} bytes	=	1,000,000,000,000	=	The largest current hard drive
Petabyte (PB)	=	10^{15} bytes	=	1,000,000,000,000,000	=	AT&T currently carries about 18.7 Petabytes of data traffic on an average business day
Exabyte (EB)	=	10^{18} bytes	=	1,000,000,000,000,000,000	=	Approximately all of the hard drives in home computers in Minnesota, which has a population of 5.1M
Zettabyte (ZB)	=	10^{21} bytes	=	1,000,000,000,000,000,000,000		

(Bohn & Short, 2008:8)

2000: The first Lyman and Varian report (2000) estimated that in 1999 the world produced between 1 and 2 exabytes of unique information per year, or roughly 250 megabytes for every man, woman, and child on earth. Lyman and Varian identified three key conclusions in summarising their 2000 report:

- Lyman and Varian referred to the "paucity of print". Printed materials of all kinds made up less than .003 percent of the total amount of annual information produced in the world.

- They identified the growing "democratization of data" – the fact that a vast amount of new information is created and stored by individuals. They included the example whereby original documents created by office workers were more than 80% of all original paper documents (the other 20% included original copies of newspapers, books, magazines, and other print material).

- They noted the rapidly growing and increasing "dominance of digital" content. (Lyman & Varian, 2000).

2003: Lyman and Varian (2003) added a new dimension on the Internet, where they sample the World Wide Web to estimate the size of the surface web and to determine the source and content of Web pages. They also added an analysis of desktop disk drives, to determine how people consumed information received on the Internet. Their conclusions can be summarised as follows:

- Print, film, magnetic, and optical storage media produced about 5 exabytes of new information worldwide in 2002 of which 92% of the new information was stored on magnetic media, mostly on hard disks.

- Information flowing through electronic channels (telephone, radio, TV and the Internet) contained almost 18 exabytes of new information worldwide in 2002, three and a half times more than was recorded on storage media.

- The total amount of new information stored annually on paper, film, magnetic, and optical media worldwide had doubled since the previous study.

- They noted that our ability to store and communicate information was far outpacing our ability to search, retrieve and present it.

- Paper is the primary medium for the formal publication of information, although it represents only 0.01% of new information recorded in all media. They assumed a tree can produce about 80 500 sheets of paper, thus it requires about 786 million trees to produce the world's annual paper supply. (Lyman & Varian, 2003).

2009: The research includes all three measures of information consumption, which are hours, words and bytes. "In 2008, Americans consumed information for about 1.3 trillion hours, an average of almost 12 hours per day. Consumption totalled 3.6 zettabytes and 10 845 trillion words, corresponding to 100 500 words and 34 gigabytes for an average person on an average day." (Bohn & Short, 2008:7.)

The 2000 and 2003 researches by Lyman and Varian estimated the United States produces up to 40% of the world's new stored information and if we assume the same estimate is still valid, the information from Bohn and Short, which is only for the United States, can be more than double for the world.

2.6.3 Difference between Document Management and Records Management

In the introduction to this chapter it was mentioned to realise the relationship between records and documents and how they relate to the life cycle of the execution of capital projects. The chapter also referred to some definitions for records and documents and this section further explores the differences between documents and records.

RM in an organisation is based on the systematic building of activity-trail. It represents the life-cycle of decisions made and the execution thereof. ISO 15489 (2001:3) standard defines RM as "the field of management responsible for the efficient and systematic control of the creation, receipt, maintenance, use and disposition of records, including the processes for capturing and maintaining evidence of and information about businesses activities and transactions in the form of records". This process today is mostly done in electronic format. MoReq (2001:12) states "An ERMS is primarily an application for managing electronic records, though it may also be used to manage physical records."

"An ERMS is often closely integrated with an Electronic Document Management System. Technically, an ERMS manages records, while an EDMS manages documents (which are not records). However, especially when used to support day-to-day working, it can be difficult to separate their functionality." Compulink Management Centre shares the concept by stating "all records management includes document management, but not all document management is records management. Records Management also includes archival issues - both assuring permanent records are accessible and readable 100+ years into the future and protecting often fragile historical archives." (Laserfiche, 2007:54.)

The European Standards and Guidelines, MoReq2 of 2008, make a distinction between an Electronic Document Management System (EDMS) and an Electronic Record Management System (ERMS) which is summarised in Table 2.2.

"Electronic Document Management Systems – EDMS – are widely used in organisations to provide management and control over electronic documents. Many EDMS functions and facilities overlap with ERMS. EDMS typically include indexing of documents, storage management, version control, close integration with desktop applications and retrieval tools to access the documents. Some ERMSs provide full EDMS capability, others only provide a subset. Conversely some EDMSs have incorporated core record management functions. EDMSs often form part of a wider system implementation and contain collaborative working tools to enable a number of users to participate in document drafting." (MoReq2, 2008:109.)

Table 2.2: Distinction between an EDMS and an ERMS

An EDMS	*An ERMS*
Allows documents to be modified;	Prevents records from being modified;
Allows documents to exist in several versions;	Allows a single final version of a record to exist;
May allow documents to be deleted by their owners;	Prevents records from being deleted;
May include some retention controls;	Except in certain strictly controlled circumstances;
May include a document storage structure;	Must include rigorous retention controls;
Which may be under the control of users;	Must include a rigorous record arrangement structure (the classification scheme) which is maintained by an administrative role;
Is intended primarily to support day-to-day use of documents for ongoing business.	May support day-to-day working, but is primarily intended to provide a secure repository for business records;

(MoReq2, 2008:109)

2.6.4 Distinction between Document Management and Document Control

Stainhow (2009) wrote an article for Ezine explaining the difference between the concepts of DM and Document Control. According to Stainow, "There seems to be confusion between the term 'document control' and the commonly used term 'document management'. In fact, in many instances it appears that document management has become the generic term for anything that involves the handling of documents whether they are of a transient nature or are core to an organisation's operations." He further defines between the two terms as follows:

"**Document Management** as a generic term means a system where documents can be securely stored, indexed and searched, accessed, version controlled, archived or deleted. Document Management can also create a collaborative environment permitting multiple users to access and modify documents and, at the front end, to scan hardcopy documents and convert them into a digitised format where they can then be managed electronically. In its position as a generic term and umbrella status it could be said that document management involves the management of a high volume of documents that will largely

include documents of a short-lived nature.

Document Control on the other hand is more prescriptive in nature and involves the management (or control) of documents that are more essential to an organisation's operations. They are documents that have been put together with a specific use in mind, released for well thought out reasons and have gone through a recorded approval process to ensure relevance and accuracy. When the documents need to be modified to reflect changes in operations, the required changes and their reasons are identified, the person making the changes and the dates of those changes are recorded and, importantly, the modified versions are separated from prior versions to prevent confusion." (Stainhow, 2009.)

From this it can be derived that as soon as a document forms part of the organisation's operation trail with regard to governance and compliance, the controlled document then becomes a record. The IRMT (2009e:14) supports this conclusion by their definition of DM: "The systematic *control* of documents by predetermined rules, principles and techniques".

2.6.5 Metadata – background information of documentation

2.6.5.1 Introduction - What is Metadata?

Metadata is defined and explained by various sources and the most descriptive explanation for metadata can be summarised as "data about data". It is the background information about a file or a record. It describes how, when and by whom a record was created, accessed or used and how it is formatted.

The Australian Standard on RM (AS ISO 15489, 2002) defines recordkeeping metadata as: "Data describing context, content and structure of records and their management through time."

The IRMT defines *metadata and related terms* in their Glossary of Terms in the following way:

- "**Metadata** - Data describing the context, content and structure of records and their management through time. The preservation of the record with its associated metadata is necessary to maintain the integrity of the record. Types of metadata include technical/structural, administrative, descriptive, preservation and use."

- A metadata standard for encoding descriptive, administrative and structural metadata about objects within a digital library; the metadata is expressed using XML language, so that it can be accessed and used consistently through the World Wide Web.

- **Metadata profile:** A collection of metadata associated with a specific record, allowing the identification, description and retrieval of that record." (IRMT, 2009e:27.)

The National Archives of Australia further defines recordkeeping metadata as structured or semi-structured information that enables the creation, management and use of records through time and across domains. (Australian Government: Recordkeeping Metadata Standard Version 2.0, 2008)

"Recordkeeping metadata can be used to identify, authenticate and contextualise records and the people, processes and systems that create, manage, maintain and use them." (Wallace, 2000: 253-269.)

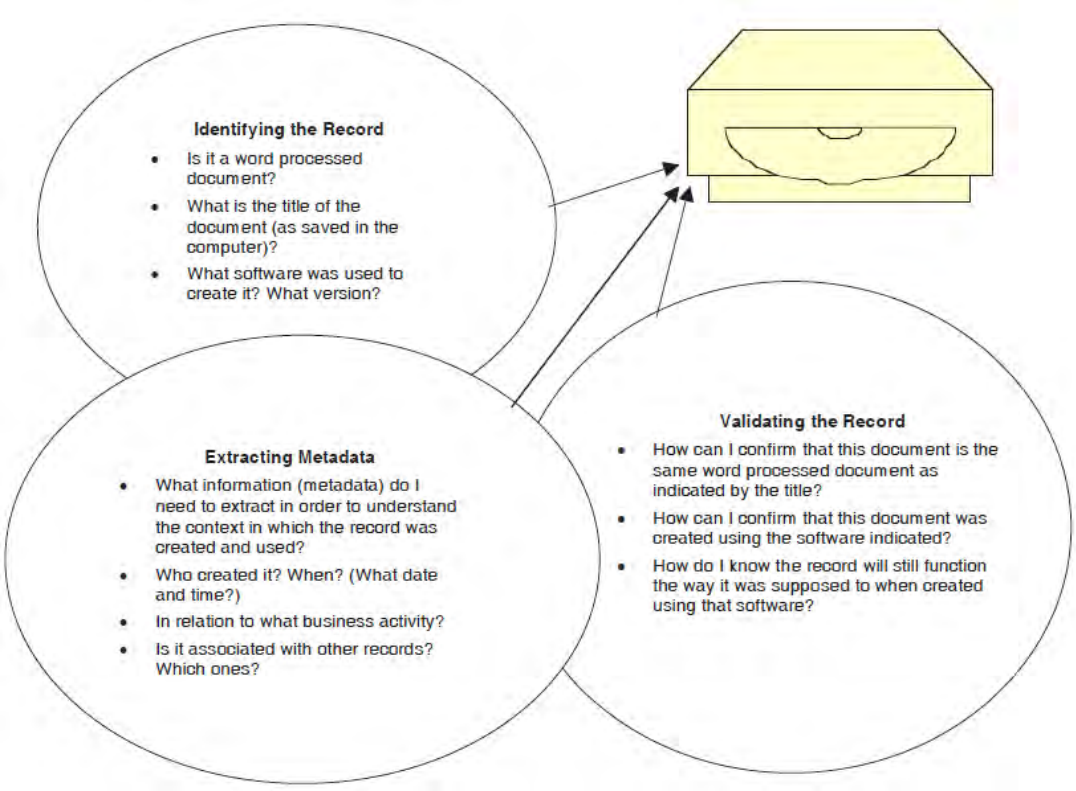

Figure 2.10: Characterising the Objects that make up an Electronic Record

(IRMT, 2009d:7)

2.6.5.2 Types of Metadata

Several types of metadata are identified and applicable to ERM.

- Access/location retrieval metadata.
- Systems operating metadata.
- Descriptive metadata according to IRMT (2009a:63)
  - documents in storage/archives used by other people.
  - metadata archival description elements:
    - Author
    - Writer
    - Addressee
    - Creation date
    - Provenance
- Data management metadata.
- Record keeping metadata assists with the following, according to IRMT (2009a:63)
  - Identifying records.
  - Authenticating records.
  - Administering terms and conditions of access and disposal.
  - Restricting unauthorised use.
  - Tracking and documenting the use of records including distribution, retrieval and delivery for unauthorised users.
  - Capturing structural and contextual information necessary to preserve the record's meaning.

2.6.5.3 Attributes of Metadata

It has always been the task of a record professional to maintain the contextual information regarding records. IRMT (2009a:22) explains the three important attributes of records: "Records have three important attributes: content, context and structure.

- "*Content* is what the record says.

- *Structure* relates to both the appearance and arrangement of the content (for example, the layout, fonts, page and paragraph breaks, tables, graphs, charts and so on) and the physical or, more appropriately, logical relationship of the record to

other related records in the system (for example, where a document is found in a file folder or in a bound journal).

- *Context* is the background information that helps explain the meaning of the document. One piece of information identifies the particular document, such as the title, author and date of creation. Another piece of information identifies the creator and the purpose of creation, such as the nature of the business function or activity or the creating agency and unit concerned." (IRMT, 2009a:22.)

ISO 15489-2 (2001:14) confirms the same concept by stating "systems that capture records also need to capture metadata associated with the record in a way that:

- describes the record both for what it contains and the context of the business taking place,
- enables that record to be a fixed representation of action, and
- enables the record to be retrieved and rendered meaningful.

These aspects are often referred to as *context, content and structure*."

Metadata about the "use" of a record may also be captured and is very relevant in an audit trail. It shows how a record was used after it was created, whether it was viewed, edited, copied, indexed, sent, etc.

It is also possible to assign Terms and Conditions metadata to records. This will impose restrictions on access and use of the data, reproduction rights, permissions and disposal or destruction conditions.

2.6.5.4 Collecting Metadata

Metadata can be gathered systematically by the system users by completing forms or templates or automatically by the computer system. Metadata that is entered via a DC may include descriptive elements such as links, names or titles.

When Metadata gets collected, IRMT (2009c) states the importance of considering the following Issues:

- "The greater the amount of metadata attached to a record, the higher the potential cost for storing and managing the metadata of the record.

- The poorer the quality of the metadata, the harder it is to manage, locate, retrieve and access electronic information.

- Entering complex metadata efficiently, accurately, and consistently can be costly, time consuming and error-prone, leading to inaccuracies and inconsistencies. Vigilance is required to ensure quality information is gathered.

- Manual capture of metadata can lead to variations.

- The greater the amount of metadata attached to a record, the higher the potential cost for storing and managing the metadata depending on the interpretations made by different people during the process. To avoid variations, it is important to:
  - use naming conventions consistently,
  - use metadata that are meaningful to the users and the organisation,
  - train staff thoroughly and monitor their work regularly,
  - focus on capturing metadata schema that is useful for the organisation's business processes and do not attempt to create elaborate systems if they are not required.

- Another difficult challenge with capturing metadata is getting staff members to comply with the process. Many users do not want to enter information into computer screens, considering it a poor use of their often very limited time." (IRMT, 2009c:24-25.)

It will be for the owner company's benefit to have specific project document metadata requirements predetermined and to practise the managing thereof effectively to help improve operational requirements and saving time in the long run.

2.6.5.5 Existing Metadata Standards

The capturing of metadata about electronic records plays a vital role in preserving digital information as reliable and authentic evidence. Various metadata standards are available and may be used to suit the needs of an organisation. Applicable changes to suite the

requirements are in order. The following two metadata standards are selected and briefly summarised:

- ***Dublin Core Metadata Initiative (DCMI)***

A generic metadata standard comprised of 15 properties for usage in resource descriptions. ISO adopted the standard in 2003 and is called ISO 15836, Information and Documentation - The Dublin Core Metadata Element Set.

The standard was revised and released in 2009. Table 2.3 illustrates the Dublin Core Metadata Elements. ISO 15836:2009(E) does not limit what might be a resource. "It defines the elements typically used in the context of an application profile which constrains or specifies their use in accordance with local or community-based requirements and policies. However, it does not define implementation detail, which is outside the scope of this International Standard."(ISO 15836, 2009:1.)

Table 2.3: Dublin Core – Fifteen Core Elements

Title	Definition	Remarks
Title	Name given to the resource	
Creator	Entity primarily responsible for making the resource	Examples of Creator include a person, an organisation, or a service. Typically, the name of a Creator should be used to indicate the entity.
Subject	Topic of the resource	Typically, the subject will be represented using keywords, key phrases, or classification codes. Recommended best practice is to use a controlled vocabulary. To describe the spatial or temporal topic of the resource, use the Coverage element.
Description	Account of the resource	Description may include, but is not limited to, an abstract, a table of contents, a graphical representation, or a free-text account of the resource.
Publisher	Entity responsible for making the resource available	Examples of a Publisher include a person, an organisation, or a service. Typically, the name of a Publisher should be used to identify the entity.

Title	Definition	Remarks
Contributor	Entity responsible for making contributions to the resource	Examples of a Contributor include a person, an organisation, or a service. Typically, the name of a Contributor should be used to indicate the entity.
Date	Point or period of time associated with an event in the lifecycle of the resource	Date may be used to express temporal information at any level of granularity. Recommended best practice is to use an encoding schema such as the W3CDTF profile of ISO8601 [W3CDTF].
Type	Nature or genre of the resource	Recommended best practice is to use a controlled vocabulary such as the *DCMI Type Vocabulary* [DCMI- TYPE]. To describe the file format, physical medium, or dimensions of the resource, use the Format element.
Format	File format, physical medium, or dimensions of the resource	Examples of dimensions include size and duration. Recommended best practice is to use a controlled vocabulary such as the list of *Internet Media Types* [MIME].
Identifier	Unambiguous reference to the resource within a given context	Recommended best practice is to identify the resource by means of a string conforming to a formal identification system.
Source	Related resource from which the described resource is derived	The described resource may be derived from the related resource in whole or in part. Recommended best practice is to identify the related resource by means of a string conforming to a formal identification system.
Language	Language of the resource	Recommended best practice is to use a controlled vocabulary such as RFC 4646.
Relation	Related resource	Recommended best practice is to identify the related resource by means of a string conforming to a formal identification system.

Title	Definition	Remarks
Coverage	Spatial or temporal topic of the resource, the spatial applicability of the resource, or the jurisdiction under which the resource is relevant	Spatial topic and spatial applicability may be a named place or a location specified by its geographic coordinates. Temporal topic may be named period, date or date range. A jurisdiction may be a named administrative entity or a geographic place to which the resource applies. Recommended best practice is to use a controlled vocabulary such as the *Getty Thesaurus of Geographic Names* [TGN]. Where appropriate, named places or time periods can be used in preference to numeric identifiers such as sets of coordinates or date ranges.
Rights	Information about rights held in and over the resource	Typically, rights information includes a statement about various property rights associated with the resource, including intellectual property rights.

(ISO 15836, 2009:2-3)

- ***The national Archives of Australia Recordkeeping Metadata Standard (NAA)***

It is based on a multiple-entity model, and allows for the description of up to five separate entities: Record, Agent, Business, Mandate and Relationship. It can be used for records management and archival purposes. "The standard defines a basic set of 26 metadata properties and an additional 44 sub-properties that may be used to describe these entities." (Australian Government: Recordkeeping Metadata Standard Version 2.0, 2008:7.)

"The new standard sets out the type of information that agencies should capture in a structured way to describe the identity, authenticity, content, structure, context and essential management requirements of records. Such descriptive information will ensure that reliable, meaningful and accessible records that satisfy business needs, evidential requirements and broader community expectations are kept." (Australian Government: Recordkeeping Metadata Standard Version 2.0, 2008:9.)

NAA states that organisations are required to carry out their business in an accountable, equitable and efficient manner. Good recordkeeping is an essential requirement for efficient administration and democratic accountability. It is the basis for establishing and

maintaining documentary evidence of organisational activities, and helps agencies manage and preserve corporate memory for short and long-term purposes.

Reliable RM functionality ensures that the owner company records:

- "can be proven to be genuine;
- are accurate and can be trusted;
- are complete and unaltered;
- are secure from unauthorised access, alteration and deletion;
- are findable and readable; and
- are related to other relevant records.

Agencies need to create and keep not only information about what transactions they have carried out via electronic means but also evidence, in the form of records, that captures the content and context of these activities. This evidence therefore needs to document what transaction occurred, when it occurred, its location, the identity of the participants, its relationship to the business process for which it serves as evidence, and links to broader mandates governing the business of which it is part.

While in the traditional paper recordkeeping environment these requirements are accepted and built into a RMS, the electronic environment makes it necessary to think anew about strategies to adopt to ensure records have the same degree of reliability, authenticity and usability as paper records.

In short, electronic recordkeeping systems are metadata systems, and metadata is vital to any good recordkeeping system." (Australian Government: Recordkeeping Metadata Standard Version 2.0, 2008:9.)

Table 2.4: National Archives of Australia Metadata Standard

No.	Element	Description
1	Category	Specifies the specific category or aggregation of the entity being described, such as a Series for a Record, a Work Group or Person for an Agent, a piece of Legislation or a Policy for a Mandate, or a Recordkeeping Event for a Relationship.
2	Identifier	A unique identifier for the entity, such as an identifier automatically assigned to a document registered into an EDRMS, or a person's APS or employee number
3	Name	The title or name given to the entity.
4	Date	Start and end dates and times associated with an entity.
5	Description	A free-text description of the entity.
6	Related Entity	A means of identifying other entities in a relationship.
7	Change History	A means of recording changes to an entity's metadata property and sub-property values
8	Jurisdiction	Specification of a jurisdiction within which an entity operates, exists or is valid.
9	Security Classification	A label that denotes the security status or sensitivity of a record, mandate or the business.
10	Security Caveat	A warning that a record or mandate requires special handling, and that only people cleared and briefed to see it may have access.
11	Permissions	The security clearance or other accreditation of an agent or business function or activity that determines its access and use rights to records.
12	Rights	Policies and requirements that govern or restrict non-security related use of and access to records.
13	Contact	Information about how to contact an agent.
14	Position	The name of the current position occupied or held by an agent.
15	Language	The language that is used for a record, or that is spoken or used by an agent in doing business.
16	Coverage	The jurisdictional applicability, or the temporal and/or spatial topic, of the entity.
17	Keyword	The subject of the record, or the general or agency-specific functions and activities that are documented by the record.

No.	Element	Description
18	Disposal	Information about current records authorities and the disposal actions that relate to the record
19	Format	Information about the logical form of a digital record.
20	Extent	The physical dimensions or logical size or duration of the record.
21	Medium	The physical 'carrier' on which a digital record is stored. For physical records, the material of the record.
22	Integrity Check	A method for determining whether the bits that make up a digital record have been changed in the course of transmission or storage. Sometimes referred to as 'fixity'.
23	Location	The current (physical or system) location of the record.
24	Document Form	Information about the recognised form the record takes, which governs its internal structure and relates to its transactional purpose. Document form can relate to the activity that a record documents.
25	Precedence	A mechanism by which the current time sensitiveness of a record can be flagged.

(Australian Government: Recordkeeping Metadata Standard Version 2.0, 2008:14)

2.6.5.6 Registration and Metadata

The purpose of registration is to provide evidence of a records creation and capture in the ERMS. Before the shift made to electronic RM and electronic DM, archivists were responsible for the control of records, mainly a paper based system. In manual, paper based control systems a register is normally a separate record. Electronic records consist of various different elements and components that create a "replica" of the original record when they are brought together. There is no original record as understood in a paper based environment. ISO 15489-2 (2001:15) states that "Electronic records systems can be designed to register records through automatic processes, transparent to the user of the business system from which it is captured and without the intervention of a records management practitioner. Even where registration is not totally automated, elements of the registration process (specifically some of the metadata that are required for registration) can be automatically derived from the computing and business environment from which the record originates."

"Whatever form it takes, as a general rule the register is unalterable. If, however, changes are required, there has to be an audit trail.

"Registration specifies the following *metadata* as a minimum:

- a unique identifier assigned from the system;
- the date and time of registration;
- a title or abbreviated description;
- the author (person or corporate body), sender or recipient." ISO 15489-2 (2001:15)

ISO 15489-2 (2001) furthermore asserts that "more detailed registration links the record to descriptive information about the context, related records. Specific jurisdictions may have mandated metadata requirements for full and accurate records. Some of these metadata requirements may be met through the initial registration of a record and its relationships. Depending on the nature of the business recorded, the organization's evidence requirements and technology deployed, the information attached to the record's unique identifier can include:

- document name or title,
- text description or abstract,
- date of creation,
- date and time of communication and receipt,
- incoming, outgoing or internal,
- author (with his/her affiliation),
- sender (with his/her affiliation),
- recipient (with his/her affiliation),
- physical form,
- classification according to the classification scheme,
- links to related records documenting the same sequence of business activity or relating to the same person or case, if the record is part of a case file,
- business system from which the record was captured,
- application software and version under which the record was created or in which it was captured,
- standard with which the records structure complies (for example, Standard Generalized Markup Language –SGML, Extensible Markup Language – XML),
- details of embedded document links, including applications software and version under which the linked record was created,
- templates required to interpret document structure,
- access,
- retention period, and

- other structural and contextual information useful for management purposes." (ISO 15489-2, 2001:15-16.)

"Records document the actions of government, organisations and individuals. Managing records and other document-like information objects (DIOs) in networked environments depend on inextricably linking them to authoritative *metadata* from the point of creation. Without a rules and standards infrastructure equivalent to the bibliographic and quality assurance regime in the paper world, the integrity, transparency and accessibility of such electronic information resources cannot be assured over time." (McKemmish, *et al.* 1998-99.)

2.6.6 Electronic Records as Evidence

The IRMT (2009a) states that records professionals or DCs should be able to recognise and identify electronic products that can be considered evidence of actions and transactions; which should be preserved as records.

There is a distinct difference between electronic records and information, and data and information. There is an evolution from data to information, from information to records and from records to knowledge, as illustrated in Table 2.5.

"Data comprise raw unformatted information and can be easily updated, edited, copied and reused. A list of numbers is data. **Information** is data that carries some meaning to the user. A list of numbers with names beside them could be a statement about how much income employees in the organisation received each month. A list of numbers and names could become a **record** if it is used as the evidence for issuing cheques to staff: it might confirm who got paid and how much they received. That record can be used to gain **knowledge** if senior managers review it to determine how much their annual payroll costs are and whether they need to consider reviewing their staffing structure as a result of cost overruns.

Whereas records derive meaning from their context and structure as well as their content, data lack context and structure and therefore are meaningless on their own. In an archival context, the authenticity of a record is paramount to its acceptance as evidence, so that it is not simply considered information or data. The authenticity of an electronic record derives from three essential characteristics: reliability, integrity and usability." (IRMT, 2009a:27.)

Table 2.5: Data, Information and Records

DATA	*INFORMATION*	*RECORD*	*KNOWLEDGE*
Raw unformatted pieces of information	Data that is presented in an understandable form	Structured information	Information that has been understood in light of previous experience or other knowledge
Easily manipulated, updated, edited, copied and reused	Meaning may be derived from the context in which it is presented	"Permanently" recorded on a medium	Does not need context or structure
Consists of content but lacks context and structure	Contains content and context but does not necessarily have any structure	Has content, context and structure	
		Provides evidence	
		Is inviolable	

(IRMT, 2009a:27)

2.6.7 Assessment of existing Systems

2.6.7.1 Introduction

This section examines and summarises some of the existing DM Institutions, Standards and Practices that can contribute to South African owner companies who want to develop or improve a DMS for the execution of capital projects.

2.6.7.2 DLM Forum

"In 1996 by initiative of the EC the DLM Forum was initiated. The DLM Forum is a community of Public Archives and interested parties in archive, records, document and information lifecycle management throughout the EU. In 2004 the DLM Forum was founded as a constitutional. 'DLM' shall mean 'Document Lifecycle Management')" (DLM Forum, 2004 Constitution).

"The DLM FORUM has the following goals -

- To establish a strategic network to bring together individuals and organisations from both the public and private sector involved in Document Lifecycle Management.

- To provide a formal and sustainable entity to support the Forum members in fulfilling their roles and responsibilities and to raise awareness in the field of Document Lifecycle Management.

- To provide technology and knowledge transfer and information services, appropriate practice guidelines, benchmark indicators and information, educational, skills development and research opportunities.

The DLM FORUM shall, *inter alia*, have the following objectives –

- To provide for information services (on-line information portal, list-serv, publications, discussions forum, news, dynamic document archive).

- To provide for technology & knowledge transfer (technology watch, standards, legislation and policy monitoring, consultancy, connecting technology providers with users, partnership development).

- To provide for education & skills development (conferences, seminars and exhibitions, workshops and training sessions, managed learning environments).

- To provide for research (user needs analysis, economic modelling, ontology development, knowledge engineering, classification, information retrieval)."(DLM Forum Constitution, 2004.)

2.6.7.3 ISO 15489

ISO 15489 consists of two parts and is summarised below.

2.6.7.3.1 ISO 15489-1 Information and Documentation-Records Management - Part 1: General

Based on the Australian Standard AS 4390, *Records Management*, this ISO standard was developed to standardise international best practice in RM. It provides guidance on

managing records of originating organisations, public or private, for internal and external clients to ensure that adequate records – in all formats and media – are created, captured and managed. This standard also provides guidance on:

- Determining organisational responsibilities for records and records policies, procedures, systems and processes.

- Supporting a quality process framework to comply with ISO 9001 and ISO 14001, and designing and implementing a records system (but not the management of archival records within archival institutions).

2.6.7.3.2 ISO/TR 15489-2 Information and Documentation - Records Management - Part 2: Guidelines

The international RM standard, ISO 15489-1, "specifies the elements of records management and defines the necessary results or outcomes to be achieved." (ISO 15489-1, 2001:vi.) This technical report, ISO/TR 15489-2, is supplementary to the standard, providing further explanation and one methodology for implementation of the standard. Both ISO 15489-1 and this technical report apply to records in any format or media, created or received by any public or private organization during the course of its activities. This technical report addresses RM in terms of:

- policies and responsibilities,
- strategies, design, and implementation,
- processes and controls,
- monitoring and auditing and
- training.

2.6.7.4 MoReq

Another important development in Electronic Records Management (ERM) is *MoReq.* The development of The Model Requirements for the Management of Electronic Records (MoReq) was completed in 2001. MoReq (2001) states that "The need for a comprehensive specification of requirements for electronic records management was first articulated by the DLM-Forum in 1996, as one of the ten action points arising from its meeting. Subsequently, the European Commission Enterprise DG's Interchange of Data between Administrations (IDA) programme commissioned the development of this model specification. "Development was carried out by a small team of specialist consultants from

Cornwell Affiliates plc (now Cornwell Management Consultants plc), supported by a guiding team of experts drawn from several countries, and validation organisations from both the private and public sectors."

"Other closely-related requirements, such as DM and the electronic management of physical records (e.g. paper files and microfilm) are also addressed, but in less detail. For example, the specification includes guidelines on the requirements for managing physical records; but it does not include all the detailed functionality associated with tracking physical locations, bar coding, etc." (MoReq, 2001:1-2.)

2.6.7.5 MoReq2 – Update and extension of MoReq

It is the second version of the Model Requirements for the management of electronic Records (MoReq2). The specification concentrates mainly on the functional requirements for the management of electronic record by an ERMS. The system was developed for both physical and electronic record requirements.

The IRMT summarised the functional requirements in MoReq2 as follows:

- "Create new files.
- Maintain classification schemes and files.
- Capture records.
- Delete files and records.
- Search for and read records.
- Change the content of records.
- Capture and change metadata about the records.
- Manage retention and disposal transactions.
- Export and import files and records.
- View audit trail data.
- Provide access to authorised users." (IRMT, 2009a:53.)

"MoReq2 was prepared for the European Commission by Serco Consulting with financing from the European Union's IDABC programme. The development process was overseen by the European Commission working closely with the DLM Forum and drafts were reviewed by DLM Forum experts at key stages in the development. These reviews were in addition to input and review by dozens of users, consultants, suppliers, academics and professional bodies from around the globe, giving MoReq2 an unprecedented level of authority. As such MoReq2 will be of great value to all those involved in the management of electronic records in Europe and around the world." (MoReq2, 2008:7.)

"Information technology has changed since 2001. There has been growth and evolutionary change in many technology areas that affect the creation, capture and management of electronic records. This new version of MoReq, called MoReq2, addresses the impacts of that technological change. It also takes account of new standards and best practice that have been developed over the last several years. Accordingly, it is written as an evolutionary update of the original MoReq." (MoReq2, 2008:7.)

The specification states that it can effortlessly "manage electronic records with the desired levels of confidence and integrity, by combining both the advantages of electronic ways of working with classical RM theory. Examples of this pragmatic approach include the incorporation of requirements for document management, workflow, metadata and other related technologies.

Although MoReq2 covers a wide range of types of records, it is important to understand that ERMS solutions address mainly records that are often referred to as "unstructured" records. In simple terms, unstructured records are those that contain information presented in a form primarily intended to be used by human users. Examples of unstructured records are letters, memoranda, e-mail messages, pictures, photocopies, scanned images, audio recordings and video recordings. It can be held that all properly managed electronic records are structured, as they all are linked to metadata, audit trail data, etc. in a structured manner. On this basis it would be more accurate to refer to unstructured records as "records containing unstructured content"; however, this usage is not common and so is not adopted in MoReq2. Structured records by contrast contain information in a form intended to be used primarily by computer applications (examples include accounting system records, manufacturing scheduling system records, and air traffic control system records). While an ERMS can, in principle, be used to store such structured records, it rarely is. In most situations, structured data is stored under the management of a data processing application" (MoReq2, 2008:11-12).

2.6.7.6 International/Guidelines Applicable to Electronic Records Management

"A number of records-oriented guidelines and requirements have been developed around the world, including international, national and regional tools. Many of these products address the 'functional requirements' for effective record keeping. 'Functional requirements' refer to specific operations that a computer system needs to perform in order to achieve the desired output. Specifically, a function is a set of inputs, processes and outputs that leads to an intended product." (IRMT, 2009a:49.)

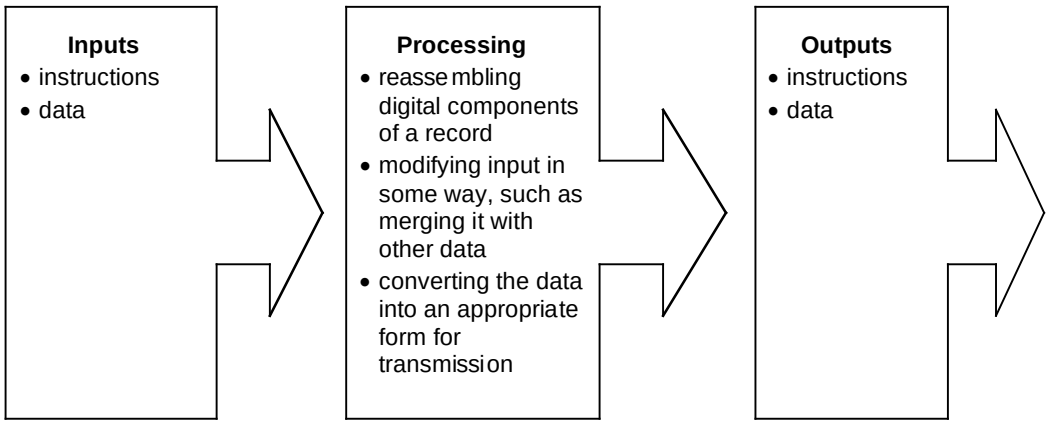

Figure 2.11: Simple Representation of a System

(IRMT, 2009a:17)

The following document/record related standards aiding DM/RM are summarised as follows by MoReq2 Specification:

Table 2.6: Summary of International Standards

FIPS 186-2	NIST Digital Signature Standard(http://csrc.nist.gov/publications/PubsFIPS.html)
ISAAR (CPF)	International Standard Archival Authority Record for Corporate Bodies, Persons and Families (International Council on Archives). (http://www.ica.org/en/node/30230)
ISAD (G)	International Standard for Archival Description (General). (http://www/icacds.org.uk/icacds.htm)
IETF RFC 2821	Simple Mail Transfer Protocol. http://www/ietf.org/rfc/rfc2821/txt)
IETF RFC 2822	Internet Message Format. http://www.ietf.org/rfc/rfc2822.txt)
ISO 216	Writing paper and certain classes of printed matter – Trimmed sizes A and B series.
ISO 639	Codes for the representation of names of languages.
ISO 2788	Guidelines for the establishment and development of monolingual thesauri.
ISO 5964	Guidelines for the establishment and development of multilingual thesauri.
ISO 8601	Representation of dates and times.

ISO 9834-8	Procedures for the operation of OSI Registration Authorities: Generation and registration of Universally Unique Identifiers (UUIDs) and their use as ASN.1 Object Identifier components (see also ITU X.667).
ISO/TS 12033	Guidance for selection of document image compression methods.
ISO/TR 12037	Recommendations for the expungement of information recorded on write-once optical media.
ISO 12142	Media error monitoring and reporting techniques for verification of stored data on optical digital data disks.
ISO/TR 12654	Recommendations for the management of electronic recording systems for the recording of documents that may be required as evidence, on WORM optical disk.
ISO 14721	Open archival information system – Reference model (OAIS).
ISO/IEC 15444	JPEG 2000 image coding system: Core coding system.
ISO 15489	Records Management.
ISO/TR 15801	Information stored electronically – Recommendations for trustworthiness and reliability.
ISO 15836	The Dublin Core metadata element set.
ISO 18492/TR	Long-term preservation of electronic document-based information.
ISO 19005-1	Electronic document file format for long-term preservation – Part 1: Use of PDF 1.4 (PDF/A-1).
ISO 23081	Metadata for records.
ITU X.667	Generation and registration of Universally Unique Identifiers (UUIDs) and their use as ASN.1 object identifier components. (http://www.itu.int/ITU-T/studygroups/com17/oid/X.667-E.pdf).
TIFF	Tagged Image File Format. (http://partners.adobe.com/public/developer/tiff/index.html).
X.509	ITU-T Recommendation X.509: Open systems interconnection – The Directory: Public-key and attribute certificate frameworks. (http://www.itu.int/rec/T-REC-X.509-200003-I/en).
XKMS	XML Key Management Spec. (http://www.w3.org/TR/xkms).
XML	W3C Extensible Markup Language (XML). (http:///www.w3.org/TR/REC-xml/).

(MoReq2, 2008:200-202)

MoReq2 further summarises other available guidance applicable in the field:

Table 2.7: Summary of International Guidance

ISO/DIS 9241-171	Ergonomics of human-system interaction – Part 171: Guidance on software accessibility
ISO/TS 16071	Guidance on accessibility for human-computer interfaces (due to be superseded by ISO 9241-171).
WfMC	Workflow Management Coalition Terminology & Glossary. (http://www.wfmc.org/standards/referencemodel.htm)
1999/93/EC	Directive on a Community Framework for Electronic Signatures. (http://europa.eu/scadplus/leg/en/lvb/124118htm)
DLM Forum Guidelines	Guidelines on best practices for using electronic information. INSAR (European Archives News) Supplement III (1997). ISBN: 92-828-2285-0. (http://dlmforum.typepad.com/gdlines.pdf)

(MoReq2, 2008:196)

2.6.7.7 Other guidance available for records management

Other guidance available for RM is documented in International Records Management Trust as detailed below.

2.6.7.7.1 Australia: AS ISO 15489

"The Australian national standards organisation published Australian Standard (AS) 4390: *Records Management,* in 1996. In fact, this document formed the basis for ISO 15489, which was published by ISO in 2001. In 2002, Australia published AS ISO 15489-2002, *Records Management*, which replaced Australian Standard AS 4390. The 2002 document, AS ISO 15489, is an Australian codification of ISO 15489, with some amendments to recognise specific terminology or requirements in the Australian context. Since the Australian standard is so closely aligned with the international standard, it represents international best practice for record keeping and is considered the national standard for records management throughout Australia." (IRMT, 2009a: 52.)

2.6.7.7.2 United States: DOD 5101.20

IRMT (2009a:52) reports on The Department Of Defense the following: "In the United States, the Department of Defense (DOD) issued a formal standard for the management of the records of that department in 1997. This standard was updated in 2007 and is known as DoD 5015.02-STD, 'Electronic Records Management Software Applications Design Criteria Standard,' April 25, 2007. The standard sets forth the functional requirements for RM application software used by the Department of Defense. The standard includes definitions of the required system interfaces and search criteria that RM applications must support and outlines the minimum RM requirements that must be met to comply with National Archives and Records Administration (NARA) regulations.

The DoD 5015.02 standard does not focus on general RM principles but instead specifically addresses the mandatory and desirable functional requirements that should be in place when selecting and implementing electronic RM software. Therefore, its guidance focuses specifically on a computerised record-keeping environment. However, the principles articulated in the standard can be valuable even in those situations where upgrading manual RM processes is the first priority.

Among the valuable information included in the DoD 5015.02 standard are descriptions of the components of file plans or record folders; information about essential records metadata to capture and the identification of specific information that should be captured when documenting classified or protected records. The DoD 5015.02 standard is now used by both the public and private sectors in the United States and internationally as a basis for creating technical specifications for records management software and programmes." (IRMT, 2009a:52.) See also DoD 5015.02-STD(A), 2000.

2.6.7.7.3 United Kingdom: BS ISO 15489

BS ISO 15489 (2001) BSI British Standards is the UK's National Standards Body (NSB) and was the world's first. IRMT (2008a:53-54) reports that "The British Standards Institute (BSI) has adopted the ISO standard and refined it slightly for use within the United Kingdom. The actual tool is called BS ISO 15489: 2001: *Information and Documentation. Records Management. General.* The BSI has also produced a number of related guidance tools, including BS DISC PD 0025-1:2002: *Effective Records Management. A Management Guide to the Value of BS ISO 15489-1* and BS DISC PD 0025-2:2002: *Effective Records Management. Practical Implementation of BS ISO 15489-1*."

2.6.7.7.4 Digital Preservation: OAIS Reference Model

Another model discussed and summarised by the IRMT (2009a:54-55) is the OAIS Reference Model "One of the most important guidelines for digital preservation is OAIS or the Open Archival Information Systems Reference Model. The OAIS model was originally developed by the space science community to provide a generic structure for the organisation and management of digital archives; scientists were motivated by the need to manage the growing body of astronomical and related information that was being generated by national and international space agencies. Subsequently, the model has been adopted as an effective approach to digital preservation for information management communities around the world"

The IRMT (2009a:54-55) also reports: "The OAIS model addresses the full range of archival functions, including ingesting, storing, managing and accessing records. The model also defines the requirements for describing archival digital resources. OAIS has been ratified as an international standard (ISO 14721:2003: Space Data and Information Transfer Systems: Open Archival Information System – Reference Model), and its terminology and concepts are now widely accepted among records and information technology professionals."

A summary of OAIS features to support the preservation of electronic records is:

- "a framework for increased awareness of archival concepts related to digital preservation and access, for both records professionals and those outside the discipline.
- clearly defined terminology for describing information architectures and digital archival operations.
- the information needed to compare different long-term preservation strategies and techniques.

OAIS also forms the basis for a certification scheme for the creation and management of trusted digital repositories. This scheme, developed by the American National Archives and Records Administration (NARA) in conjunction with the Online Computer Library Center (OCLC) and the Research Libraries Group (RLG) in the United States, is based on a checklist called TRAC or Trustworthy Repositories Audit and Certification. TRAC is designed as an audit mechanism for assessing the capacity of institutions to establish trusted digital repositories that serve to preserve electronic records securely and reliably for the long term." (IRMT, 2009a:55.)

2.6.7.7.5 ICA ISAD (G)

The IRMT (2009a:55) reports "In 2000, the International Council on Archives issued *ISAD(G)* or the *General International Standard Archival Description.* The standard is intended to provide general guidance for the preparation of archival descriptions. *ISAD(G)* may be used alone or in conjunction with other national standards, or it may form the basis for the development of regional, local or institutional standards."

2.6.7.7.6 ICA ISAAR (CPF)

This standard was issued in 2004 by ICA and was called "*ISAAR(CPF)* or the *International Standard Archival Authority Record for Corporate Bodies, Persons, and Families, Second Edition.* This standard offers guidance for the preparation of authority records, in order to provide consistency in the identification of corporate bodies, individuals and families, when describing archival materials." (IRMT, 2009a:52-56.)

2.6.7.7.7 ICA ISDF

In 2008 the ICA released the first edition of ISDF or the International Standard for Describing Functions. "The main scope of archival arrangement and description is to preserve the original context of records creation, by safeguarding their evidential value and their authenticity." (ICA-ISDF, 2008.)

2.6.8 Essential Elements of a Quality Document and Records Management System

2.6.8.1 Introduction

A number of processes and elements that should be included in a document or RM system are identified. These processes and elements do not always follow a definite process flow and sequence but should be considered in a document and RM systems when owner companies execute capital projects. Most of the DM systems provide the basic elements such as scanning, storage and retrieval of documentation. In the execution of capital projects where multiple users work with a huge volume of documents from multiple locations, the DMS should include essential elements far beyond the basics to meet the requirements. The features included in this section are extracts from various literatures and will add value to DMSs for owner companies executing capital projects. These elements may happen simultaneously or in different order.

2.6.8.2 Identification of Documents and Records

ISO 15489 gives emphasis to the following: "Determining which documents should be captured into a records system is based on an analysis of the regulatory environment, business and accountability requirements and the risk of not capturing the records." ISO 15489 explains that businesses environment and organisational requirements may differ according to legal and social operational context. (ISO 15489-1, 2001:11.)

"Documents are created and received in a variety of media using technology that is constantly changing. "Business or personal actions should be captured as records and linked with metadata which characterize their specific business context when they commit an organization or individual to action, render an organization or individual accountable, or document an action, a decision or decision-making process." (ISO 15489-1, 2001:11.)

2.6.8.3 Usability

A number of different stakeholders make use of the DMS and a really important factor in how successful and efficient the system is, is how easy it is to use. "Usability is critical in encouraging rapid staff acceptance. A system will only be widely used if it is simple to capture documents, organize and find them. The best systems are user-friendly and flexible enough to adapt to the way people already work within an organization, rather than forcing them to change their preferred way of working. To guarantee that a document management system is readily accepted by users throughout an organization, it is important that the graphic interfaces for common operations, such as search and retrieval, are clear and easy-to-use. User-friendly interfaces not only assure rapid adoption of the document management system by staff, but they also reduce training expenses associated with implementation." (Laserfiche, 2007:14.)

2.6.8.4 Determining how long to retain documents and records

It is vital to know how long documents should be retained. As execution of projects in owner companies' increase and regulations also become more stringent, informal guidelines for keeping various types of documents give way to more formal RM practices.

"Decisions about how long records should be maintained within a records system are based on an assessment of the regulatory environment, business and accountability requirements and the risk. Initially, such decisions should involve the unit administering the specific business activity, the designated records manager and others as required, in compliance

with the external and internal records management policies or standards and the requirements for records associated with the specific business activity. Statutory or other regulatory requirements may demand minimum retention periods or submission to an authorizing body such as an archival authority or auditors for any necessary approval. The rights and interests of all stakeholders should be considered when determining how long records need to be maintained. The decisions should not be made intentionally to circumvent any rights of access." (ISO 15489-1, 2001:11-12.)

ISO 15489 includes the following reasons why records retention should be vigilantly managed and emphasize the need to;

- "meet current and future business needs by

  1) retaining information concerning past and present decisions and activities as part of the corporate memory to inform decisions and activities in the present and in the future,

  2) retaining evidence of past and present activities to meet accountability obligations,

  3) eliminating, as early as possible and in an authorized, systematic manner, records which are no longer required, and

  4) retaining the context of the record which will enable future users to judge the authenticity and reliability of records, even in cases where the records systems in which they are retained have been closed or have undergone significant changes,
- comply with legal requirements, by ensuring that the regulatory environment applicable to records management for specific business activities is documented, understood and implemented, and
- meet the current and future needs of internal and external stakeholders by

  1) identifying the enforceable or legitimate interests that stakeholders may

  2) identifying and assessing legal, financial, political, social or other positive gains from preserving records to serve the interests of research and society as a whole, and

  3) following regulations of the appropriate archival authority where applicable." (ISO 15489-1, 2001:11-12.)

ISO I5489-1 (2001) argues that "Records identified for continuing retention are likely to be those which:

- provide evidence and information about the organization's policies and actions,
- provide evidence and information about the organization's interaction with the client community it serves,
- document the rights and obligations of individuals and organizations,

- contribute to the building of an organization's memory for scientific, cultural or historical purposes, and
- contain evidence and information about activities of interest to internal and external stakeholders." (ISO 15489-1, 2001:11-12.)

2.6.8.5 Create

It is important to know how documents are created and this is captured in various literatures. This element becomes important when multiple people need to collaborate, and the logistics of version control and authorisation issues arise.

2.6.8.6 Capture

Laserfiche (2007:15) states that "For a document management system to enhance business operations it must accommodate all the types of documents – paper, electronic, fax, audio and video, to name a few – that are part of an organization's processes and procedures. It should also enable batch processing of documents and forms for organizations that rely on high-volume processing as a part of business operations." Laserfiche (2007:15) furthermore identifies three ways to bring files into a digital document management system:

- "Scanning or imaging (for paper files).
- Importing (for archiving electronic documents such as Microsoft Office files, spreadsheets, faxes, audio and video).
- Conversion (for creating unalterable images of electronic documents). Converting documents is the process of transforming electronic files, such as word processor or spreadsheet documents, into permanent, raster-image format for storage within a document management system."

ISO 15489-1 (2001) included the following techniques to ensure that the capture of records is functional and include elements that are also discussed in more detail in this section:

- "classification and indexing which allow appropriate linking, grouping, naming, security protection, user permissions and retrieval, disposition, and identifying vital records.
- arrangement in a logical structure and sequence, whether a physical file or an electronic directory, which facilitates subsequent use and reference.

- registration which provides evidence of the existence of records in a records system, and
- systems which profile or template the actions undertaken in doing business, which
  1) provide metadata describing the business context.
  2) provide evidence of where a record is located.
  3) identify what action is outstanding.
  4) identify who has accessed a record.
  5) identify when such access took place, and
  6) provide evidence of the transactions that have been undertaken on the record." (ISO 15489-1, 2001:12-13.)

2.6.8.7 Registration

According to ISO 15489, a records system which employs registration processes necessitate the following:

- "a record is registered when it is captured into the records system.
- no further processes affecting the record can take place until its registration is complete." (ISO 15489-1, 2001:13.)

ISO 15489-1, (2001) supported by other literature, indicates that "the primary purpose of registration is to provide evidence that a record has been created or captured in a records system, and an additional benefit is that it facilitates retrieval. It involves recording brief descriptive information or metadata about the record and assigning the record an identifier, unique within the system. Registration formalizes the capture of the record into the records system. Records may be registered at more than one level or aggregation within a records system. In the electronic environment, records systems may be designed to register records through automatic processes, transparent to the user of the business system from which it is captured and without the intervention of a records manager." (ISO 15489-1, 2001:13.)

2.6.8.8 Classification

Classification of documentation according to the activities during the execution of projects is required to enhance the usability thereof. ISO 15489 also includes classification in the performance of business and in many of the processes involved in the management of records including:

- "providing linkages between individual records which accumulate to provide a continuous record of activity.
- ensuring records are named in a consistent manner over time.
- assisting in the retrieval of all records relating to a particular function or activity.
- determining security protection and access appropriate for sets of records.
- allocating user permissions for access to, or action on, particular groups of records.
- distributing responsibility for management of particular sets of records.
- distributing records for action, and
- determining appropriate retention periods and disposition actions for records." (ISO 15489-1, 2001:14.)

2.6.8.9 Indexing

Indexing can be done manually or be automatically generated and occurs at various levels within a document or RM system. The allocation of numbers or codes is required to ensure the record may be retrieved by specifying the residence within the records system. This numbering system should have a location function, where the number or code indicates the "address" of the record.

"In a recent survey, three-fourths of executives said that information is their organization's most important asset. Ensuring that this information is readily available to the employees who need it is one of the major challenges for today's executives". (Laserfiche, 2007:17.)

Laserfiche (2007:17) continues with "A full featured document management system makes it easy to find what you want when you want it. Retrieval of relevant documents should be fast, easy and efficient, with multiple methods of indexing (categorizing) information. Indexing allows users to quickly sort large volumes of data to find the right document. Whatever the combination of indexing methodologies, search methods need to be easily used and understood by the people who retrieve the documents, as well as those who file them."

More guidance on indexing can be found in ISO 5963:1985.

2.6.8.10 Storage and Handling

A holistic approach should be followed when storage and handling of documentation is considered. ISO 15489 recommends that "records should be stored on media that ensure their usability, reliability, authenticity and preservation for as long as they are needed. Issues relating to the maintenance, handling and storage of records arise throughout their existence, not only when they become inactive. Records require storage conditions and handling processes that take into account their specific physical and chemical properties. Records of continuing value, irrespective of format, require higher quality storage and handling to preserve them for as long as that value exists. Storage conditions and handling processes should be designed to protect records from unauthorized access, loss or destruction and from theft and disaster" (ISO 15489-1, 2001:14.)

It is recommended for organisations to design and implement policies and procedures on converting or migrating records from one records system to another. "Systems for electronic records should be designed so that records will remain accessible, authentic, reliable and useable through any kind of system change, for the entire period of their retention. This may include migration to different software, re-presentation in emulation formats or any other future ways of re-presenting records. Where such processes occur, evidence of these should be kept, along with details of any variation in records design and format." (ISO 15489-1, 2001:14.)

2.6.8.11 Workflow

A variety of workflows can be pre identified and set up. "Workflow modules can increase the benefits of a document management system by automating the routing of documents to various people, eliminating bottlenecks and streamlining business processes. This added functionality is crucial for large offices, for organizations with central and branch offices and for organizations that plan to expand their system." (Laserfiche, 2007:26.)

2.6.8.12 Distribution

Laserfiche (2007:24) highlights the following on distribution: "A document management system should assist you in putting the right information in the hands of the right people. A quality system makes it possible for multiple users to access the same files at the same time and aids in distributing documents to authorized individuals both inside and outside your organization over an intranet, by email or through publication to the Web, CD or DVD. A full-featured document management system safeguards an unalterable copy of the

original while allowing you to enhance collaboration and service by circulating copies in the format that best serves your business needs." (Laserfiche, 2007:24.)

The following ways of distribution are mentioned:

- Print, Fax and E-mail.
  To maximise their usefulness, DMS should support the most common printer and fax drivers and be able to print images, text and annotations. E-mail has become the default mode of communication in many organisations.

- Intranet and Internet.
  A DMS should provide a simple way to publish information to the Internet or an intranet. This allows organisations to share information with other departments, remote offices, clients or the public. Web systems should be fully searchable and must support the same security protocols as network systems. Ideally, a DMS will not require HTML or complex coding to post files to the Web.

  When system administrators decide to deploy a DMS across their entire network through an intranet, or even to the public over the Internet, they should make it possible for users to search, retrieve and view documents with any Web browser. Browser-based document access removes the logistical problems associated with conflicts between computer platforms such as Windows, Macintosh® or Unix®

- Briefcases and Portable Volumes.
  DMSs should enable users to carry important documents anywhere, enabling convenient viewing on other computers (Laserfiche, 2007:24).

2.6.8.13 Retrieval

One of the main reasons for employing a DMS is the system's ability to retrieve information and/or data entered previously. "Retrieval is where the quality of the indexing system is most evident. Some document management systems let users search only by indexed keywords, which requires a person to know how the document was categorized and what template fields were assigned to it. A powerful indexing system will make it possible for users to find any document based on what they know, even if that amounts to no more than a word or phrase within the document." (Laserfiche, 2007:17.)

2.6.8.14 Tracking

ISO 15489 distinguishes between action tracking for processes where time limits for actions are imposed and location tracking where the movement of records should be documented to ensure that items can always be located when required. Tracking can only be effectively implemented if documentation is registered in the document or RM system. Tracking of the movement and use of records within a records system is required to:

- "identify outstanding action required.
- enable retrieval of a record.
- prevent loss of records.
- monitor usage for systems maintenance and security, and maintain an auditable trail of records transactions (i.e. capture or registration, classification, indexing, storage, access and use, migration and disposition),
- maintain capacity to identify the operational origins of individual records where systems have been amalgamated or migrated." (ISO 15489-1, 2001:15.)

"The movement of records should be documented to ensure that items can always be located when required. Tracking mechanisms may record the item identifier, the title, the person or unit having possession of the item and the time/date of movement. The system should track the issue, transfer between persons, and return of records to their "home" location or storage, as well as their disposition or transfer to any other authorized external organization including an archives authority." (ISO 15489-1, 2001:16.)

2.6.8.15 Annotations

Basic annotations may consist of stamps, sticky notes, redactions and highlighting. Laserfiche (2007:21) explains why annotations are important in a DMS. "Annotations permit users to append or remove information about a document without permanently changing the original image.

"A document management system's security should give the system administrator control over who can view annotations and see through redactions. In order for the document to maintain its integrity, all annotations should be overlays that do not change the actual image. This way, a document can be printed with or without the annotations. Although the legal standing of imaged documents varies from state to state, for a document stored in the system to stand up as the best copy of a record, users must not be able to modify the original image." (Laserfiche, 2007:21.)

2.6.8.16 Access

It is important to have clear guidelines regulating which project members are permitted access to documents and records and under what conditions.

"The regulatory environment, in which the organization operates, establishes broad principles on access rights, conditions or restrictions that should be incorporated into the operation of records systems. There may be specific legislation covering areas such as privacy, security, freedom of information and archives. Records may contain personal, commercial or operationally sensitive information. In some cases, access to the records, or information about them, should not be permitted. Restrictions on access can be applied both within an organization and to external users. Restricted records should be identified only where specifically required by business needs or the regulatory environment. Restrictions should be imposed for a stated period, to ensure that the additional monitoring required for these records is not enforced for longer than required. The need to place restrictions on accessibility can change with the passing of time. Ensuring appropriate access controls is done by assigning access status to both records and individuals." (ISO 15489-1, 2001:14-15.)

ISO 15489 prescribes how to best manage access:

- "records are categorized according to their access status at a particular time.
- records are only released to those who are authorized to see them.
- encrypted records can be read as and when required and authorized.
- records processes and transactions are only undertaken by those authorized to perform them, and
- parts of the organization with responsibility for particular business functions specify access permissions to records relating to their area of responsibility.

The monitoring and mapping of user permissions and functional job responsibilities is a continuing process which occurs in all records systems, regardless of format. Electronic records systems, particularly those accessible across geographically distributed systems, may inherit user identification protocols from other applications." (ISO 15489-1, 2001:14-15.)

2.6.8.17 Security

"System security is an absolute necessity for any document management system. A rigorous security system should permit every authorized person to perform required duties – whether

from desktop, laptop, the office, a remote location or over the Web – without compromising the integrity of the database, system or network. Comprehensive security is critical to the successful implementation and ongoing protection of a document management system." (Laserfiche, 2007:28.) The following security features are of importance.

Authentication is the level of security that requires users to present credentials, normally a user name and password, in order to access the system.

Authorisation is the level of security that controls access to objects such as files and folders. Authorisation encompasses two primary areas: **access rights,** which determine the objects users can open, and **feature rights,** which determine the actions that users can perform on the objects they have access to.

Redaction (blackout or whiteout) is a security feature applied within documents to make certain portions of the document inaccessible, except to authorised users.

As an additional level of security, a DMS should offer the ability to generate **audit trails and reports** that detail system activity.

Digital archiving with a DMS simplifies **disaster recovery and business continuity planning** by allowing backups of entire document repositories to be stored on durables CDs, DVDs or other media. (Laserfiche, 2007:28-29).

2.6.8.18 Integration

"The introduction of new software and databases often creates logistical challenges for an organization's computer support staff. A quality digital document management solution should provide information to make integration easier. This information might include a complete set of documentation, tools and sample code to speed systems integrations and customizations addressing your organization's specific business needs, or it may include packaged integration solutions that deliver basic image enablement without a major investment of time or money." (Laserfiche, 2007:30.)

2.6.8.19 Archiving

"Once documents are brought into the document management system, they must be reliably stored. Document management storage systems must be able to accommodate

changing technologies and an organization's future growth. A versatile document management system should be compatible with all storage devices currently available, as well as emerging systems, to provide long-term document storage and archiving." (Laserfiche, 2007:22.)

2.6.8.20 Disposition

"Disposition authorities that govern the removal of records from operational systems should be applied to records on a systematic and routine basis, in the course of normal business activity. No disposition action should take place without the assurance that the record is no longer required, that no work is outstanding and that no litigation or investigation is current or pending which would involve relying on the record as evidence. Disposition action may encompass

- immediate physical destruction, including overwriting and deletion,
- retention for a further period within the business unit,
- transfer to an appropriate storage area or medium under organizational control,
- transfer to another organization that has assumed responsibility for the business activity through restructure, sale or privatization,
- transfer to a storage area managed on behalf of the organization by an independent provider with whom appropriate contractual arrangements have been established,
- transfer of responsibility for management to an appropriate authority while physical storage of the record is retained by the creating organization,
- transfer to an organizational archive, or
- transfer to an external archives authority." (ISO 15489-1, 2001:16.)

2.6.8.21 Destroy

ISO 15489 maintains that the following principles should govern the physical destruction of records.

- "Destruction should always be authorized.
- Records pertaining to pending or actual litigation or investigation should not be destroyed.
- Records destruction should be carried out in a way that preserves the confidentiality of any information they contain.
- All copies of records that are authorized for destruction, including security copies, preservation copies and backup copies, should be destroyed." (ISO 15489-1, 2001:16.)

2.6.8.22 Technical Considerations

When documents are not properly managed it can lead to information loss and increased liability. Laserfiche (2007:32) explains that "the goal of digital document management is not solely to eliminate and organize paper, but to manage all organizational documents, both computer-generated and paper-based, and all files, including digital audio and video files. This is the most important reason to implement a digital document management system." Since documents are considered to be organisational assets, it is of the greatest importance to effectively manage these assets.

"In the past, 'document management' was synonymous with managing documents after they were scanned into a computer. Today, the term encompasses a variety of technologies – paper documents that have been scanned to create a digital image, workflow technologies, multimedia technologies and formats, and computer generated content." (Laserfiche, 2007:32.)

The following technical components are identified by Laserfiche and it is advisable to consider these where appropriate:

- System Compatibility.
  Compatibility is the capacity of a DMS to work with existing hardware and software systems.

- Networked Systems.
  In any office, documents are used to transmit information between people. For document management to be truly useful in an office environment, documents must be accessible to all authorised users. Storing documents on individual PCs impairs the flow of information between co-workers and wastes valuable time and resources, so it is important for DMS to have a central repository of records accessible from any PC in the organisation.

- Scalability.
  The scalability of a system determines how easily it can grow with your organisation.

- Hardware requirements.
  Hardware requirements should entail easy operability and compatibility with existing infrastructure and hardware.

- Server requirements.

  It is advisable to install the document management server and the database management system (software program) on separate machines to ensure stability.

- Workstation requirements.

  Should be able to facilitate the DM software and allow users to scan and have access to the DM repository.

- Software requirements.

  The chosen solution should be a scalable package that can be web deployed for effective rolling out to large number of users.

- Licensing requirements.

  The type and the amount of simultaneous connections as well as features like audit trail, e-mail etc. are determined by server licenses.

- Scanning requirements.

  Consideration should be given to size, speed, quality and volume of paper to be used in relation to price and budget.

- Storage Options.

  There are five primary storage options for document management systems (Each storage system has advantages and drawbacks):

  - Magnetic media. (hard drives).
  - Magneto-optical storage.
  - Compact discs.
  - DVDs.
  - WORM (Write Once, Read Many) is an optical disc technology that allows you to write data onto a disc just once. (Laserfiche, 2007:32-38).

2.6.8.23 Documenting Document and Records Management Processes

ISO 15489-1 (2001:16) states that "Documentation describing records management processes and records systems should address legal, organizational and technical requirements. Authority for records management processes, such as classification, indexing, review and disposition of records, should be clearly stated." ISO 15489-1 (2001:16-17) furthermore advises that "relevant legislation, standards and policies should

be recorded, to determine requirements for practice, review, audit and testing of records management processes. Close attention should be paid to other information systems and policies in use within the organization to maintain the corporate integrity of the information management environment."

It is important for organisations to pre determine and document which records should be captured and how long records should be maintained. ISO 15489-1 (2001:16-17) states that "decisions may be presented as a disposition authority. Formal documentation of the analysis or other assessment that results in decisions to capture and retain records should be prepared and submitted to senior management for approval. The documentation should contain details of business activities and the records that result from each business activity, and specify their retention periods and disposition actions clearly and unambiguously."

Another consideration is disposition of records. "Events that activate or enable disposition actions should be clearly identified. Instructions for the transfer of records to alternative forms of storage (e.g. off-line or off-site storage) should be included. Where necessary, such documentation should be submitted to an external authorizing body, such as an archival authority, auditors, etc. for necessary approval. A record of disposition actions, once they have been carried out, should be maintained." (ISO 15489-1, 2001:16-17.)

2.6.9 Relationship between the different Records Management and Document Management Standards and Processes

The previous two sections examine different standards and also the different elements of a good DMS and RMS. This section brings together the previous two results and illustrates the relationship between these standards and processes.

MoReq2 illustrates in Fig 2.12 key processes that affect RM. It also explains and summarizes the following:

- "Create includes not only the creation of records within an organisation, but also receipt of records from outside the organisation.
- Capture includes the registration, classification, and the entry of records management metadata.
- Use includes search, retrieve, browse, render, maintain, review etc.
- Preserve is the processes required to maintain accessibility over time.
- Manage includes maintaining access controls and disposition authorities." (MoReq2, 2008:198)

Figure 2.12: Document/Records Management Processes

(MoReq2, 2008:198)

Fig 2.13 illustrates the extent of the standards' relevance – "Where possible, the standards are shown by their common name (e.g. PDF/A, OAIS) rather than by their less-descriptive standard number (e.g. ISO 19005, ISO 14721)." (MoReq2, 2008:199)

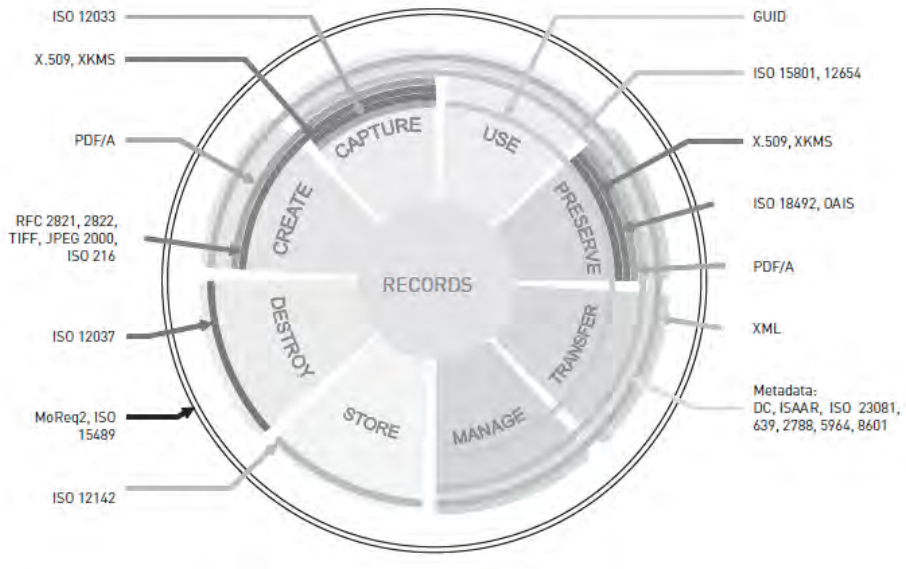

Figure 2.13: The relationship between standards and Electronic Record Management processes

(MoReq2, 2008:198)

Standards that are applicable across many processes are explained in MoReq2 and included below. (Table 2.8 illustrates the relationship between the various standards and processes.)

"ISO 15489 and MoReq2

ISO 15489 and MoReq2 both cover the entirety of the processes affecting electronic records. Accordingly, they are shown as encircling all the processes.

"XML

XML is shown as being relevant to almost all processes – all except store and destroy. Its relevance varies greatly according to the environment. In principle however, it can influence the format of record creation then the way in which the metadata is stored and expressed at capture and during later use; it is an important standard facilitating the interpretation of metadata and content in long term preservation; it can be used to provide a common schema for transfers between systems; it can be used to describe access and schemas and disposition authorities.

"Metadata

Metadata standards are relevant to the processes of capture, use, preserve, transfer and manage. These include ISO 23081 (which covers all aspects of records management metadata), Dublin Core (which specifies a standard set of metadata for discovery), ISO 639 (controlled vocabulary for language codes), ISAD and ISAAR (approaches to the use of metadata for record keeping and archival description) and ISOs 2788 and 5984 (Thesaurus standards).

"Create

The major standards consideration in the process of records creation is the format of the record. Many format standards exist, including RFCs 2821/2822 (for e-mail), ISO 216, TIFF and JPEG (for scanned images), and PDF/A.

"Capture

Metadata standards of all kinds apply strongly to the capture process. Some of the format standards affecting capture are also relevant from the point of view of extracting metadata values automatically. Standards affecting legal issues also apply to capture, namely ISO 15801 and ISO 12654.

"Use

The standard governing GUIDs (Globally Unique IDs), X.667, affects the way electronic records are used, as do standards relating to legal issues, ISO 15801 and ISO 12654.

“Preserve

The key standard for digital preservation is OAIS; this provides a framework for the design and management of preservation activities. ISO 18492 also provides general guidance. Most preservation work relies greatly on the use of metadata standards; and a key standard is PDF/A, which describes a preservation format. Standards for electronic signatures, X.509 and XKMS also have a bearing on preservation issues.

“Transfer

The use of metadata standards is essential to transfers between organisations or between systems.

“Manage

Metadata standards can support the processes of managing access and retention. Also relevant are the legal standards, ISO 15801 and 12654.

“Store

ISO 12142 addresses a small aspect of storage, related to storage on optical discs.

“Destroy

ISO 12037 addresses a small aspect of destruction, namely expungement; this is only relevant is some environments. (MoReq2, 2008:198-200).

The relationship between the standards and processes is shown in Table 2.8 in a tabular form. The table from MoReq2 shows the processes in columns, and the standards in rows. Where a tick (✓) is shown at the intersection of a row and a column it indicates that corresponding standard is related to the corresponding the process.

2.6.10 Conclusion

The different processes related to DMS from the various standards and guidelines used worldwide can be used to ensure the required control and access to information is available through the various stages of the project life cycle. DMS in practice provides systematic control of all documents and records, from their creation, through the different processes, distribution, maintenance and use, to their ultimate disposition.

Table 2.8: Relationship between Standards and Processes

Standard		Create	Capture	Use	Preserve	Transfer	Manage	Store	Destroy
ISAAR(CPF)	International Standard Archival Authority Record for Corporate Bodies, Persons, and Families (International Council on Archives)		√	√	√	√	√		
IETF RFC 2821	Simple Mail Transfer Protocol.	√	√						
IETF RFC 2822	Internet Message Format.	√	√						
ISO 216	Writing paper and certain classes of printed matter – Trimmed sizes – A and B series.	√	√						
ISO 639	Codes for the representation of names of languages.		√	√	√	√	√		
ISO 2788	Guidelines for the establishment and development of monolingual thesauri.		√	√	√	√	√		
ISO 5964	Guidelines for the establishment and development of multilingual thesauri.		√	√	√	√	√		
ISO 8601	Representation of dates and times.		√	√	√	√	√		
ISO 9834-8	Generation and registration of Universally Unique Identifiers (UUIDs) and their use as ASN.1 Object Identifier components (see also ITU X.667)			√			√		
ISO 12033	Guidance for selection of document image compression methods		√						
ISO 12037	Recommendations for the expungement of information recorded on write-once optical media								√

Standard		Create	Capture	Use	Preserve	Transfer	Manage	Store	Destroy
ISO 12142	Media error monitoring and reporting techniques for verification of stored data on optical digital data disks.							√	
ISO 12654	Recommendations for the management of electronic recording systems for the recording of documents that may be required as evidence, on WORM optical disk.		√	√			√		
ISO 14721	Open archival information system – Reference model (OAIS)				√				
ISO 15444	JPEG 2000 image coding system: Core coding system.	√	√						
ISO 15489	Records Management.	√	√	√	√	√	√	√	√
ISO 15801	Information stored electronically – recommendations for trustworthiness and reliability.		√	√			√		
ISO 15836	The Dublin Core metadata element set.		√	√	√	√	√		
ISO 18492	Long-term preservation of electronic document based information				√				
ISO 19005-1	Electronic document file format for long-term preservation	√	√		√				
ISO 23081	Metadata for records		√	√	√	√	√		
ITU X.667	Generation and registration of Universally Unique Identifiers (UUIDs) and their use as ASN.1 object identifier components.			√			√		
MoReq2	Update and extension of the Model Requirements for the management of electronic records	√	√	√	√	√	√	√	√

(MoReq2, 2008:200-202)

2.7 Benefits of a Quality Document Management System

2.7.1 Introduction

An effective DMS is required to enable efficient capture, distribution and control over information, files during the life cycle of a project. Owner companies can realise many benefits that noticeably improve the efficiency of executing projects. Every owner company must address the project objectives that add value to the bottom line of the company. The management of documents and records facilitates effective project performance throughout the project's life cycle. This section explores some of the benefits which are derived from the important drivers of any capital project and include:

- saving time.
- saving money and thus also improving the generation of revenue.
- increasing project efficiency and productivity.
- improving communication and collaboration.

2.7.2 Save Time

This section will summarise some of the focus areas of a research done by Laserfiche Institute to help identify the benefits of a quality DMS.

Saving time is by far the most common benefit in all DMS literature. According to a PriceWaterHouseCoopers study the average worker spends 40% of their time managing non-essential documents. The Laserfiche Document Overview further quote "**estimates that employees spend 20% of their day looking for information in hard copy documents and that, 50% of the time, they can't find what they need".** (Laserfiche, 2007:5.)

Laserfiche (2007:5) highlights the fact that searching for information is a time wasting activity and that company time can be better spent on meeting customer requirements. An increase in productivity can be achieved with a digital solution. The implementation of a DMS minimises time spent handling paper and allows more time for serving clients. Laserfiche furthermore states that a DMS can help you save time by:

- "Answering information requests immediately, eliminating call-backs and phone tag.
- Responding quickly to auditors' requests for information.
- Immediately locating documents and highlighting essential information.
- Eliminating lost documents that must be recreated and re-filed.

- Cutting time spent copying and distributing documents to staff, branch offices and outside contacts.
- Speeding document-handling workflow by enabling automation." (Laserfiche, 2007:5.)

2.7.3 Increase Profitability

The Laserfiche research further confirms that while implementing a document management system can result in upfront costs, it does lead to long-term savings. The research pinpoints the outcome of other studies that conclude that "**the return on investment (ROI) of document management at less than one year, with a five-year ROI of 404%.** Half of the organizations studied had payback within six months. In fact, a quality document management solution can deliver a rapid return on investment without overtaxing IT resources." (Laserfiche, 2007:7).

The Laserfiche research (2007:7) includes estimates from other companies indicating that "Digital document management increases profitability by reducing costs and by increasing revenue. EDI Group Ltd., estimates that implementing a document management system results in a cost savings of $1-5 per document, while Gartner, Inc., estimates that **a document management system can reduce overall document-related costs by 40%.** There are the benefits of reduced overhead, lower costs for both on-site and off-site storage, reduced costs of regulatory compliance and, often, the elimination of staff positions or reassignment of staff to more strategic positions." (Laserfiche, 2007:7.)

"Because a document management system helps you better utilize your time, you generate more revenue. You spend more time meeting with clients and closing deals, offer the value-add of a quicker response time to customer queries and provide quality customer service which ultimately leads to more referrals." (Laserfiche, 2007:7.)

Laserfiche provides methods to cut costs and increase revenue by:

- "Lowering paper-handling costs.
- Cutting the filing, duplication and retrieval costs of off-site storage.
- Reducing organizational downtime in the case of a natural disaster.
- Simplifying business continuity planning.
- Using space currently needed for paper storage for more productive revenue-generating activities.

"Overall lower costs and increased revenue result in enhanced profitability and greater business value. The cost of implementing a document management solution is ultimately an

investment in your future organizational success." (Laserfiche, 2007:7.)

2.7.4 Increase Productivity and Efficiency

Laserfich (2007:9) advises to "put the right tools – and the right information – in the hands of the right people. From an intelligent document search that helps customer service answer questions more quickly to workflow automation that maintains the pace of business processes and alerts managers to employee action and inaction, a document management system can help your organization increase productivity and efficiency.

"Reduce misfiling, document retrieval time and photocopying costs with a single system that manages paper and electronic documents, physical records, multimedia files and e-mail. Using one platform to manage all your organizational information allows you to apply organizational records policies and procedures consistently, regardless of document format." (Laserfiche, 2007:9.)

Laserfiche (2007:9) estimates a "**20% time savings** based on filing and retrieval efficiencies, eliminating misfiling and workflow efficiencies. They further claim that increased efficiency, as well as greater staff productivity can save up to 6 000 hours annually, or **2,4 full-time staff positions.**"

Laserfiche identified how document management can help organisations to increase productivity and efficiency with:

- "Intelligent search methods that support searching with whatever criteria you have available.
- Streamlined document distribution and improved accountability with automated workflow routing and notification.
- Reduced labor and clerical mistakes with automated OCR and indexing.
- Management of your entire organizational archives from your desktop computer.
- Fast document distribution with Web and CD publishing.

"Digital document management provides your staff with immediate access to the information that allows them to make better decisions about issues that impact your organization's bottom line. With digital document management, your employees will be able to support their work processes, work more efficiently, collaborate more effectively and make better informed choices - dramatically increasing productivity while accelerating the pace of business and your clients satisfied." (Laserfiche, 2007:9.)

2.7.5 Increase Communication and Collaboration

One of the expected developments due to the technology age is that more and more organisations adopt DMS and replace filing cabinets and microfilm with digitised images. Laserfiche (2007:11) indicated that in spite of this, organisations still face the problem of getting information to users who do not have access to the system.

"Document management systems make it easy to share documents electronically with colleagues and clients over a network, whether that is Network Attached Storage (NAS) or a Storage Area Network system (SAN), on CD or DVD, or securely over the Web. Sharing paper documents usually entails photocopying, and sharing microfilm requires conversion to paper, but with digital documents, you can view the same documents simultaneously." (Laserfiche, 2007:11.)

Laserfiche (2007:11) prescribes what features a quality document management solution should offer:

- "Create CDs with built-in viewers and search capabilities, so documents can be viewed and searched on any PC, regardless of whether document management software is installed.
- Allow you to distribute CDs royalty-free.
- Present a consistent face to customers and the public with a customizable interface that matches your Website.
- Balance access and security, assisting you in retaining strict control over which documents are available to staff and the general public.
- Work with documents on a wide variety of Internet browsers, operating systems and hardware."

2.7.6 Enable Automation

Allowing technology to work for people in organisations is crucial when time management is considered. "Your staff searches for information, acts on it, move it and archives it every day. This process, with it manual searching, faxing, photocopying and distribution, is costly and time-consuming. The inefficiencies of this process divert your staff from the crucial business of making productive use of the information.

Document management solutions with an automated workflow component deliver more efficient work processes. **A workflow solution reduces costly paper handling with intelligent document routing and saves time and money by reducing photocopying, hand**

delivery and repetitive dragging and dropping. A quality workflow solution doesn't treat your staff as stations along an assembly line, but as responsible workers whose time is better spent on more productive tasks than making copies" (Laserfiche, 2007:12.)

A typical workflow solution can enable organisations to:

- "Design rules-based routing systems to streamline document-handling procedures.
- Copy and move documents using routing services and your computer network.
- Automatically notify staff and supervisors when certain events take place.
- Monitor user activity, guaranteeing efficiency and project completion while enabling enhanced staff efficiency reporting.
- Workflow solutions give you the power to recapture lost hours, reduce your overhead expenses and increase profitability, all while improving the level of service you provide to your customers." (Laserfiche, 2007:12.)

2.7.7 Conclusion

Document and RM govern the practice of all the team members in a project who create or use documents related to the project. These documents may contain information that is valuable to the company and can thus be seen as a business asset. The documents that are required as records become a source of information about the project and are evidence of the decisions taken during the life cycle of the project that can support subsequent activities and business decisions. The benefits of an effective system provide consistency and continuity in projects and in the same time protect the interest of the company.

2.8 Key Success Factors in Document Management

2.8.1 Introduction

DM is a core support function in the execution of projects throughout the life cycle of these projects. The DMS involves managing records in all formats from their creation to their ultimate disposal. Globalisation and the fact that project team members and stakeholders who are not in one location are putting pressure on project managers and DCs to manage increasingly decentralised project document systems. As a result, many owner companies find it difficult to locate documentation and information when required. If not effectively managed, the end result is a disjointed DMS which can lead to total chaos. In order to support an effective DMS, the benefits of key success factors should be identified to guide

project teams and quantify the performance of the systems implemented against the benefits discussed earlier.

This section primarily examines the training module in ERM compiled by the International Records Management Trust (IRMT) and the Project Management Body of Knowledge (PMBOK) compiled by the South African Project Management Institute (PMI) to identify key success factors in DM/RM and consists of the following:

- Develop and implement a DMS policy.
- Communication Plan for adequate project integration.
- Financial Benefits.
- Stakeholder Benefits.
- Effective Administrative Closure.

2.8.2 Develop and Implement a Document Management System Policy

One of the key success factors for a successful DM system is to establish the necessary DMS infrastructure which should include the development and implementation of policies for the management of records and information, both electronic and on paper, throughout the life cycle of a project. IRMT (2009b:5) defines a records policy as "a written, formally approved statement that explains why an organisation should care for its records, whether in electronic or paper form, in an effective and appropriate fashion, so that the records remain authentic and reliable evidence for as long as they need to be kept."

A policy should not only be a written authoritative declaration to give direction on paper, but should be implemented to be of value. The required systems should be developed to ensure the implementation, as prescribed by the policy, is possible. Actions required to implement the system can include improvement of electronic and paper RM projects, acquisition of electronic DMS software and emphasising the importance of sound DMS practices to all stakeholders involved in the execution of projects. IRMT (2009b:6) emphasised the importance that the policy should be approved of and supported by the highest levels of the organisation and that key stakeholders should have the opportunity to contribute to the development of any records-related policy and that they should be willing to serve as champions once the policy has been adopted. "If senior managers are not supportive of the policy from the beginning, then it will likely be ignored." (IRMT 2009b: 6.)

It is very important to ensure the policy fits within the overall framework of how projects are executed in a company. It should also be consistent with the goals of the organisation. For example, the policy should not state that only original or faxed documents will serve as

official project documentation if the organisation has already decided that electronic mail will be its primary means of communication. In this case, the policy must adequately address the importance of managing the resulting electronic communications effectively as records in digital form.

The purpose of the policy is best defined by IRMT (2009b) which says that the policy:

- "provides clear guidance on what records are and why they need to be managed effectively.
- explains how good records management will serve the needs of the organisation.
- sets out general principles and policies relevant to the organisation on specific aspects of records management, which then form the basis for the implementation of new records management programmes.
- identifies statutory or other legal foundations for organisational record keeping." (IRMT, 2009b: 5.)

IRMT (2009b:7) also summarises the following characteristics of a strong and effective DMS policy:

- "It will be relevant to the current needs of the organisation, particularly by ensuring records management programmes are closely linked to the organisation's overall purpose, goals and objectives.
- It will be relevant to all stakeholders within or associated with the organisation.
- It will conform to relevant legislation, regulations and standards, including government requirements for access and privacy, records legislation or international and national records and information standards.
- It will provide a basis for organisational accountability, specifically by clarifying how the organisation will monitor compliance with record-keeping requirements in order to remain transparent and effective in all its work.
- It will identify specific responsibilities for the management of records and information, and in particular it will identify and define the role of the records manager and the roles and responsibilities of other individuals involved with the creation and management of records." (IRMT, 2009b: 7.)

The IRMT document included an examination of the purpose and scope of DMS policies and explains the elements that should be included in a strong and sustainable policy. The following sample policy statement, Fig 2.14 of IRMT (2009b:8-9) is a very useful example.

Purpose

This policy provides for

- the requirements that must be met for the records of *[the organisation]* to be considered as authentic and reliable records of the activity of the organisation
- the requirements for systems, technologies and processes that create, capture, use and preserve the organisation's records
- the requirements for quality and reliability that must be maintained in the record-keeping process in order to ensure records are retained as valuable information and knowledge resources for the organisation
- the regular review of the policy and ongoing oversight of the quality of implementation.

Explain the key purpose(s) for the policy in as much detail as needed.

Scope

This policy covers records in all formats, created in the course of *[the organisation's]* business, including records in electronic, video, audio or other formats.

Outline the scope, including the range of records covered, clearly. The definitions section below should include clear definitions of all important concepts.

Policy Statement

Information is a corporate asset and the records of *[the organisation]* are important sources of administrative, fiscal, legal, evidential and historical information. They are vital to the organisation in its current and future operations, for the purposes of accountability and for an awareness and understanding of its history. They are the corporate memory of the organisation.

Systematic records management is fundamental to organisational efficiency. It ensures that the right information is

- captured, stored, retrieved and destroyed or preserved according to need
- fully exploited to meet current and future needs, and to support change
- accessible to those who need to make use of it.

The policy statement should be a clear articulation of the importance of systematic records management.

Systematic records management also ensures that the appropriate technical, organisational and human resource elements exist to achieve the desired results.

[The organisation] will create, use, manage and destroy or preserve its records in accordance with all statutory requirements, in order to maintain an authentic and reliable record of its actions, transactions and decisions.

All staff members of *[the organisation]* who create, use, manage or dispose of records have a duty to protect those records and to ensure that any information added to the organisation's official records is accurate, complete and necessary. All staff involved in managing records will receive the necessary training.

Associated policies

This records management policy is a specific part of the organisation's overall corporate programme and relates to other policies, such as

- best practice principles for organisational management
- the organisation's e-government strategy
- data protection legislation
- access to information legislation
- archives management policies.
- information security
- the management and implementation of technology.

If possible, name specific policies that relate to this records management policy so that the reader can see the full scope of corporate policy as it relates to information and records management.

Accountability

The Chief Executive has a duty to ensure that [the organisation] complies with the requirements of legislation affecting management of the records and with supporting regulations and codes.

The Records Manager will work closely with Heads of Departments to ensure consistency in the management of records and ensure that advice and guidance on good records management practice is provided.

Managerial and professional staff members are responsible for ensuring that records and information systems in their areas conform to this policy and to the requirements of legislation. All members of staff are responsible for documenting their actions and decisions in the records and for maintaining the records in accordance with good records management practice.

Identify all key players responsible for ensuring the successful implementation of the policy and outline their duties clearly.

Monitoring Compliance

[*The organisation*] will follow this policy, along with all relevant procedures and guidance used for operational activities whenever creating, capturing, using, or preserving records. Interpretation of the policy will be monitored by senior management. Regular inspections will be conducted by quality services staff and internal auditors to assess how the policy is being put into practice. These inspections will seek to

- identify areas of good practice to use throughout the organisation
- highlight non-conformance to procedures
- recommend performance improvements to ensure compliance is achieved.

Explain any mechanisms for monitoring or performance measurement.

Definitions

Archives: Records, usually but not necessarily non-current records, of enduring value selected for permanent preservation. Archives will normally be preserved in an archival repository.

Records: Documents regardless of form or medium created, received, maintained and used by an organisation (public or private) or an individual in pursuance of legal obligations or in the transaction of business, of which it forms a part or provides evidence.

Records management: That area of general administrative management concerned with achieving economy and efficiency in the creation, maintenance, use and disposal of the records of an organisation throughout their entire life cycle and in making the information they contain available in support of the business of that organisation.

Add formal and accepted definitions and be sure they are consistently used in all policy and procedures documents.

References

- National Access to Information and Protection of Privacy Act
- National Copyright Law
- State Financial Information and Records Act
- *[The organisation's]* Access to Information and Protection of Privacy Policy
- *[The organisation's]* Electronic Mail Policy
- *[The organisation's]* Archives Policy

Identify any other associated materials or references that should be considered by users or when reviewing the policy.

Associated materials

- *[The organisation's]* Records Retention Schedule
- *[The organisation's]* Records Management Procedures Guide
- *[The organisation's]* Procedures for Records Transfer or Destruction

Review date

- To be reviewed by senior management on or before July 12, 2009.

Identify a specific date for review of the policy; this date should be approved by senior management. As part of the review, all specific references to legislation, policies, or other documents should be updated to reflect the latest iteration of all materials.

Figure 2.14: Sample Records Management Policy

(IRMT, 2009b:8-9)

2.8.3 Communication for Adequate Project Integration

Project management with its support functions, of which DM is fundamental, is an integrated undertaking and the successful realisation of this integration is another key success factor in a DMS. One of the benefits an effective DMS can provide, as mentioned in the previous section, is better communication and collaboration between stakeholders. The interactions may be straightforward and well-understood, or they may be confusing and subsequently negatively affect the outcome of project objectives. To help in understanding the integrative requirements of a DMS for project management, and to emphasise the importance of integrated, it is important to first review project management in terms of its component processes and their interactions. These interactions require a proper communications plan to ensure the execution of projects is successful.

2.8.3.1 Project Processes

The PMBOK (PMI, 1996:28) illustrates the links between five project management processes that distinguish the project life cycle. These project management processes are then also divided into five groups of one or more processes each. These groups are linked by the results they produce whereby the result or outcome of one becomes an input to another and consists of:

- "Initiating processes — recognizing that a project or phase should begin and committing to do so.
- Planning processes — devising and maintaining a workable scheme to accomplish the business need that the project was undertaken to address.
- Executing processes — coordinating people and other resources to carry out the plan.
- Controlling processes — ensuring that project objectives are met by monitoring and measuring progress and taking corrective action when necessary.
- Closing processes — formalizing acceptance of the project or phase and bringing it to an orderly end." (PMI, 1996:28.)

Among the central process groups, the links are iterated — the planning processes provide the executing processes with a documented project plan early on, and then provide documented updates to the plan as the project progresses. These connections are illustrated in Figure 2.15.

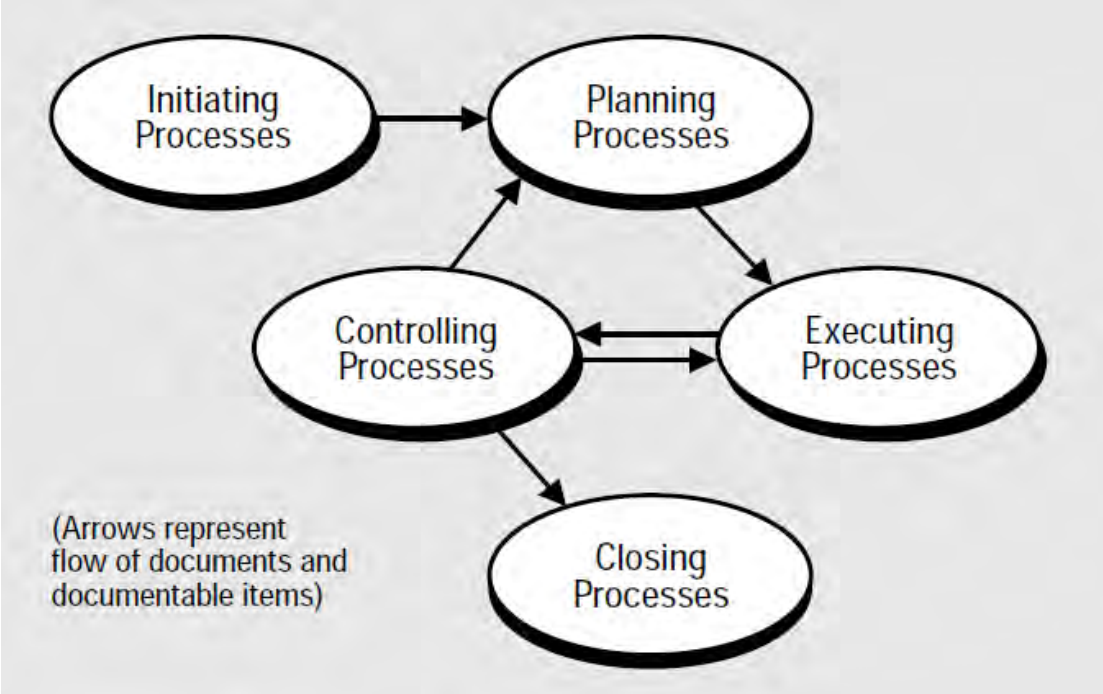

Figure 2.15: Links among Process Groups in a Phase

(PMI, 1996:28)

It was already mentioned that within each process group, the individual processes are linked by their inputs and outputs. The inputs consist of documents or communications that will be acted upon and outputs documents and communications that are a result of the process. The different phases of a typical project are described in Section 2.3. These project management process groups are not discrete, one-time events and the PMI (PMI, 1996:29) illustrates how they are overlapping activities which occur at varying levels of intensity throughout each phase of the project. Figure 2.16 illustrates how the process groups typically overlap and vary within a phase.

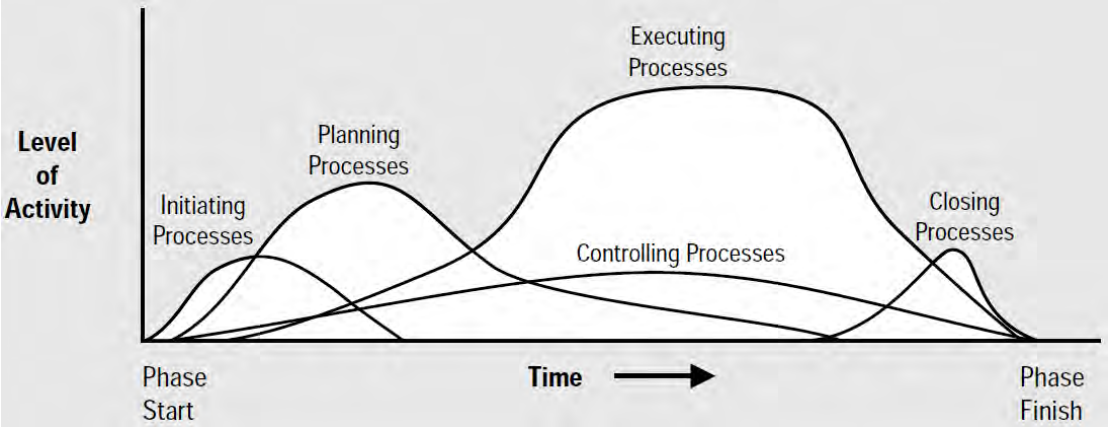

Figure 2.16: Overlap of Process Groups in a Phase

(PMI, 1996:29)

Finally, the process group interactions also cross phases such that closing one phase provides an input to initiating the next. For example, closing a design phase requires customer acceptance of the design document. Simultaneously, the design document defines the product description for the ensuing implementation phase. This interaction is illustrated in the PMBOK (PMI, 1996, 29) as shown in Figure 2.17.

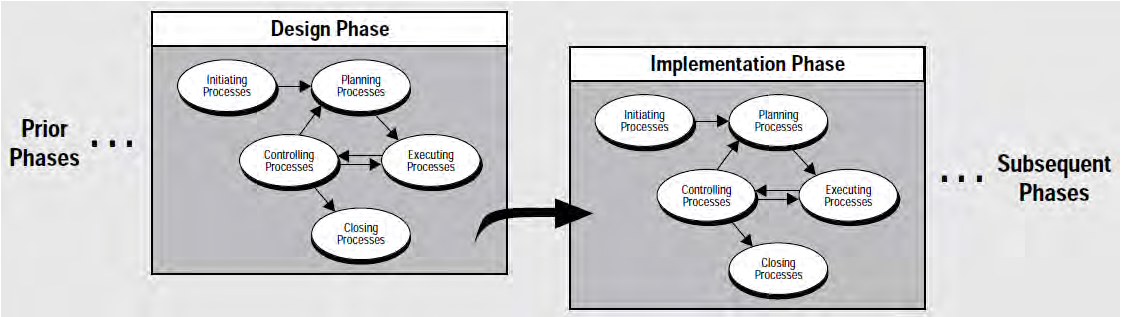

Figure 2.17: Interaction between Phases

(PMI, 1996:29)

2.8.3.2 Communication Plan

The PMBOK conveys the importance of repeating the initiation processes at the start of each phase to keep the project focused on the project objective. It should also help to ensure that a project is stopped if the business objective will not be met; the markets requirement changes or if the project is unlikely to satisfy that need. Although Figure 2.17 is illustrated with separate phases and separate processes with well defined interfaces, project management in practice provides evidence that the overlaps are not so straightforward. These processes interact with each other and with the processes in all the other business areas of an owner company and with all the different stakeholders of a project not detailed here. Each process will have participation from at least one individual or groups of individuals based on the needs of the project. A proper communications plan is therefore required to ensure timely and appropriate generation, collection, distribution, storage, and ultimate close out of project information during the different phases.

This communication plan should provide the essential links between people, data, and other information that are necessary for the successful execution of a project. The PMBOK describes this captivatingly by stating “everyone involved in the project must be prepared to send and receive communications in the project ‘language’ and must understand how the communications they are involved in as individuals affect the project as a whole.” (PMI, 1996:103.)

A proper communications plan should include the information required and address the communications needs of all the stakeholders of a project. To determine the above, answers should be acquired for:

- who needs what information,
- when will they need it, and
- how will it be given to them.

"While all projects share the need to communicate project information, the informational needs and the methods of distribution vary widely. Identifying the informational needs of the stakeholders and determining a suitable means of meeting those needs is an important factor for project success. On most projects, the majority of communications planning is done as part of the earliest project phases. However, the results of this process should be reviewed regularly throughout the project and revised as needed to ensure continued applicability." (PMI, 1996:105.)

The key success factor is therefore to fully align the project documentation plan and the owner company's DMS in support of the needs of a project and its stakeholders throughout the life cycle. PMBOK includes the following as essential element of such a DMS:

- "A collection and filing structure which details what methods will be used to gather and store various types of information. Procedures should also cover collecting and disseminating updates and corrections to previously distributed material.

- A distribution structure which details to whom information (status reports, data, schedule, technical documentation, etc.) will flow, and what methods (written reports, meetings, etc.) will be used to distribute various types of information. This structure must be compatible with the responsibilities and reporting relationships described by the project organization chart.

- A description of the information to be distributed, including format, content, level of detail, and conventions/definitions to be used.

- Production schedules showing when each type of communication will be produced.

- Methods for accessing information between scheduled communications.

- A method for updating and refining the communications management plan as the project progresses and develops." (PMI, 1996:106.)

2.8.4 Financial Benefits

All functions within an owner company have a role to play, and support functions more often than not basically add non-monetary benefits to the organisation. In times when cost savings are required to sustain the organisation's profitability, all functions are then confronted by the challenges to demonstrate expected benefits that outweigh the original investment, running costs and the expected risks to continue with the services to other functions. The previous section emphasised the financial benefits on the company bottom line. Contrary to the statement that support functions only add non-monetary benefits, financial benefits of a fit for purpose implemented DMS is therefore a key success factor in the management of documents and is therefore included in this section again.

The IRMT (2009b:20) defines financial benefits in the development of a DMS as those improvements that can be measured in actual economic terms (such as savings in licence fees for superseded computer systems that have been replaced) or that can be calculated as monetary value (such as savings in staff time).

"Indeed, the better use of staff time is often a large part of the financial justification for developing or improving electronic records management programmes. Sometimes, however, the time saved by implementing improved records management processes ends up being diverted to other work, at which point the benefit is not just financial but has a wider benefit to the organisation. It is important also to remember that the introduction of a new electronic records management programme requires a great deal of staff involvement; the savings in time and effort in records care are not necessarily immediate." (IRMT, 2009b:20.)

Cost savings are a very important driver to ensure sustainable support to project management and senior managers should be convinced of the value of DMS as a cost-savings tool. The immediate response from support functions is that they cannot add to the financial bottom line of the organisation and this fallacy is far from the truth. The IRMT included the following examples of financial benefits of effective electronic ERM in their training modules in electronic ERM:

- "Time saved filing information because it is no longer necessary to print out documents, find the correct file, insert the documents in the file and index them.
- Time saved retrieving information because less time required to search for files, to wait for access to files that are being used by somebody else or to photocopy documents from files.
- Time saved redoing work because documents can now be found quickly and easily.

- Space saved because fewer desks, filing cabinets and cupboards are needed or because fewer records need to be kept in intermediate storage (such as through a records storage company).

- Resources saved, because there is less need for computers, software, hardware, filing cabinets, or other equipment or consumables such as paper, file covers, printer cartridges and other stationery items.

- The rate of server-based file storage growth is reduced and the volume of files stored on servers becomes more manageable." (IRMT, 2009b:21.)

There are also non-quantifiable financial benefits when the DMS supports the commercial requirements inherent in the execution of projects. Different contracts have different terms and conditions but there is always a period to reply to communications and also a period for the project manager to accept or reject drawings, specifications and most importantly claims from the contractors. Poor tracking of instructions and decisions can have a detrimental cost impact on projects when dealing with claims and disputes. A longer than required turn-around time can also have a schedule impact and a schedule impact have a direct and indirect impact on the economical viability of a project.

2.8.5 Stakeholder Benefits

One of the paramount success factors of DM is to determine if a DMS is working for the company's employees involved with project execution instead of the employees working for the system. The greatest beneficiaries of an effective DMS are usually the employees who get to use the systems. It is difficult to determine a DMS' benefits to its stakeholders in particular, but issues as simplicity of filing, efficient retrieval of documents or efficiency in responding to requests for information are factors that contribute to a successful system.

A previous section describes how information distribution involves making needed information available to project stakeholders in a timely manner. The management of owner companies wants to see the extent to which the use of an effective DMS may improve actual execution of projects.

The IRMT included the following examples of benefits to stakeholders in a project:

- "Improved access by all appropriate staff to documents in electronic filing systems.

- Effective maintenance and updating of electronic records through web-enabled or distributed and decentralised computer systems.

- Improved ability to share documents with colleagues.

- Increased flexibility when accessing and using records, such as access outside normal hours, enabling staff to respond more effectively and quickly to business requirements.

- Greater usability of records because the computer system allows for searching under several parameters (such as keyword, author, date or type of record).

- Improved security, through the creation of backup copies of vital records and the protection of records in a secure electronic environment.

- Improved accountability through the creation and preservation of records as reliable and authentic evidence.

- Reduced work loads because of improved awareness of and use of information created elsewhere. (Of course, time savings in one area does not mean staff will not be given new tasks in other areas; achieving sustained reductions in work loads cannot be achieved simply through changing software systems.)

- Improved retention of organisational knowledge when staff leave or retire.

- More effective organisational planning, through better management of and access to information." (IRMT, 2009b:22.)

2.8.6 Effective Administrative Closure

At the end of each phase of the project as described earlier and obviously at the end of the project, when the project achieved its objectives or is terminated for other reasons, appropriate closure is required. The saying that "no job is complete until the paperwork is done" epitomises this key success factor and consists of verifying and documenting project results to formalise acceptance of the project by the sponsor, client, or customer. The importance hereof is also included in the PMBOK where the criteria for effective administrative closure of projects is summarised. "It includes collection of project records, ensuring that they reflect final specifications, analysis of project success and effectiveness, and archiving such information for future use. Administrative closure activities should not

be delayed until project completion. Each phase of the project should be properly closed to ensure that important and useful information is not lost." (PMI, 1996:109.)

PMBOK (PMI, 1996:110) goes further to indicate the three important outcomes of effective administrative closure which can be summarised as follows.

- ***Formal acceptance*** After verifying the project results, documentation that the client or sponsor has accepted the product of the project (or phase) should be prepared and distributed. All legal documentation should also be formally accepted and signed off.

- ***Project archives*** A complete set of indexed project records should be prepared for archiving by the appropriate parties. Any project-specific or program-wide historical databases pertinent to the project should be updated. When projects are done under contract or when they involve significant procurement, particular attention must be paid to archiving of financial records.

- ***Lessons learned*** The causes of variances, the reasoning behind the corrective action chosen, and other types of lessons learned should be documented so that they become part of the historical database for both this project and other projects of the performing organisation (PMI, 1996: 46:110).

2.8.7 Conclusion

These key success factors should create the understanding and awareness of the value and importance of an effective DMS in the execution of projects. This understanding and awareness should be evident throughout the owner company and throughout the life cycle of projects. If all stakeholders buy into the DMS and become supporters of the system, the result will be that the system will bring about improved performance by all its users.

It is therefore important that all project team members and stakeholders are aware of the key success factors and know who is responsible and accountable for delivering results for each of these. The IRMT (IRMT, 2009b: 24) included a register that identifies specific potential benefits for electronic ERM and indicates how they will be measured. This can be used as an example and a typical register or framework can be derived to determine how the key DM success factors play a role, how critical they are to the project and owner company, and how the key success will be measured to assess whether the objective is achieved. A sample extract from the IRMT benefits register is shown in Table 2.9 below.

Table 2.9: Sample extract from the IRMT benefits register

No.	Benefit	Description	Critical Level (1-5)	Metric	Expected Outcome	Measurement Baseline	Measurement Interval	Person responsible
1	Information retrieval time	Time spent searching for and retrieving required information from the ERM system	2	Survey users on the average time spent retrieving required information	Decrease	From current paper system From ERM system as soon as implemented	Project end	
2	Reduction in storage space	Reduction of filing of paper on paper files and folders, and space required to store files	2	Track accommodation space used Track accommodation costs Track number of file covers issued	Decrease	From information about use of space, accommodation costs, and number file covers as given at the beginning of the project	Yearly	
3	Improvement in business processes	Current business procedures and improvements in time and quality	3	Conduct a stakeholder survey	Less time on procedural work; better decision making	From status indicated in initial functional analysis	Yearly	

(IRMT, 2009b:24)

2.9 Education and Certification

As information professionals in the new digital age, new librarians and those upgrading their skills must become familiar with information management and demonstrate collaborative capacity with one another and with allied professions, including archive management, information systems and RM, as well as diverse business and public service cultures. Moreover, business knowledge, including change and project management, has become 'table stakes' for all new information professionals. (Noll and Wilkins: 2002).

An Internet search for applicable institutions offering related courses and/or degrees indicated that DM certification can be obtained globally. Many colleges and universities offer degree programmes in library and information sciences which cover records or document management.

In addition, there are professional organisations such as the Records Management Association of Australasia (RMAA) and the Institute of Certified Records Managers which provide a separate, non-degree, professional certification for practitioners, the Certified Records Manager designation or CRM. (Records Management Association of Australasia (RMAA))

Further educational opportunities in the form of a certificate programme are also available from AIIM International. (Association for information and image management (AIIM))

Education and training courses and workshops on scientific and technical records full life cycle management and the Quality Electronic Records Practices Standards (Q-ERPS) are available from the Collaborative Electronic Notebook Systems Association (CENSA).

On the international front, responding to pressure from employers and rapid technological change, Fuji Xerox, State Library of South Australia, State Records of South Australia, the University of South Australia's School of Computer and Information Science and Library have developed postgraduate programmes in Business Information Management and Library and Information Management, comprising a Graduate Certificate, a Graduate Diploma and an MSc. These programmes educate archivists, information systems professionals, library managers and record managers who: are highly knowledgeable and skilled in their core disciplines; regard disciplinary boundaries as permeable; and can integrate cross-disciplinary knowledge into professional practice. (University of South Australia's School of Computer and Information Science and Library).

A recent addition to RM education in the United States is the MARA - Master of Archives and

Records Management degree programme, offered by the San Jose State University School of Library and Information Science. (University of San Jose, Master of Archives and Records Management degree).

- In South Africa, the following institutions offer Degrees and Diplomas in Library and Information Science:

  - ***University of Cape Town - (UCT)*** The Department of Information and Library Studies provides research, consultancy and a programme leading to academic and professional qualifications in Library and Information Science. (University of Cape Town)University of South Africa - The Bachelor of Information Science degree has been conflated from a four year to a three-year degree from 2007. (University of South Africa).
  - ***University of Kwazulu Natal- Information Studies was established in 1973. It*** offers the full range of study programmes from an undergraduate course in Information Literacy to PhD. Information Studies enjoy the support of an impressive number of organisations in selecting and training students. Its graduates find employment as qualified professionals in libraries and media centres and as records managers. Note that Information Studies is available only on the Pietermaritzburg campus. (University of KwaZulu Natal).
  - ***University of Zululand*** - B.A. Information Science BA (IS) will take duration of three years and at least 24 or 48 modules/384 credits and is aimed at jobs in the broad information field both within public and corporate organisations. The purpose of the programme is to offer the student knowledge, skills and attitudes for information and knowledge management in broad information fields in public and corporate organisations. Work experience focuses on three areas, choosing from: Software, Hardware, Networking, Internet, Practical Information Services Environment, and Management. Students will select their areas of choice in consultation with the Department. (University of Zululand).
  - ***Rutgers University*** - The Department of Library and Information Science offers a 39-credit undergraduate major in Information Technology and Informatics. The ITI major places emphasis on the evaluation, implementation, use, and management of information technologies for a wide range of organisations and corporations, as well as the social and organisational aspects of information and communication technologies. The major unites theories drawn from the humanities and social sciences with practical computer-based competencies. (Rutgers University).

There are many professional associations where students, librarians and information management practitioners can join to support a professional career.

- ACRL: Association of College and Research Libraries
- ALA: American Library Association
- ALIA: Australian Library and Information Association
- ASAIB: The Association of Southern African Indexers and Bibliographers
- CILIP(formerly LA): Chartered Institute of Library and Information Professionals
- EBLIDA: European Bureau of Library, Information and Documentation Associations
- LIASA: The Library and Information Association of South Africa
- OSALL: Organisation of South African Law Libraries:
- Private Libaries Associations:
    - SAOUG: Southern African Online User Group
    - SLIS: Special Libraries & Information Services
    - WSIS: World Summit on the Information Services

By obtaining a Bachelor of Information Science qualification, students may choose from the following possible career opportunities:

- Archivist
- Bibliographer
- Classifier
- Corporate librarian
- Data content developer
- Data miner
- Digital archivist
- Indexer
- Information consultant
- Internet researcher
- Knowledge broker
- Knowledge manager
- DM Manager
- DM Specialist
- Lecturer
- Librarian
- Management consultant
- Research librarian
- Subject librarian

Timely and equitable access to authoritative and pluralist sources of culture and knowledge is a foundation of the knowledge societies envisaged by the Organisation for Economic Co-Operation and Development for the 21ST century (Drotner, 2005:20-23). Corporate, medical and university libraries are acknowledge innovation engines for the knowledge economies

which underpin knowledged societies (Hedstrom & King, 2006, 113-134) and Partridge (2007) recognised the continuing demand for document, record and knowledge professionals to manage accurate, legal and ecumenical knowledge, as well as being the developers of equitable digital literacy within society.

2.10 Conclusion

Document and RM through meticulous and strict document control practices, form the backbone of organisational authentic evidence compliance. An appropriate DMS or RMS should be selected and designed according to an organisation's own needs and requirements. Various standards and guidelines are available and a most suited solution should be selected by the owner company to ensure the execution of capital projects supports the business objective.

CHAPTER 3 EMPIRICAL INVESTIGATION

3.1 Introduction

Chapter two reviewed many DM and RM related topics, practices and standards during the life cycle of a document that may be used during the execution of projects in an owner company. This chapter focuses on the research design to support the research objectives of providing Sasol Technology with recommendations for an improved DMS.

3.2 Research Strategy

Cooper and Schindler (1998:151) wrote: "A research design is the strategy for a study and the plan by which the strategy is to be carried out. It specifies the methods and procedures for the collection, measurement, and analysis of data". The design process for this research study is summarised in Figure 3.1 and elaborated on in this section. Kerlinger (1986:279) confirms the above statement with the following: "A research design expresses both the structure of the research problem and the plan of investigation used to obtain empirical evidence on relations of the problem".

Figure 3.1: Management Research Question Hierarchy

(Cooper & Schindler, 1998:58)

Cooper and Schindler (1998:134-152) explain the difference between an ***Exploratory*** and a ***Descriptive*** research approach. "The objective of exploration is the development of a hypothesis, not testing". "Exploration is particularly useful when researchers lack a clear idea of the problems they will meet during the study. Through exploration researchers develop concepts more clearly, establish priorities, develop operational definitions and improve the final research design." On the contrary, "the objective of a descriptive study is to learn the *who, what, when, where* and *how* of a topic*."* Descriptive research is thus a formalised study to be used when research questions need to be answered.

"***Qualitative*** research is all about exploring issues, understanding phenomena and answering questions. It "seeks out the 'why', not the 'how' of its topic through the analysis of unstructured information – things like interview transcripts, e-mails, notes, feedback forms, photos and videos. "It's used to inform business decisions, policy formation, communication and research. Focus groups, in-depth interviews, content analysis and semiotics are among the many formal approaches that are used, but qualitative research also involves the analysis of any unstructured material, including customer feedback forms, reports or media clips." (QSR International, 2007.)

The research design method that was chosen to authenticate this research question is an ***Exploratory Qualitative*** approach, combined with a ***Descriptive*** approach.

For the exploratory research, published and available existing data are gathered and used as guidelines. Due to budget and time constraints a cross sectional approach is followed where face to face interviews with discipline specialists are also conducted. An open ended question approach is followed when interviewing the selected group. Interviews are also conducted with a selected target population (DM and Information Management (IM) Specialists) and all relevant key project role players (Commercial and Legal, Planning, Costing, Estimating, Engineering Management, Plomic and Engineering Data centre (EDC) (as the Business Unit)), with the aim to augment current DM background and to consolidate findings of how to optimise practices and procedures.

For the descriptive research, e-mail administrated questionnaires are developed and distributed to relevant project team members within Sasol Technology to assess the current system and to determine additional requirements for an enhanced DMS. The target population is a wider audience, consisting of project engineers and project managers, as well as the DCs. This is done to enable the formation of new concepts/ideas and ultimately optimise on the current DM practices.

3.2.1 Primary Data Collection

Information and knowledge gained from the literature survey and the secondary data collection (explained later) are used to develop a framework to gain more data and feedback from the Sasol target population by means of questionnaires and by interviewing selected Specialists. Figure 3.2 represents the research strategy followed to determine the research questions in terms of the Management Research Question Hierarchy illustrated earlier.

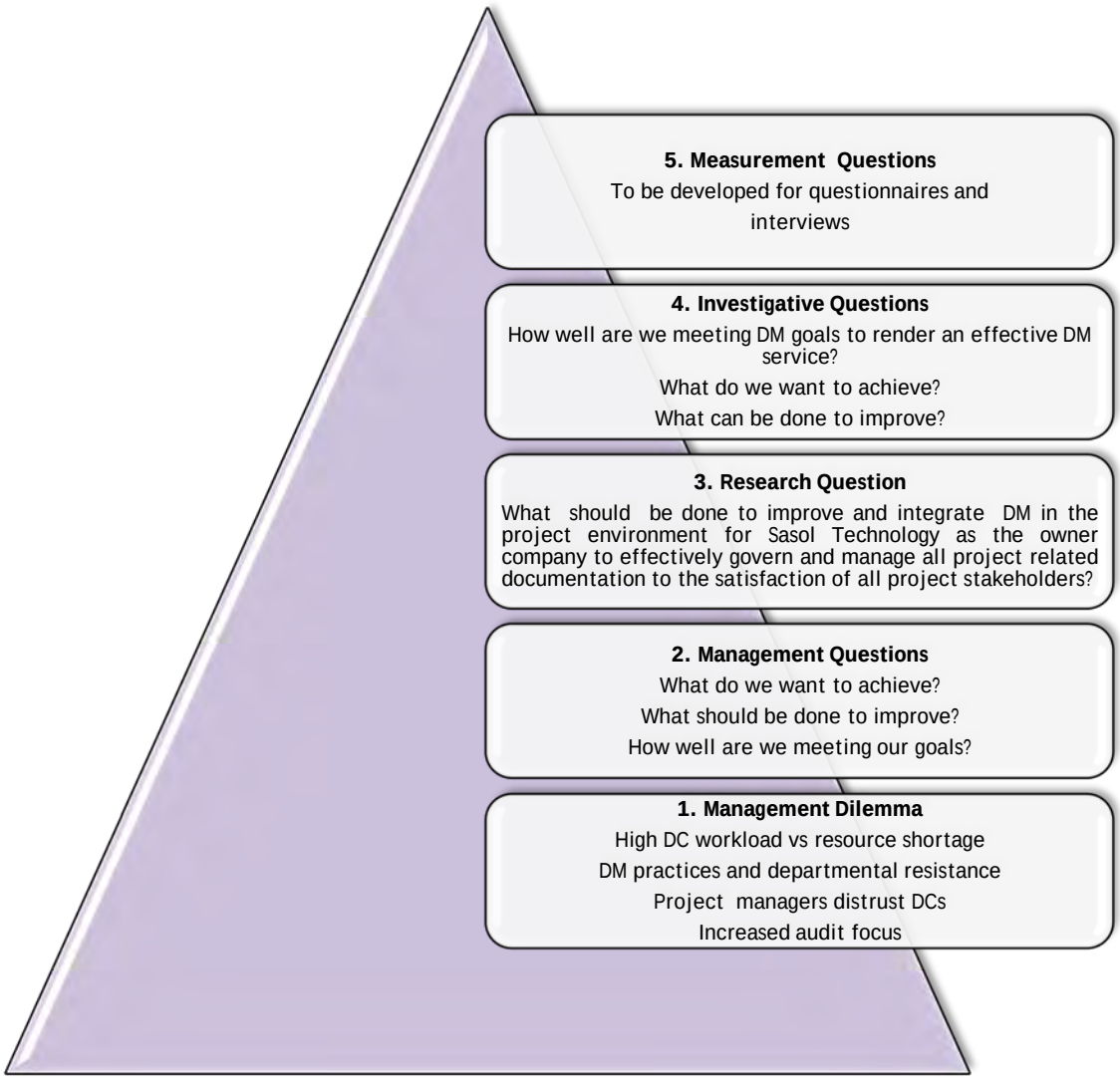

Figure 3.2: Applied Research Question Hierarchy Design for this research.

3.2.2 Refine Research Questions (how to investigate the problem)

Chapter 1 refers to the research question for this study being "what should be done to improve and integrate DM in the project environment for Sasol Technology as the owner company to effectively govern and manage all project related documentation to the satisfaction of all project stakeholders?

With the knowledge gained from the literature survey and the secondary data collection, the research question can be dissected to derive the following proper and appropriate investigative questions:

1. How well are we meeting DM goals to render an effective DM service?
2. What do we want to achieve?
3. What can be done to improve?

The above questions are used to compile the measurement questions. The measurement questions are used for the e-mail questionnaires and for the interviews. For this research, a communication approach to collect the primary data is followed. Interviews will be held, telephone interviews will be conducted as well as the surveying of a specific target group. The responses will be recorded for analysis.

Cooper and Schindler (1998:287) wrote "Questioning is more efficient and economical than observation. A few well chosen questions can yield information that would take much more time and effort to gather by observation. A survey that uses the telephone, mail or the Internet as the medium of communication can expand geographic coverage at a fraction of the cost and time required by observation."

3.2.2.1 Electronic Mail questions

E-mail questions were self constructed and done in accordance with the advice received from the North West University Statistical Consultation Service with regard to the construction validity of the instrument. The e-mail questions that will be used to validate findings and to make recommendations are categorised according to the following sections:

- System
- Process
- Governance
- Organisation

Question 1: How well are we meeting Document Management goals to render an effective Project Document Management service?

1.1 To what degree do you consider the project Livelink filing system user friendly?

1.2 To what degree do your DCs provide you with Livelink assistance?

1.3 Please rate the execution of the following basic DM practices:

- verification that documentation and /or communication are issued or received.
- registering of project documentation on Livelink.
- preparing Livelink reports on request.
- tracking of documents.
- scanning.
- copying.
- filing.
- squad checking process.
- SPIR List coordination.
- meeting document turn-around times.
- proactive document harvesting.

1.4 To what extent do you rate the importance of the following statements?

- It is compulsory for DCs to attend project kick-off meetings.
- DM service adds value to the overall project objective throughout the different phases.
- The importance of project team members to have access to view the signed project contractual documents (without the rates).

1.5 Do you know which documents should be kept as records?

1.6 Are you aware of any of the following in your environment?

- Project document retention schedules.
- Project document disposal policies.
- Storage/archival policies and facilities.
- Metadata requirements. (data describing context, content and structure of records and their management through time.)

1.7 Has your DC explained her roles and responsibilities to you?

1.8 Do you still keep project documentation on your PC's hard drive?

1.9 Do you receive a link from Knowledge Management to view Commercial and Legal department documents including signed contracts, change orders and purchase orders stored with Knowledge Online on behalf of Commercial and Legal?

1.10 To ensure availability of integrated project documentation, should each project function be made responsible to store applicable project documentation directly into the Livelink project filing structure?

Question 2: What do we want to achieve?

2.1 DM service is currently limited to Projects in the SA Chemical and Energy cluster, including Natural Working Teams. To be able to take control of all project related documentation, do you agree/disagree that the following should be included?

- international projects.
- all commercial and legal project documentation.
- environmental and risk engineering project related documentation.
- integrate the Plomic structure with DM structure for EoJ documentation
- integrate Sasol Business Unit document management structure (Eng Data Centre (EDC) and Engineering Information Enablement (EIE)) with DM structure.
- Any other integration opportunities? Please specify.

2.2 Please indicate the optimal workload for a DC for Tier 1 projects.

- DCs to work on only 1 project
- DCs to be limited to 2-3 projects max
- DCs to be limited to 4-6 projects max
- DCs to be limited to 8-10 projects max
- DCs to be limited to 14-17 projects max
- 2 x DCs/Tier 1 classified project

2.3 Please indicate the optimal workload for a DC for Tier 2 projects.

- DCs to work on only 1 project
- DCs to be limited to 2-3 projects max
- DCs to be limited to 4-6 projects max
- DCs to be limited to 8-10 projects max
- DCs to be limited to 14-17 projects max

2.4 Please indicate the optimal workload for a DC for Tier 3 projects.

- DCs to work on only 1 project
- DCs to be limited to 2-3 projects max
- DCs to be limited to 4-6 projects max
- DCs to be limited to 8-10 projects max
- DCs to be limited to 14-17 projects max

2.5 Please indicate the optimal workload for a DC for Tier 4 projects.

- DCs to work on only 1 project
- DCs to be limited to 2-3 projects max
- DCs to be limited to 4-6 projects max
- DCs to be limited to 8-10 projects max
- DCs to be limited to 14-17 projects max

2.6 To what degree of importance should the following processes be investigated?

- Automated registration process.
- Improved document tracking.
- Electronic squad checking.
- Optimise version/revision control.
- Automated work flow as per a predetermined work flow design.
- Automated retention schedules notices and practices.
- Automated storing/archiving notices and practices.
- Automated disposal notices and practices.
- DM requirements to be clear and captured at project kick-off meeting.
- Request a document deliverable schedule from engineering contractors/planners at project kick-off.
- Move away from hard copies when electronic version is available/obtainable.
- Improved project Close-out procedure.
- Keep on using Livelink as the storage medium and develop more functionality.
- Investigate integration of (Microsoft) SharePoint and Livelink functionalities.

2.7 How important do you consider the DC's role when assisting with the following?

- Gate reviews.
- Audits.
- Project document reports from Livelink.

2.8 A document becomes a record when information is created, received and maintained as evidence and information by an organisation or person, are relevant in pursuance of legal obligations or in the transaction of business. Taking this into account, do you agree or disagree with the following (RM) statements?

- There is a clear indication of which project documentation should be retained as records.
- RM should be able to meet legislative and regulatory requirements including archival and audit activities.
- RM should be able to provide required documentation to ensure business continuity in the event of a disaster.
- RM should be able to provide protection and support in litigation including the management of risks associated with the existence of, or lack of, evidence of project activities.
- RM should be able to provide evidence of business.
- RM should be able to maintain corporate memory.

3.2.2.2 Open-ended Questions

Cooper and Schindler (1998:325) explained that an open-ended question is an "unstructured" question "that do not offer a limited set of responses but does provide a frame of reference for respondents' answers".

Typical Interview Questions

- Background (Current "as is situation")
- Livelink Storage medium.
- Hard copy archival methods.
- Metadata to impose retention, disposition, archiving of documentation.
- Experience of DM cooperation and service.
- What can be done to integrate/improve the DM supporting service?

Interviews were held with a preselected target population with technical expertise. The findings of these interviews are discussed in Chapter 5.

Question 3: What can be done to improve?

The aim is to address the following possible challenges and in doing so provide an answer to Question 3:

- New electronic storage system.
- Hard copy storage, archival facilities.
- Better work distribution/DC.
- Optimised DM practices.
- DM standards and procedures designed for all project management functions (Programme, NWT and International).
- Accountability for *all* Project related documentation including commercial and legal.
- Proactive harvesting of all project related documentation.
- Include RM practices in Sasol Technology's DMS (use ISO 15489, MoReq2, IRMT, etc as guidelines).
- Metadata requirements to be developed.
- Determine applicable retention, disposition and archival periods.

The data derived from the interviews and teleconferences and the information gathered from Questions 1 and 2 are consolidated and validated in Chapter 6. To arrive at a conclusion to Question 3: "W*hat can be done to improve?"* the following:

- Chapters 2, 4, 5 and 6 will be used to compile recommendations for an improved DMS for Sasol Technology and these recommendations are captured in Chapter 7.

- Due to the time restraints of this research and the worldwide economic recession, implementation of the recommendations for this will follow a phase approach.

3.2.3 Secondary Data Collection

An investigation into existing and available data and information in the Project Development and Control Business unit of Sasol Technology is conducted. "A search of secondary sources provides an excellent background and will supply many good leads if one is creative." (Cooper and Schindler, 1998:136.) The secondary data findings are included in Chapter 4.

3.3 Data Analysis

Cooper and Schindler (1998: 80) include the following key aspects of data analysis:

- Reduction
- Summarisation

- Pattern examination
- Statistical evaluation of hypothesis

The data obtained from the primary and secondary research done is captured as findings in the next two chapters. A statistical evaluation is done to analyse the results from the survey questionnaires. This statistical evaluation of the research question will be used in conjunction with the findings of exploring secondary sources and findings from the interviews conducted to validate the effectiveness of the existing Sasol Technology DMS against a set of requirements.

3.4 Conclusion

Good research generates trustworthy data if the correct research methodologies are used to achieve the research objective. Ongoing research is a valuable and important function for organisations and is used to assist with reliable managerial decision making. A carefully planned research design should produce objective results successfully.

The design of this research is formulated to arrive at conclusions in support of accomplishing the next steps needed to optimise the existing DM practices for Sasol Technology as the owner company. Chapter Four summarises the secondary findings of how documents are managed in Sasol and Chapter Five focuses on the results of the primary findings of the research. It explores how the various role players and functions interact and conduct their business within the project environment of Sasol Technology as the owner company. Chapter Six presents a framework of significant requirements for a well-designed DMS; and a validation of the data collection from the primary and secondary findings of the Sasol DMS is done against this framework of requirements. Chapter Seven consist of a summary, conclusions and recommendations to improve the existing Sasol Technology DMS, based on the validation of the findings.

CHAPTER 4 DOCUMENT MANAGEMENT IN SASOL – SECONDARY DATA FINDINGS

4.1 Introduction

It was mentioned earlier that a search of secondary sources provides an excellent background and will supply guidance in further research if one is inspired. It is important to understand the environment and organisational interfaces in which projects are executed in Sasol, as the owner company, to grasp the essence of the associated required DM support.

4.2 Sasol at a glance

It is important to understand the extent of Sasol's businesses in Southern Africa and worldwide to associate with the significance of DM in the execution of projects in Sasol. All the information in Section 4.2 is a brief overview taken from the Sasol Facts booklet. (Sasol, 2009).

Sasol is an integrated South African based energy and chemical company with operations in about 30 countries and almost 34 000 employees. Sasol was formed in 1950 and started producing synthetic fuels in 1955. The Sasol proprietary processes, of which Fischer-Tropsch (FT) is significant, convert coal, oil and gas into liquid fuels, fuel components and chemicals.

Sasol mines coal in South Africa and produces gas in Mozambique and oil in Gabon. In South Africa Sasol refines imported crude oil and retails liquid fuels through a network of retail convenience centres. Sasol also supplies fuels to other distributors in the region and gas to industrial customers in South Africa. Sasol is further pursuing international opportunities to commercialise Gas-To-Liquids (GTL) and Coal-To-Liquids (CTL) technology.

Sasol's historical milestones indicate the continuous growth and how the focus is now on global growth. To maintain this focus on growth, projects are executed with resources from various locations all around the world and rely on an appropriate functioning electronic DMS.

1950 Sasol is formed to commercialise Coal-To-Liquids (CTL) technology in South Africa

1955 Original CTL complex starts producing synthetic fuels and chemicals at Sasolburg, South Africa

1971 Joint-venture Natref Oil Refinery begins production at Sasolburg

1975 Sasol starts developing new collieries at Secunda, South Africa

1976 Construction of Secunda synfuels and chemicals complex begins

1979 Sasol privatises and lists on the JSE in Johannesburg, South Africa

1989 First Sasol Advanced Synthol™ (SAS™) reactor commissioned at Sasolburg

1990 Launch of polymer production and first international chemical marketing office at Birmingham, UK

1992 First Asian-Pacific sales office established at Hong Kong, China

1993 First full-scale Sasol Slurry Phase Fischer-Tropsch reactor commissioned at Sasolburg

1994 Formation of Polifin joint venture with AECI (now Sasol Polymers)

1995 Formation of international wax business (today Sasol Wax)

1996 Commissioning of first of nine SAS™ reactors at Secunda

1997 Formation of Exel Petroleum heralds Sasol's black economic empowerment (BEE) programme

2001 International Condea chemical businesses acquired from RWE-DEA of Germany; first agreement signed for developing our first GTL plant, Oryx

2002 Sasol Mining wins Platts/Business Week Global Energy Award for coal company of the year

2003 Sasol lists on the New York Stock Exchange in the USA

2004 Start of natural gas production in Mozambique's Temane field; Sasol Oil merges with Exel Petroleum and enters the South African fuel retail market

2005 Engineering, procurement and construction contract awarded for the EGTL plant in Nigeria

2006 Launch of major BEE deals for Sasol Oil and Sasol Mining

2007 First international GTL plant, Oryx, starts production in Qatar; start of restructuring of Sasol Olefins & Surfactants to transform it into a robust and sustainable business

2008 Commissioning of third Secunda 1-octene plant and Arya Sasol Polymer facilities in Iran; Sasol concludes landmark R24 billion Inzalo broad-based BEE transaction

2009 Feasibility study advances for the design and development of a CTL plant in China

(Sasol, 2009:6)

The Sasol Group of Companies is made up of business in the South African Energy Cluster, the International Energy Cluster, Chemical Cluster and the supporting Business Units. Sasol Limited is the holding company for the group's subsidiaries. A short summary of the different Energy and Chemical Businesses underline the diverse and unique technologies, operations and end products of Sasol for which Sasol Technology manages the project execution.

The South African **Energy Cluster's** key business focus areas are in coal mining, gas marketing and distribution, synthetic fuels production, chemical feedstock production and liquid fuels production whereas the International Energy Cluster focuses on gas exploration and production, development of international Gas-To Liquids (GTL) and Coal-To-Liquids (CTL) ventures. These clusters are made up of the following subsidiaries (with locations in brackets):

- **Sasol Mining** (Sigma Mooikraal near Sasolburg and the Bosjesspruit, Brandspruit. Middelbult, Syferfontein and Twistdraai Export operations at Secunda).

- **Sasol Gas** (Mozambique, Secunda. It delivers gas through a 2 118 km pipeline network to 550 industrial and commercial customers in Gauteng, the Free State, Mpumalanga and KwaZulu-Natal).

- **Sasol Synfuels** (Secunda).

- **Sasol Oil** (Secunda, Sasolburg. Sasol Oil operates 410 retail convenience centres in South Africa and exports fuels to Southern Africa).

- **Sasol Synfuels International** (Mozambique, South Africa, Gabon, Nigeria, Gulf of Guinea, Papua New Guinea and Australia), and

- **Sasol Petroleum International** (Qatar, Beijing, Mumbai and Houston).

The following end products are produced by these various Energy Cluster businesses:

- Petrol, diesel, jet fuel, fuel oil, illuminating paraffin, liquefied petroleum gas, pipeline gas, lubricants, greases, bitumen, speciality carbon products, chemical feed stocks and GTL naphtha.

The **Chemical Cluster** is responsible for the production and marketing of ammonia and ammonia based compounds, fertilisers, commercial explosives, hydrogen and other speciality gases, sulphur, waxes, and waxy oils, cresols and other cresylics, alkylamines, mining reagents, a variety of surfactants, speciality inorganic chemicals, alcohols, esters, acrylates, ketones, as well as other solvents, co-monomers and polymers such as polyethylene, polypropylene and polyvinyl chloride.

The cluster is made up of the following subsidiaries:

- **Sasol Polymers** (Secunda, Sasolburg, Malaysia and Iran).
- **Sasol Solvents** (Secunda, Sasolburg, Germany).
- **Sasol Olefins & Surfactants** (Germany, Italy, USA, China, Dubai and South Africa).
- **Sasol Nitro** (Sasolburg, Secunda and Bronkhorstspruit).
- **Sasol Wax** (South Africa, Germany, Austria, UK, USA with sales offices in France, Egypt, Malaysia and Australia).
- **Sasol Infrachem** (Sasolburg).
- **Merisol** (South Africa, USA and Japan).

The following end products are produced by the various businesses in the Chemical Cluster:

- Detergents and soaps, paints and coatings, perfumes and deodorants, catalysts, pharmaceuticals, compact and digital video discs, pipes, conduits, cables, electrical accessories, woven polypropylene carpets, automotive components, plastic film and packaging, household cleaning liquids, fertilisers, explosives, rubber-processing chemicals, candles, crayons, polishes and coatings, microchip coatings, sun protection creams, water treatment chemicals and inks.

4.3 Sasol Technology

One of the Sasol Group of Companies' supporting businesses is Sasol Technology which provides the Energy and Chemical businesses with appropriate technological solutions and services to maintain growth and a competitive advantage. Sasol Technology manages the research and development, technology, management and innovation, engineering services and project management portfolios. By its very nature, the execution of capital projects produces a huge amount of documentation which should be managed vigilantly to ensure successful execution of these projects.

One of Sasol Technology's business areas is the Business Development & Implementation area whose main business activities are divided into the following portfolios:

- Engineering.
- Project Management & Control.
- Operations Profitability Improvement.
- Business Sustainability.
- Special Assignments.

These sub areas and functions ensure a sustainable capital programme implementation capability for all the Sasol Energy and Chemical businesses, overseeing the integration and alignment of components in the Sasol Technology value chain, sustainability and continuous improvement of work processes. The Project Management and Control function is made up of a number of functions which are collectively responsible for the execution of capital projects and consist of:

- Project Management.
- Estimating.
- Cost Engineering.
- Planning.
- Commissioning.
- Document Management.

The Sasol Technology DM function is an important support function for successful execution of projects by the Project Management and Control function.

4.4 Sasol Technology Project Management

The Sasol Technology project managers manage projects for the Sasol business units and make use of the Business Development & Implementation (BD&I) Model that is briefly explained later in this section. The project management team provides the active, day-to-day sponsor representation on the project, from feasibility stage forward through start-up and close-out of the project. The project manager is the Steering Committee's day-to-day player on the project and ensures consistent and sharp focus on project objectives supporting the business objective which includes some of the following functions:

- Facilitation of the integration of the different tracks as of the BD&I Model, ensuring alignment to the business perspective.
- Championing of teambuilding and teamwork.
- Facilitation of life cycle cost decisions to maximize Return on Investment and advise the Steering Committee where necessary.
- Resolving day-to day project related conflicts.
- Taking responsibility for coordination/facilitation between stakeholders.
- Managing project communication.
- Although the project track is accountable for the detail execution of the project, this expertise will usually be contracted in and the Sasol project manager will ensure that:

- project professionals follow project procedures as defined for the project.
- overall project quality and integrity are maintained.
- Conform to regulatory and legal requirements.
- contracts are prepared, awarded and upheld.
- major project deliverables - budget, duration, risk and quality are managed well.
- project execution plan is established and maintained.
- resources (time, money, equipment and human resources etc. are identified and managed.

4.4.1 Classification of projects

Projects being executed by Sasol Technology for the different Sasol business units are classified in terms of a risk tier classification. This classification is used to prioritise projects to assist management with strategic decision making of which resource allocation is of value. Projects are not only prioritised by means of capital cost but a matrix of risk and other factors is taken into account. The 4 different tiers are therefore not a straightforward process but can, as a guideline, be summarised as follows:

- Tier 1
  - Operational or business impact with potential loss of income or market share >US $100 million.
  - End of Job cost greater than US $500 (R3 000) million.
  - Multiple integrated with proven and unproven process technologies.
  - Interdependent projects and programmes/portfolios.
  - Project duration of more than 72 months.
- Tier 2
  - Operational or business impact with potential loss of income or market share <US $100 million.
  - End-of-Job cost less than US $500 (R3 000) million.
  - Single unproven process technology.
  - Interdependent project portfolio.
  - Project duration of less than 72 months.
- Tier 3
  - Operational or business impact with potential loss of income or market share <US $10 million.

- End-of-Job cost less than US $150 (R1 000) million.
- Single, well proven or modified process technology or multiple, well proven process technologies.
- Multiple sequential independent work packages.
- Project duration of less than 48 months.

- Tier 4
  - Operational or business impact with no potential loss of income or market share.
  - End-of-Job cost less than US $20 (R150) million.
  - Well proven process technology.
  - Single work package.
  - Project duration of less than 30 months. (Sasol: 2009a: 5.)

4.4.2 Sasol Business Development & Implementation (BD&I) Model

Sasol Technology uses the (BD&I) Model as a systematic approach for the execution of capital projects. The model is based on a stage gate process associated with project life cycles. By using the BD&I Model's principles, a suitable business opportunity identified in the idea generation stage, could become a capital project as it becomes more focused through application of the model. Input from Independent Project Analysis (IPA) and the Project Management Institute (PMI), ensured that world best practices are included in the model and internationally accepted terminology and methodologies used.

The objective of the model is to focus all efforts on the establishment of the business, to improve decision making and to provide a master plan for business and project visualisation, to enable improved planning, collaboration, and communication between teams, decision makers and other stakeholders. A key feature of the model is that it facilitates alignment between business and operational requirements and project and technical activities, to ensure that the right actions are executed at the right time. The amount of detail and specific actions required during the execution of a project vary between different types of projects and also depend on the project size, complexity and risk profile. It is up to the user to select the appropriate deliverables and amount of detail required within the framework provided, also taking into account regional requirements and procedures. (Sasol, 2009b)

The model consists of four tracks (Sponsor track, Business track, Technical and Engineering track and Project management track), each with distinctive roles, responsibilities and a

large number of deliverables. The purpose behind dividing the different tasks into tracks is to ensure that all key aspects are developed in a focused way to the required level of detail at the end of each phase. The model progresses from *Idea Generation*, followed by a *Front-End Loading* (FEL) period, then the *Project Implementation* and finally *Continuous Improvement*, through seven phases. Each phase depicts the typical deliverables required to be reached for approval to be able to proceed to the next phase with minimum risk of failure. Figure 4.1 gives a one page illustration of the different tracks and phases of the Sasol Business Development & Implementation (BD&I) Model with the key objectives. The focus areas for each phase are summarised below.

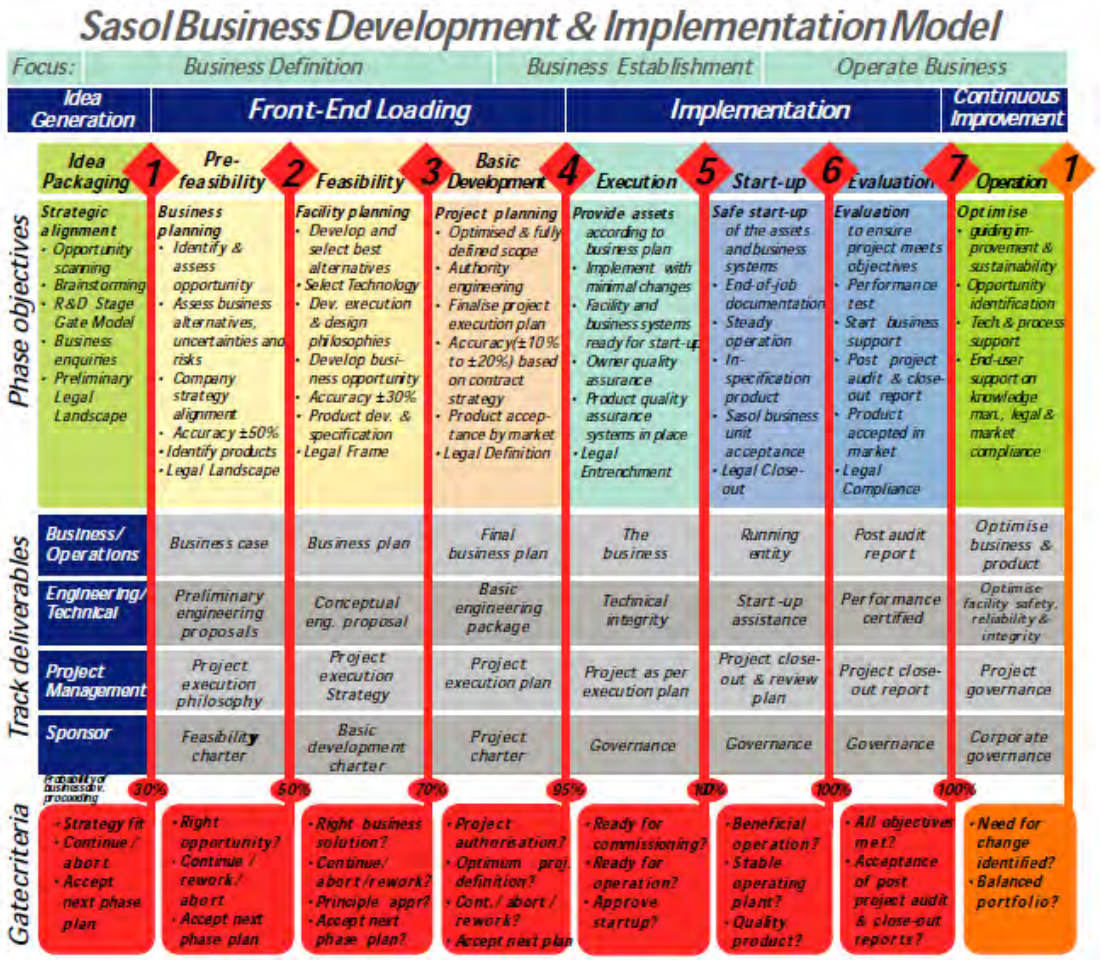

Figure 4.1: Sasol Business Development & Implementation Model

(Sasol, 2009b)

4.4.2.1 Prefeasibility Phase

This phase primarily focuses on planning the business. During this phase it is determined whether an opportunity is aligned with company strategy and if the opportunity is in fact worth pursuing. Technical and project management work is limited to scanning the environment for technology and project implementation options and the need for a structured project DM system is imminent. The direction for future work is indicated.

4.4.2.2 Feasibility Phase

Business, technical and project execution alternatives are identified, considered and the best alternative selected for each track. The selected alternatives are developed into single well defined concepts. The cost and benefits are calculated and it is determined if the project is viable from a technological and economical point of view. Any killer concerns are identified and possible mitigating actions proposed. The project is approved in principle (Go/No Go decision).

4.4.2.3 Basic Development Phase

The selected business, technical and project execution options are sufficiently developed for final authorisation. This involves the development of the selected technical option and the preparation of the project implementation plan and cost estimate, to support the final business plan. All the necessary resources for project implementation will be sanctioned at the end of this phase.

4.4.2.4 Execution Phase

The facilities are designed in detail, procured and erected as per the accepted Project Execution Plan (PEP), with minimum change, to the agreed quality, and within the authorised budget and time frame. On acceptance of Ready for Commissioning (RFC), the facility and business systems are prepared for the first introduction of process feedstocks to achieve the Gate 5 - Ready For Operation (RFO) milestone. The business track concentrates on securing services and resources for the operation of the business.

4.4.2.5 Start-up Phase

Start-up commences when the commissioning activities have been completed and process feed stocks can be introduced for production purposes (RFO). The start-up phase is completed when sustained manufacture of on-specification products has been achieved at the Beneficial Operation (BO) milestone.

4.4.2.6 Evaluation Phase

The performance of the newly implemented business concern is evaluated to ensure that the business objectives are met. The technical track starts business support for operational and profitability improvement. The post-project audit and the project closure are completed and lessons learnt and best practices captured and shared.

4.4.2.7 Operation Phase

During this phase on-going optimisation takes place. Newly identified opportunities are fed back into phase 1 of the BD&I Model. Project Management is not involved in this phase of the model.

4.5 Narration of project related document management in Sasol

4.5.1 Introduction

Sasol Technology executes projects for the other businesses to enable these business clients to legally own, operate, maintain and modify the plant within its assigned responsibilities at optimum life cycle cost. It also has to deliver all documentation deliverables that are associated with the project and plant to the client. It is illustrated earlier how DM in Sasol Technology is classified as a support function to Project Management and resides with the Project Management and Control Function. DM entails the management of all project related documentation from the start of a project through to handover of master data at operational phase, including closure and archiving of documentation.

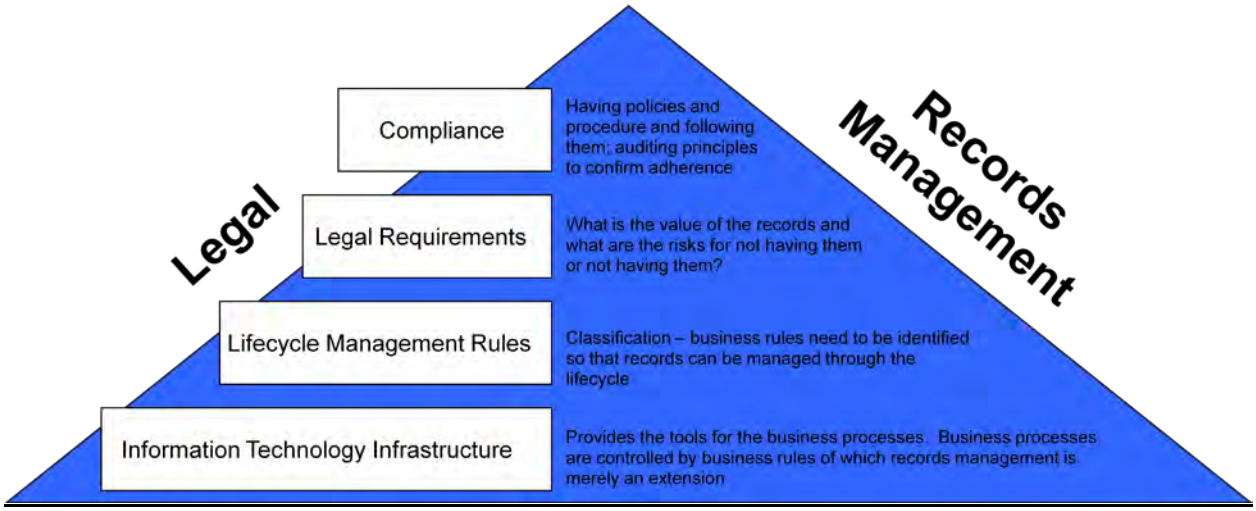

Figure 4.2: Records Management Framework

(Sasol, 2008)

Fig 4.2 demonstrates the holistic approach to RM in Sasol. The Sasol Group of Company draft policy, Sasol-Pol-01, states "it is necessary for all companies within the Sasol Group of Companies to responsibly manage and retain documents relevant to the conduct of their respective businesses for appropriate periods". It furthermore explains the policy enforcement mechanisms that Annual confirmation by the Business Unit Legal Advisor that a guideline is in place and that the Business Unit is compliant." (Kruger, 2007:3-5)

4.5.2 Period before and up to 2004

Before 2004 there was no formal organisational structure in place for the management of documentation in projects. Contractors were appointed as project resources in the capacity of DCs which reported to individual project managers per project. The roles and responsibilities, accountability and boundaries related to the management of documents of the DCs and those of the project team members and other stakeholders were unclear and not defined. DM was perceived by senior management as a clerical function of filing and finding with little or no planning involved. No goals, objectives or even a budget existed and there were no standard policies and procedures in place to manage project documentation in a consistent manner across and within the different business functions.

As described before, Sasol Limited consists of the different businesses and the management of documents is divided between the different organisations and different business functions within these organisations. As can be expected there was thus no coordinated

effort between the different organisations and business functions on how to manage cross related information during the execution of projects.

Ms Trudie Botha from Functional Governance always had a passion for DM and originally started to investigate the status of DM in Sasol Technology in 2002. Her main conclusion was that a DC was seen as an individual service done in isolation due to the erroneous perception that a DC is no more than a filing clerk. The position had no value or profession linked to it.

These issues were raised with her then Line Manager, Mr Mark Heap, and during 2004 Sasol Technology started a forum for DCs within the organisation. Sasol Technology requested an independent consultant to analyse the current state of affairs and to provide recommendations for an integrated strategy. The following key specific problems were identified:

- There is an absence of a functional structure and fixed responsibility for DM within the organisation.

- There is a limited definition of DM processes within the organisation. There are no policies or procedures in place to manage information in a consistent fashion across and within the different Sasol business functions. It was found that in some cases procedures overlap and can even be contradictory across and within these business units. There are also no goals policies and procedures for DM for Sasol Technology, who should execute the projects for and on behalf of all the other Sasol businesses. There is therefore also no assessment of adherence and performance assessments.

- There is no formal training programme.

- There is a need for consolidation of technologies. Sasol Limited technical, hardware and applications requirements for DM are not prescriptive and organisational units implement technologies independent of one another.

- The consequence is that customer requirements cannot be met due to the limited nature of the DM processes. (Coetzer and Kotze, 2004).

Project documentation deliverables have to be delivered in accordance with Sasol Specification SP-90-37 and drawings must conform to Sasol Specification SP-90-32. These specifications stipulate requirements that must be adhered to by contractors and Sasol Technology has to deliver the same set of documentation to its business client and include *inter alia*:

- Document numbering conventions.
- Statutory document deliverables.
- Electronic document deliverables and preferred formats.
- General requirements for content and indexing of EoJ documentation.

4.5.3 Analysis of 2004 status

The following findings, problem areas and shortcomings of these procedures and proposals were identified in the 2004 investigation.

4.5.3.1 Life cycle Management and Workflow

The current Livelink system is not used to manage the life cycle of documents, as it should be. It only serves as a repository or dumping ground for electronic and digital information. Documents are not managed and controlled from creation, review, delivery, archiving and disposition. There is no standard approval cycle for regulatory or governance documents, technical reports or drawings.

4.5.3.2 Classification of Information

For projects a filing model is based on the BD&I Model tracks and phases within Livelink (Livelink is discussed elsewhere in this chapter). The issue is that the filing model is too complex which in turn makes it difficult to know where to store to document and consequently find it again. There is a lack of standardisation and each project customises according to its own standards. The classification of documents in a hierarchical nature in the BD&I filing structure in Livelink further complicates the storage of documentation since it is time consuming. There are also a large number of software applications used in a project team and the DCs do not have the software to view these files in order to either print or scan these documents. (Coetzer and Kotze, 2004).

4.5.3.3 Document naming and numbering

There is a lack of a defined standard document naming and numbering convention. A search will return multiple documents with the same title. It is then up to the user to open each document separately until the correct document is found. (Coetzer and Kotze, 2004).

4.5.3.4 Registration

The project manager is responsible for preparing a document communication procedure for the project and the DC is responsible for the management of all documentation to the requirements of this procedure. All project documentation, incoming and outgoing, should have a singular transmittal code. Because there is no standardisation of document control processes, registration does not take place and this leads to a lack of discipline regarding document management. (Coetzer and Kotze, 2004).

4.5.3.5 Distribution

Internal and external distribution of documents is manually, via courier services, Outlook and on CDs. Multiple copies of the same document are made in order for it to be distributed to various disciplines within the project team for review and/or acceptance. Annotations and mark-ups are done on the hard copy documents. Documents received electronically must be printed in order for it to be reviewed and approved. This has an impact on the time and cost of the project. Hard copy documents can be lost and damaged in the process, which result in rework. Documents are duplicated in order for it to be distributed to the various team members and annotations are done on each of these hard copies.

Contractors and outside interested parties do not have access to the internal Sasol document system. (Coetzer and Kotze, 2004).

4.5.3.6 Storage

Project information are scattered all over the different functions and duplicated, some in Livelink, some in Outlook and some in team members' folders on their hard drives. This creates a major accessibility problem. The DCs are responsible for the administration and capturing of information on Livelink. They are the primary users of the system and all project team members have access to the information but seldom access the information, once stored. Paper bank facilities exists that houses project execution and deliverables.

The following are some of the areas of concern highlighted by the investigation:

- The project manager creates the filing system for the project and the DC changes the filing system to suit the changing needs of the project.

- Documents at decentralised offices and paper banks are not very accessible. This

poses problems in that documents are not readily available and results in poor or slow decision making. As a result of this documents are not sent to the paper banks.

- There are insufficient office space to store project execution and EoJ documentation.

- Confusion arises as to which document in which folder is in fact the latest and correct version.

- Information received from contractors on CDs is large files and it is a time consuming process to load it onto the Livelink server and also slows the server down.

- Scanning services provided from Johannesburg offices only are inefficient and ineffective and once documents are removed from site, it is no longer available to business which results in waiting time when these documents are required in cases of emergency.

- There is a lack of awareness about the functions and features available on Livelink.

- There are no centralised archival structure and databank. (Coetzer and Kotze, 2004).

4.5.3.7 Retrieval and Metadata Management

There are currently no metadata requirements in place and no standard to make retrieval user friendly. There are inconsistencies in the keywords used to describe the contents of an electronic document. Because there is no controlled and consistent vocabulary for subject key words, documents cannot be found and the user has to turn to the creator of documents for assistance. The information in these documents therefore has no meaning since it cannot be reused without the intervention of its creator.

Information retrieval and management is one of the key strengths of Livelink. The Livelink system is discussed elsewhere, but the investigation revealed some inconsistencies about the performance of the system when searches and retrievals are done. (Coetzer and Kotze, 2004).

4.5.3.8 Security and Access Control

There are policy guidelines for access to information in place and this is in line with the according legislation. The DC coordinates access to information but access is granted per project, i.e. accessibility to all project related documentation. Some concerns are that security is limited to user based authorisation and not role based authorisation. The security is not properly governed because it is project based and thus free for all team members. Access is to superseded documents are also not restricted. (Coetzer and Kotze, 2004).

4.5.3.9 Archiving, Retention and Disposition

There are no formal standard in place and the retention and ultimate disposition of documents and records are not managed. It is not clear which documents should be kept as records and for how long. There is no consistent archiving procedure at project close-out and once a project is closed out, the information for that project is sent just as it is to an archive folder. Originators and modifiers of documents cannot be traced. Because there is no procedure for retention and disposition, documents are kept in archive folders in a format which is not user friendly, but seldom gets destroyed. (Coetzer and Kotze, 2004).

4.5.4 Period from 2004 to 2008

Despite the findings in the 2004 investigation and due to the fact that there was no formal custodian for the DM function, not all the problem areas were addressed. Not everyone acknowledged and was aware of the importance and the benefits of proper management of project documentation. Because no-one had the mandate or the budget for further in-depth investigations for the development of an centralised organisation, standards, procedures and best practices, those initiatives that were implemented during this period were not acknowledged as an integrated strategy for the successful standardisation of DM in the execution of projects. Resources from various sections had developed policies and procedures, but buy in from the relevant stakeholders complicated the roll out, due to the lack of an organisational DM structure.

4.5.5 Period from 2009 to 2010

To address the misalignment and lack of ownership experienced during the 2004-2008 periods, a formal structured organisational hierarchy for DM was designed and

implemented. The department now has its own manager and team leaders to manage DM related matters. The DCs in Sasol Technology reside within the DM organisational structure and do not report to the various project managers anymore. See Figure 4.2 for the organisational structure for DM in Sasol Technology. From September 2008 DM is a recognised department with standardised execution policies and procedures, which will be briefly discussed.

4.5.5.1 Resource Status

Resource loading in Sasol Technology DM department is problematic. Due to the current world wide economic crisis, Sasol implemented restrictions on appointing new people or renewing contracts of Non-permanent employees. When positions become available, these cannot be filled. During the past year, 4 DC positions became available due to various reasons. Since 2004 DC positions reduced from 42 to only 23 positions. The relation of active projects is not synchronised with the availability of DCs and serious consideration is needed in this area. Motivations for additional resources are sent to Top Management on a very regular basis, but DM is seen as an important but not indispensable function, and no additional resources were approved.

There are currently 311 projects in Sasol Technology Project Management and Control Department that have to be handled. These projects are classified in the following way:

- 11 Tier 1 projects.
- 26 Tier 2 projects.
- 88 Tier 3 projects.
- 186 Tier 4 projects

Due to the high workload, many DCs are suffering from back and neck pain, ulcers, migraines, stress and anxiety, etc. During the period 2009 to February 2010, three DCs in the Secunda area had back operations and each DC booked off for periods between 6-12 weeks. These incidents put pressure on fellow DCs and to top the situation, the DM department also currently has 4 pregnant DCs who are entitled to maternity leave for periods of up to six months.

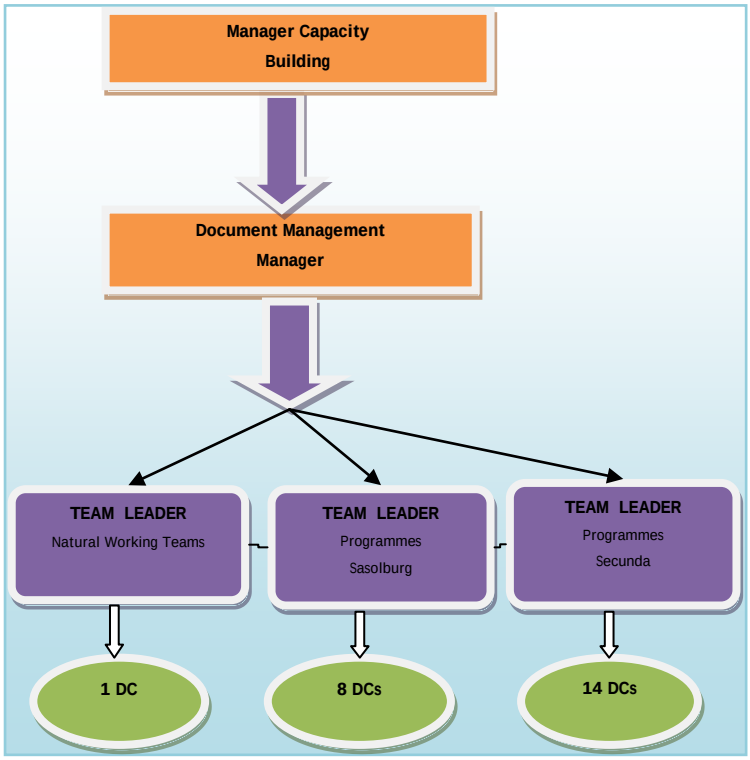

Figure 4.3: Document Management Organisational Structure in Sasol Technology

4.5.5.2 Roles and Responsibilities of a Document Controller (DC)

A DC manages all required documentation, as indicated by the project manager, according to the procedures within a project. DCs are essential in the success of Sasol Technology's execution of projects.

In Sasol Technology the generic roles and responsibilities of a DC, can be summarised as the following:

- Registration of documents.
- Distribution of documents.
- Coordination of the following document processes:
  - Squad checking.
  - Spare parts inventory.
  - Scanning.
  - Copying.
  - Drawing reports from Livelink.

- Filing of documents.
- Retrieving documents from filing system.
- Revision control.
- Conducting regular reviews.

- Document tracking and follow-up.
- Correspondence and issue follow-up system.
- Classification of documentation.
- Documentation management effectiveness measurement.
- Documentation duplication control.
- Master documentation (EoJ).
- Overseeing of junior DCs.

It is of vital importance to allow a DC to focus on all the required and identified DC roles and responsibilities with regard to following and maintaining a structured DM process.

A DC is not a project assistant/secretary/coordinator. Due to previous work methodologies the tendency among some DCs is still to wait for project documentation. This reactive behaviour stems from the fact that in the past secretaries were used to assist the project manager with project documentation. The secretaries provided the project manager with some document assistance on demand, together with their other administrative duties.

Document deliverables should be preagreed for each phase of the project, throughout the lifecycle of the project. The project manager indicates to the DC the required and applicable documents expected for the specific project phase using the BD&I deliverable list as a guideline. The DC should proactively harvest the identified documents from the project team members.

A DC should get involved in the project as early as Gate 2 (Feasibility), to ensure that proper DM alignment with project team members can be established. One of the functions with a significant impact on the project, is for the DC to support the project manager with contractual requirements of the New Engineering Contract (NEC – the contract format used by Sasol Technology), ensuring on-time distributing, action tracking and project team responsiveness.

"The DCs have the primary responsibility for managing and controlling the project's hard copy and Livelink content. The DCs perform periodic reviews of the Livelink repository to monitor document naming conventions and version control.

The DCs perform and review/audit at each gate review of the hard copy files to ensure all contents are correctly filed and are present. The DCs also perform a partial review/audit of

the Livelink repository to verify naming conventions, profile completeness, version control and security/access control. Any discrepancies or concerns are documented in the project's issue tracking or risk tracking system and assigned for correction." (Steyn, 2008)

4.5.5.3 DC Qualification and Training

The current job specification of a DC in Sasol Technology requires a minimum qualification of grade twelve. Makhura (2001:64) cleverly noted in his research that it is interesting to note "that though organisations depend on records management for their survival," it was his view that one would expect from organisations to insist that employees performing such an important role, to at least have diploma or degree qualifications. The low qualification percentage of Makhura's research findings was interpreted as either little effort with regard to staff development or lack of interest by employees to further their studies. 27% of DCs in Sasol Technology have higher qualifications than the standard Grade 12 requirement and only 14% DCs have a National Diploma in various disciplines, none of which include Information Science as discussed in Chapter 2. There are also no degree qualifications in the DC's group.

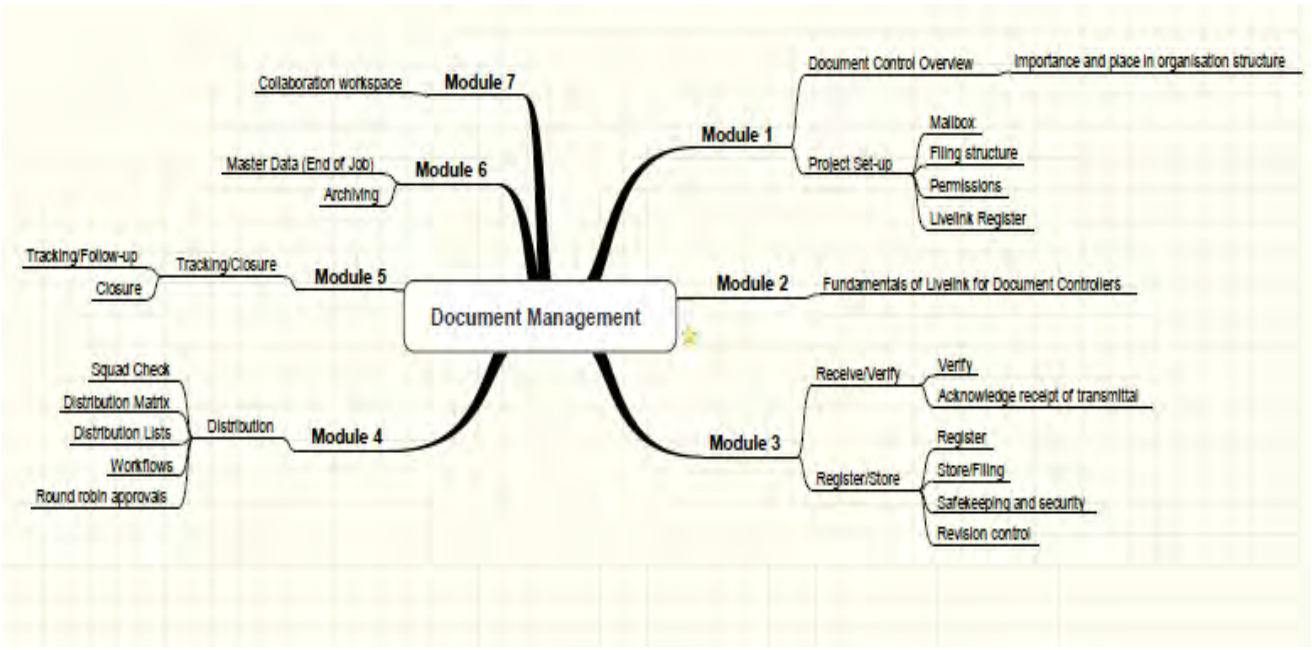

Figure 4.4: DM Training Module Layout

(Semple, 2009)

DM is in the process of designing and developing detailed training modules for the DM training programme. See Fig 4.4 for a typical DM module development and workflow. Various other training courses have also been identified and get incorporated into the DCs

Performance Development Plans. Assistant/DCs receive one to one coaching and training from senior DCs and the functional team leaders.

4.5.5.4 Livelink

Livelink, supplied by Open Text Corporation, is the information system used by Sasol Technology and according to Smook (2005:4) implemented since 2000-2001. Open Text has received DoD 5015.02-STD Certification in 2001 for complexity, flexibility, focussing on search and retrieval capabilities, process disposition, as well as report and auditing functions. (Refer to paragraph 2.6.7.7.2).

Andrew Warzecha, Vice President of Meta Group stated that "by choosing proven applications, like Livelink Records Management Solution, Organizations can minimize risk and help ensure reliable and consistent quality for their records management requirements." (Open Text Corporation, 2001).

Smook (2005:4) explained the following, "Livelink is positioned as an electronic document management, project collaboration, content and knowledge management system. It provides for the electronic submission of documents (electronic files) via a web front-end or Windows interface to a database (SQL or Oracle)". Licences are available across the geographical Sasol sites. Access control and retrieval capability are some of the core benefits the system offers.

Information Management (IM) manages and governs the system and the information structures. Each business process has its own business requirements and Livelink can be set up and developed according to the specific business needs. IM also provides functional support. The DM manual identifies the following roles and responsibilities in the Livelink project environment:

- Livelink access privileges and permissions are assigned by a Livelink coordinator who:
  - "Establishes access privileges.
  - Designates a project's public access status.
  - Defines permissions (approved by project manager) for team participants.
  - Edits the project participant list.
  - Adds or removes participants and
  - Changes participants' roles.

- "When administering project participation, the coordinator enables or disables a project's public access:
  - Enabling public access makes a project accessible to all Livelink users, without having to include an explicit permission for individual users or groups.
  - Users who have public access to the project are able to access the project and see its contents. The permissions these users have on items within the project depend on the permissions set for each item.
  - Changing a project's public access status will affect the default permissions inherited by objects that are created in the project's workspace, but will not affect the permissions of any objects that already exist in the project.

- "Members have access to modify, reserve, delete, and add their own items within a project.

- Guests can view all project items but cannot modify them." (Sasol QMS/340P:5)

The DM department currently ensures the following Livelink processes to set up the DMS at the start of a new project:

- Create a project on Livelink.
- Copy standard filing structure in the workspace.
- Copy a register for the specific project.
- Set up the Livelink permissions.

Smook (2005:11) advised that permission administration is made "easier when based on group structure for general access, with specific rights for individual where necessary. "This made the response time better and is quick and easy to maintain.

"It is faster for Livelink to verify permissions per item if done by group than having to verify each individual that has permissions.

"The size of a document or Web page affects the speed with which it is downloaded and opened, because it is done over the network. Storing documents with large sizes is not a problem, because additional disk space is not expensive or difficult to install.

"Uploading or downloading large documents can also influence the general response of the rest of the system, because a percentage of the threads going into the Livelink server and database will be tied up for that period of time". (Smook, 2005:97).

Smook (2005:4) also stated that Livelink "provides electronic discussion groups and electronic news channels and workflow technology. The user is presented with three 'workspaces', an enterprise workspace (for general publishing), personal workspace (for individual use) and a project workspace (for collaborating on projects and doing project document control). It runs from a centralised architecture of servers over a Wide network, consisting of a Web Server and indexing server."

Smook (2005:74-78) further summarised and described the following features and functions of Livelink:

- Search
- Live reports
- Browse or navigate
- Listed Items
- Catalogued items
- Version control
- Audit control
- Types of items that can be created in or added to in Livelink
- Functions that can be performed on items
- General Information on items
- Notifications
- Custom views
- Help user manual
- Categories and attributes

The system can manage, store and track project information through the life cycle of the project. It has the capability to reflect an audit trail while maintaining the integrity of project documentation. It manages accurate information delivery through all the above mentioned functions, specifically DM required functionalities like version control capabilities, item level access control and checking in-and-out features.

Livelink has the ability to increase access to an organisation's records. The system enables a DC to effectively administer, create, classify and manage both paper and electronic information and data.

4.5.5.5 Deliverables included in the Sasol Technology Document Management Procedure

QMS/340P is an internal Sasol Technology manual with guidelines and procedures to assist a DC to execute the daily required roles and responsibilities. It guides a DC in how to manage and control project documentation through the life cycle of a project, from the start through to handover of master data (EoJ).

A summary of the contents of this manual is a useful indication of the conformance to requirements as identified in the literature study. Table 4.1 summarises the content addressed in the current DMS in the project environment for Sasol Technology. (Since the researcher is the manager of the DM department, areas marked with pink indicate developmental areas and are discussed in more detail later.)

Table 4.1: Current Sasol Technology Document Management System (DMS)

1. Roles and Responsibilities		
Responsibilities	Authorisation	Accountability
2. Prerequisites/Input Requirements		
Documentation and information	Required tools	Required programmes
3- Process input requirements		
QMS /337P	SP 90-32	SP 90-37
F586	F617	F705
QMS/340P	SP -40-3	QMS/307p
4. Process Description		
Register Project on Livelink	Set Up Standard filing structure	Create Project Register
Set up Permissions	Set Up Project Mailbox	Set up Delegates
5. Verify Documentation		
Transmittal Received & Issued	Fax received, Issued	E-Mails received & issued
Letters received and issued	Project Outline	

6. Registering Documentation		
Assistance regarding the Livelink Register	Registering Process	
7. Filing Documentation		
Filing Process	Filing Structure	
8. Copying and Scanning Documentation		
Sasol Specifications and STDD request from External Parties	Copying	Scanning Documentation
Document Tracking	Document Requests	SPIR Management
SPIR Process Description	Document Control	Squad Checking Process
Revision Control		
9. Distribution		
Deliver	Distribution Matrix	Distribution List
Close-Out of Project Documentation (Preserve & Archival)	Benefits of Distributing Electronically	
10. End-of Job Documentation		
Requirements from PLOMIC	Procedure	PLOMIC Requirements
File of Transmittals	Drawing Number codes	
11. Handover, Archiving and Close-out		
Handover by Project Manager to Project Manager QMS/320W	Handover by DC to DC F591	Electronic (Secunda and Sasolburg)
Future Archiving Procedures	Hard copy (Sasolburg)	Hard copy (Secunda)
13. Document Management Reviews		
14. Close-out Projects		
Receive final close-out documentation	Close project mailbox	Complete & Submit Deletion of services on User Service section.
15. Exit from Sasol as DC		
16. Related Procedures and Specifications		
Specifications	Specification	Outlook Faxing Procedure

17. Process Measurement		
Performance Metrics	Reviews	
18. Exit Criteria		
19. Records Generated		
Hard copies in Folders	Soft copies on Livelink	
20. References: QMS/337W- Communication Management Plan		
21. Training		
BD&I Model - Project Track	Time Management	
BD&I Model - Engineering Track	Assertiveness	Applied Fundamentals for Project Management
22. Templates		
F580 Distribution List	**F581** Distribution Matrix	**F582** Document Copy Request
F583 Document Removal Register	**F584** Handover of SPIR forms to Operations	**F585 P**roject Filing Index
F586 Request for Project Registration	**F587** SPIR Register	**F588** Squad Check Register
F 589 Transmittal Note	**F590** Squad Check Notification	**F 591** Transfer from DC to DC
23. Abbreviations		
Abbreviations/ Acronyms	Jargon	
24. Definitions		
25. Contacts		
26. Acknowledgements		
27. Review Cycle: Every 2 years		

(QMS/340P, 2009)

4.5.5.6 Shortcomings of the Sasol Technology Document Management System procedure

The following areas in Table 4.1 of the Sasol DMS (marked with pink) identify areas where incomplete procedural development and/or procedural non-compliance cause reason for concern:

- Registering documentation.
  - Absence of metadata.
  - Manual process.

Day-to-day documentation is added to the electronic filing structure according to the standard folders. All these documents and communication should be registered. The registration form is currently a process document and manual input required to perform the action. The registration process does not force a DC to register. The absence of metadata makes the DMS ineffective since retrieval and document tracking are not possible without registration taking place.

During a teleconference held between DM and Knowledge Management (KM) on 19 October 2009, Mr Armand Oosthuizen stated that there should be a forced relationship between the Metadata and the Object. As the KM manager he advises that it is not good practice to rely on an index for retrieval as practised currently by DM. There should be a perfect relation between metadata and the document by using category templates. Proper search and retrieval are achieved when there is a direct association between the document and the metadata.

ISO 23081-2 (2009:3-4) confirms this by stating that "metadata support the searching of information assets and the maintenance of their authenticity" as well as "structured metadata for managing records in combination with good system search functionality, support access and retrieval of records across organisations" and "a relatively small initial investment in good metadata can enhance quality and reduce costs for retrieval of information to the organisation".

- Copying and scanning documentation.
  - Squad checking process done manually in Sasolburg area and no uniform standard to perform squad checking.
    - Squad checking of documents gets done manually, which poses the following problems:
    - This is a time consuming activity for a DC that requires manual preparing of drawings.

- After comments have been made by the various role players, a DC has to physically scan in the marked-up drawings, before sending it back to the service providers.

- Central scanner and printing facilities shared with other departments.
  - Since printers and scanners are shared with other departments at a centralised location, it obliges DCs to work after hours to scan and copy without interruptions.

- Document tracking.
  - Registering process not done according to process.
  - Lack of NEC knowledge and general DM training.
    - The use of the NEC as contract format requires a proper document tracking system. Due to the NEC course focussing on technical aspects for project managers, the length of the programme and the cost associated with the course, it was decided to develop a separate DM applicable module. Formal training modules of DCs are still being developed and have not been formally rolled out to the group

- Revision control/Version control.
  - Lack of checks and balances.

- Close- out of project documentation.
  - No physical storage area in Sasolburg.
  - No electronic archival storage server available.
  - Archiving procedures to be developed and implemented.
  - Retention strategies to be developed and implemented.

- Project Close-out.
  - No process flow to ensure DC receive financial Close- out
  - Absence of close of project mailbox.
  - Deletion of user service not happening.

4.5.5.7 Internal Document Reviews

QMS/340P should be read in conjunction with QMS/307P which covers the requirements for internal reviews. This procedure serves as a detailed instruction of how to perform document control reviews to ensure compliance to document control procedures. It entails the checking of documents for gate readiness reviews. It is used to identify the

prerequisites and input requirements for a project review. It helps project team members by identifying deviations and follow-up actions to prompt corrective and preventative actions. (QMS/307P, 2009) The Portfolio and Function Governance group issues an electronic mandatory gate acceptance form which has to be populated with the links to the documents in the filing structure by the DC. (See Appendix A)

4.5.5.8 Sasol Business Unit Document Management (SBU DM)

SBU DM is responsible for storage of plant engineering data and information. At the Sasolburg site these responsibilities are shared between the Engineering Data Centre (EDC) which is a department within the Sasol Infrachem business, and Natref. Natref has an in-house drawing and data office. Other Sasol Business Units store their engineering data at the EDC.

At Secunda Synfuels site, engineering data and drawings are kept at Engineering Information Enablement. (EIE)

Taking from a presentation on Plomics workflow, Ms R Jagadis (2009: 8) indicated the following key roles and responsibilities of the SBU DM:

- "Provide existing documents to EC as requested.
- Provide document numbers and equipment tags as requested.
- Support quality control activities by database initialisation as requested by Plomic.
- Configure SBU DM (SAP system) with document/scope specific information (Master Data) in preparation for receipt of technical deliverables.
- Receive final technical deliverables and load in to SBU DM systems. (SAP hard copy filing systems).
- Facilitate notifications and distribution of documents within SBU as agreed with EM".

4.5.5.9 Engineering Data Centre (EDC)

The EDC resides in the Sasol Infrachem Business. Infrachem is mainly responsible for providing a service platform for providing utilities, infrastructure and site support to all the businesses in the Sasolburg area. Infrachem is also responsible for site governance in the Sasolburg area. The EDC is the final destination of the project engineering data in the life cycle of the project where it gets registered as records for final storage on 'Systems Application Projects. (SAP)'

There are two Sasol sites in Sasolburg, i.e. Sasol 1 and Midlands. Previously the Engineering Drawing Office rendered a draughting service to both these sites. The drawing office was closed after a restructuring process in October 2002. The drafting service was outsourced to drawing consultants. The Engineering Drawing Office then became the EDC.

The personnel of the EDC are responsible for the governing of technical/engineering information and drawings. The EDCs current primary fields of expertise are focused on providing an engineering data distribution, archival and retrieval service for all engineering drawings, technical specifications and manuals as received from the Plomic function. Plomic hands over to the EDC the master data, which is the End of Job (EoJ) documentation, at gate 4 and 5 of the BD&I Model. A set of hard copies together with the electronic soft copy gets signed over to the EDC and one hard copy set handed over to the relevant business unit, the client for which Sasol Technology executed the project.

The EDC has various ways and systems to retrieve the historical (hard copy) technical information for the different business unit areas. Altogether there are five different systems, which are very old. Searching for information can become a very problematic and time consuming activity. Due to this problem the EDMS on SAP was developed and implemented.

Currently all business units are making use of SAP for various business requirements. The SAP system regulates and controls basically all functions within the organisation, from handling orders to supply, production processes, maintenance activities, deliveries and payment of all these activities. Each business unit has different data and links that require manual input into the system.

All Sasolburg Business Units are responsible for the updating of its own engineering drawings. Engineering data is stored in the SAP DMS system. New drawings and revisions get done by external service providers. It is the daily task of the EDC to convert from hard copy (history) to the electronic environment, by scanning and converting methodologies.

Both legacy and new data get booked into SAP. When revisions are required, the latest revisions software gets booked out from SAP to the appointed service provider. The final approved software of the drawings or revisions sometimes does not get booked back to the EDC, as the service provider hands over the hard copy drawings directly to the business unit (client). The updated drawings and information therefore often do not find their way to the EDC, and the information on SAP is not a true reflection of the actual situation

Business units that keep their data at the EDC for governance enter into a Service Level Commitment (SLC) paying a pre-agreed service rate to the EDC. The amount of

drawings/technical documents kept at the EDC determines the SLC amount. With the constant focus on cost cutting and improving profit margins, Business Units may try to save money by running their own library on-site and not making use of the EDC. This leads to several problems and concerns:

- Private libraries have no compliant management systems in place and reliance is placed on manual systems.
- There is a lack of quality control of the documents.
- There is no protection of sensitive documents.
- No drawing revision control is in place.
- Documents get filed by individuals in offices.
- Loss of information.
- No management of governance on document types/format.

Some business units pay the SLC, but still run their own library on-site. This leads to duplication. Drawings get marked up on-site or in the office and the new revision does not get booked back to the EDC. Crucial information gets outdated and revision control is very difficult to apply, often resulting in consultants working on outdated drawings when revisions need to be done.

The plant sometimes redlines a hard copy drawing and the service providers use that to do revisions on. This results in the current situation that the EDC is not always in possession of the latest engineering drawings and revisions. It can be a fatal situation for Sasol with a catastrophic outcome. The situation definitely leaves room for improvement since engineering drawings are the foundation of all safety, environmental, legal, construction and operational systems and the ease of access and availability of these documents are the main benefits of a proper functional DMS. (Sasol: 2003). The absence of checks and balances to ensure the latest engineering information residing with the EDC weakens the whole process flow and governance of engineering information.

To summarise the process flow, The Sasol Technology DM department receives the project information packages from the EC/MC after Plomic has checked and signed off the different required packages at the end of the execution phase of a project. The DC then transmits to the EDC and the applicable Business Unit. The EDC receives the EoJ by signing acceptance thereof and taking responsibility and accountability for entering the information on to the SAP DMS.

Although Natref has an in-house drawing office, similar processes to the EDC exist for Natref and the Secunda Site (EIE). Both the EIE and Natref are making use of SAP EDMS.

4.5.5.10 Knowledge Management (KM)

KM in the Sasol environment strives to add to business value through continuous business improvement and by constantly developing organisational capability development of people and groups. Past experiences are used to improve future business performances through the capturing and sharing of essential knowledge in knowledge bases.

Taken from a KM information pamphlet, the KM strategy focuses on the following "knowledge objects" within Sasol Technology:

- "Knowledge contained in documents e.g. process descriptions, technical studies, research reports etc. The strategy targets both electronic and hardcopy documents.
- Knowledge contained in IT systems or IT objects e.g. BD&I intranet pages, forums, blogs, FAQS, etc.
- Knowledge contained in people. People have competencies and experience that can be shared and transferred. The KM strategy is to make known the experience, competencies and contact information of people and establish people networks around competencies." (SASOL: What is Knowledge Management?)

4.5.5.11 Conclusion of Document Management narration

The advancement of the DM function to support all the relevant stakeholders in the execution of projects as described in this section accentuates the following two conclusive interpretations.

The first conclusion is the complexity of the environment and the large number of role players with document related roles and responsibilities. There is a risk of actions being duplicated or confusion by stakeholders of where certain deliverables lie. Documents are critical in the execution of projects for internal project team members as well as outside stakeholders, because people need to act on these documents. An integrated document focus that is sensibly linked to organisational objectives can mean the difference between the success and failure of the overall business objective.

Secondly, there are areas of concern identified but the process of addressing these shortcomings is very slow. Although huge progress has been made since the early 2000s, there are still areas of concern to make this DM function as purposeful as required. One fundamental truth is that an innovative business design, as is the case with the Sasol Technology project execution model, can very quickly become obsolete when a new

technology or business trend is included in the market place. Therefore two key areas that must constantly be re-examined are changes in the technological environment and changes the business trends and needs. Sasol Technology needs to effectively use and manage its project related information which will ensure that the information is secure, accurate and appropriately used.

4.6 Conclusion of Secondary Data Findings

The scrutiny of the secondary sources in this chapter provides the background and the progress made with regard to setting some requirements for a standardised DMS for the execution of projects throughout the entire life cycle of a project. The understanding of the environment and organisational interfaces in which projects are executed puts the complexity of the task to deliver an exceptional DM service to all the stakeholders in the project in context.

CHAPTER 5 DOCUMENT MANAGEMENT IN SASOL – PRIMARY DATA FINDINGS

5.1 Introduction

This chapter scrutinises the Sasol Technology environment in terms of the current DM practices. It explores how the various role players/functions interact and conduct their business within the project environment of Sasol Technology in Sasolburg as the owner company. Current DM practices and procedures are appraised by means of interviews conducted with a pre-selected and targeted population of role players involved in the execution of projects. The key findings from these interviews are included in the first portion of the chapter. The latter part of the chapter consists of the findings of the e-mail survey submitted to the whole Project Management and Controls group of Sasol Technology. The emphasis is on how to optimise and integrate a better DM service to the Sasol Technology Project Management and Control function.

Figure 5.1 indicates the complexity of the document flow in the project management environment. The DM function is responsible for rendering a service to all the role players in the project team with Project Management as the primary client. The majority of the documentation goes through the Project Management Office, but as indicated in the flow diagram, there is also documentation that flows within functions and directly between the different functions. It is important to ensure all this documentation is managed as required to fulfil the governance requirements. The document flow within each of the functions consists of a similar document flow diagram as the flow indicated in Figure 5.1 and to try and visualise a document flow twenty times more complex than this diagram just underlines the importance of a proper DMS to avoid total chaos and confusion.

The document flow between the project management office and the project service providers is governed by the terms and conditions as stipulated in the individual contracts agreed for each project. This research does not include the document flow of the service providers, except for receiving documentation from them and transmitting documentation back to them. A similar and sometimes more complex document flow exists for the service providers.

The documentation flow between the various functions as indicated on this diagram can be seen in an analogy where veins connect the different functions of the project body. If any connection within the system is lost, the project body cannot function properly and when the body breaks down, the project will fail.

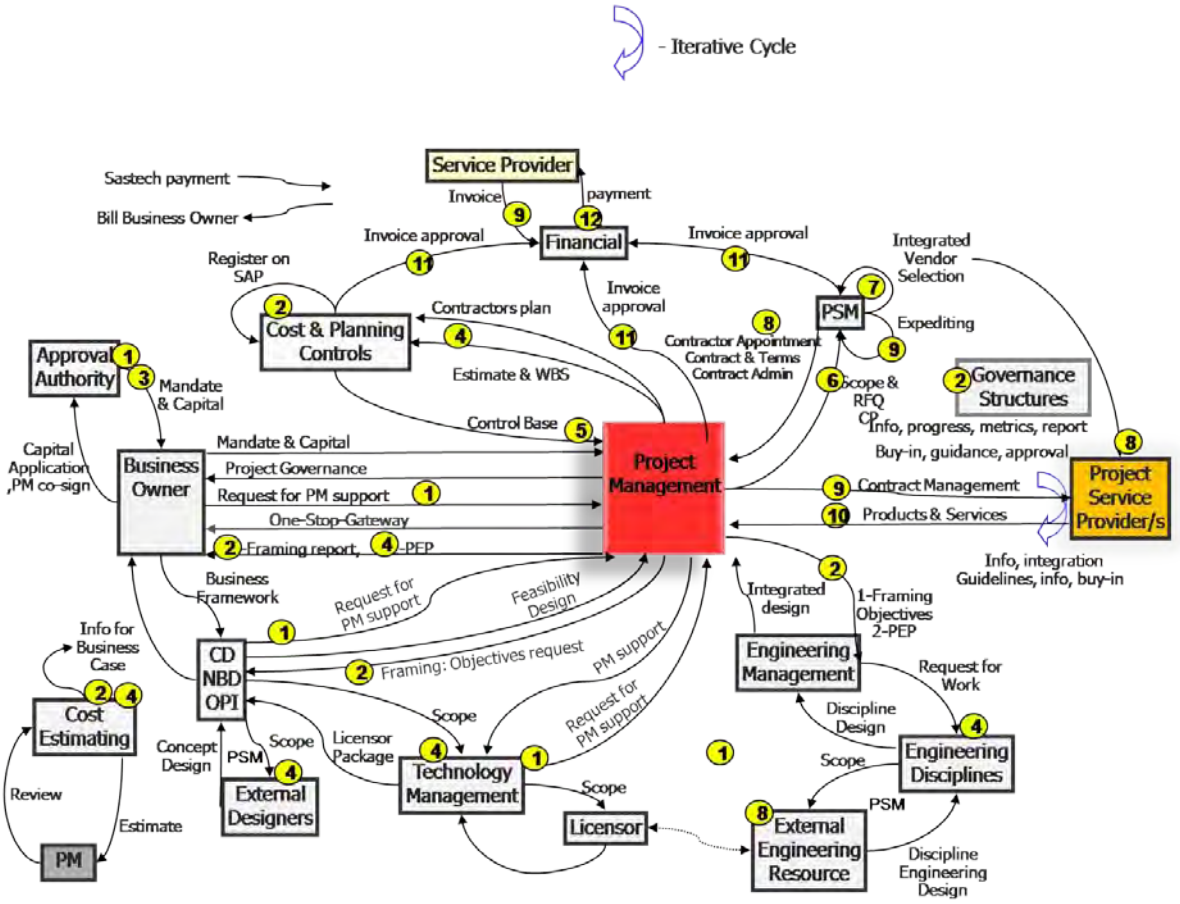

Figure 5.1: Typical flow of Project Documentation

(Sasol, 2009a:27)

5.2 Primary Findings from Interviews with the Various Role Players

5.2.1 Introduction

Interviews were set up with representatives of the following Project role players:

- Portfolio and Function Governance Group.
- Information Management
- Project Management
- Planning and scheduling
- Cost Estimating
- Commercial and Legal
- Cost Engineering
- Environmental and Risk Engineering
- Commissioning
- Engineering Management
- Plomic
- Sasol Approved Inspection Authority (AIA)

5.2.2 Portfolio and Function Governance Group

The lack of a structured function for the period 2004 to 2008 is illustrated in the secondary findings. The resources which developed the procedures during this period as part of a Centre of Excellence are currently residing under the Sasol Technology Portfolio and Function Governance group.

An interview was held on 21 January 2010 with two specialists in DM residing under the Portfolio and Function Governance, Mrs Trudie Botha and Mr Jacques Steyn. A telephonic interview was also held with Mrs Sarie Nieman, who was part of the DM Centre of Excellence from 2004 to 2008. Mrs Nieman is currently the team leader for DM in Secunda for Programme and Growth Projects. She was an active contributor and part of the task team who developed the direction of DM in Sasol Technology. The following information was gathered from the interviews.

5.2.2.1 Life cycle Management and Workflow

The Portfolio and Function Governance group (Botha and Steyn: 2010) agreed that there is still no Life cycle Management of documents in place since the 2004 findings. The life cycle of all documentation in the projects' Livelink workspace needs to be agreed upfront with all the role players and then set up accordingly.

Mr Steyn (Botha and Steyn, 2010) noted that revision control is still a problem and the latest revisions are not always included in the system. The risk exists that the people are working on old revisions. This problem is considered more human related than systems related.

The Portfolio and Function Governance group (Botha and Steyn: 2010) also confirmed that the metadata requirements is not in place for retention, disposition and archiving of project documentation.

5.2.2.2 Classification of Information

There was originally no standard and fixed filing structure. There were up to seven separate structures according to the BD&I Model. The 'phases' filing approach was replaced with a single structure and had a maximum of three fixed levels which are applicable to all the different BD&I Model phases. Various workshops and discussions with all the relevant stakeholders were held to determine the best suited categorisation for the

filing structure as we know it today. The filing structure consists of the following folders:

"01. Business/Operations
02. Integration Management
03. Process
04. Mechanical
05. Piping
06. Electrical
07. Instrumentation/Controls
08. Civil
09. SHE&R Management
10. Engineering Coordination
11. Construction Management
12. Scope Management
13. Time Management (Schedule)
14. Cost Management
15. Quality Management
16. Human Resources
17. Risk Management
18. Communications
19. Procurement Management
20. Handover & Commissioning
21. Lessons Learnt" (Steyn, 2008)

Although the filing structure is developed and in place, it was gathered from the different interviews held with all the relevant stakeholders, that the structure can be customised and optimised as per the various business specific requirements and needs. Mrs Nieman and her fellow team leaders are currently busy with the updating and optimising of the existing project filing structure. (Nieman, 2010)

5.2.2.3 Document naming and numbering

Documents filed in the standard project filing structure should be renamed for retrieval purposes. Typical document types should be pre-agreed and set up in the categories. The Portfolio and Function Governance group (Botha and Steyn: 2010) acknowledge that this has not been finalised yet.

5.2.2.4 Registration

Mrs Botha, Mr Steyn (Botha and Steyn: 2010) and Ms Nieman (2010) agreed that 'forced registration' would be ideal and should be investigated. Previously attempts to force the registration process by making use of attributes and classification did not succeed. System difficulties contributed to changes to the Livelink register where a separate registration form is filled in to initiate the registering process. The Portfolio and Function Governance group (Botha and Steyn: 2010), however, believes that the problem should be eliminated with the recent Livelink upgrade. During a meeting with KM it was established that KM currently register documentation successfully using attributes and classification. Ms Nieman (2010) on the other hand disagrees with the implementation of categories and attributes, and feels sceptical about the success claimed by KM.

5.2.2.5 Distribution

Ms Botha (Botha and Steyn: 2010) suggest that a standard DM plan should be designed that will be a project specific procedure, providing DM detail in relation to the distribution matrix. The objective of such a DM plan would be to:

- "Develop a correspondence strategy to engage the identified stakeholders with accurate, consistent and timely information.
- Identify and describe existing document control systems and RM processes.
- Provide recommendations, a list of deliverables, and a schedule for implementation of the current information processes, as well as proposed future services.
- Develop and generate lists of indices of documents and records.
- Orientate participants on the usage and benefits of the existing document control and RM programmes.
- Train participants on the application and usage of the DM processes.
- Utilise this DM plan as the system description for existing information services.
- Establish centralised location for project files and utilise the applicable database for the central indexing system.

- Define roles and responsibilities of DCs.

- Identify those teams, roles or individuals which are (R) responsible, (A) accountable, (C) consulted and (I) informed on various aspects.

- Populate key leadership positions with personnel." (Steyn, 2008.)

5.2.2.6 Storage

The Portfolio and Function Governance group (Botha and Steyn: 2010) and (Nieman: 2010) concur that electronic submission and deliverables are the solution to many storage issues and that electronic document deliverables from the contractors and service providers should be clearly stipulated in contracts. Electronic archiving can still be managed but hard copy storage brings challenging constraints to the equation, such as lack of resources and storage facilities. To properly execute and manage the storing and archiving of hard copy documents can be an entire business on its own, and external document warehouses are a costly alternative.

5.2.2.7 Retrieval and Metadata Management

The Portfolio and Function Governance group (Botha and Steyn: 2010) and Ms Nieman (2010) concur that there is still no metadata in place. The search function in Livelink can be used with the retrieval process if a document is properly renamed when filed and registered. The Portfolio and Function Governance group (Botha and Steyn, 2010) agrees that metadata should be implemented to manage the life cycle of the project documentation.

5.2.2.8 Security and access control

Security and access control is in place and stipulated in the DM QMS340P. Access should not be allocated to individual persons but to groups. Security issues are well addressed with permission control. (Botha and Steyn, 2010) This was also confirmed by Nieman (2010).

5.2.2.9 Archiving, Retention and Disposition

The Portfolio and Function Governance group (Botha and Steyn: 2010) concurs that there is

up to now still no clear indication of documentation that should be kept as records and for how long. The outcome is that existing records seldom get destroyed. The development of archiving, retention and disposition policies for DM are not developed. (Botha and Steyn, 2010)

5.2.2.10 Summary from interviews held with the Portfolio and Function Governance Group and with Ms Nieman.

Valuable information was gathered and a brief summary of the findings from the interviews held with Ms Botha, Mr Steyn and Ms Nieman can be summarised as the following:

- Revision control is still problematic due to human factors.
- There is still no life cycle management of documents in place.
- There is no metadata in place to manage retention, disposition and archival of project documentation.
- The filing structure can be optimised as per the various business specific requirements and needs.
- Typical document types to be pre-agreed and set up in the categories for proper re-naming.
- Investigate, design and implement a forced registration process.
- Suggest development of a standard DM plan for effective distribution.
- Focus on electronic submission and deliverables and electronic archiving.
- Hard copy storage and archiving are problematic due to space and resource constraints and very expensive to outsource.
- Security issues are well addressed with permission control.

5.2.3 Information Management - Livelink

A structured interview was held with Mrs Sandra Smook, IM consultant, on 09 December 2009. Mrs Smook (2009) provided general Livelink background information in line with the secondary findings captured in Chapter 4 which is not duplicated in this section. In particular, the uses of metadata with regard to registration and archiving processes, automated workflows and information on a planned archival server were explained. The allocation of permissions and search properties of Livelink was also discussed. Valuable information was gathered and a brief summary of the findings from the interview held is as per the bullets below. The Livelink system:

- can manage, store and track project information through the life cycle of the

project.

- reflects an audit trail while maintaining the integrity of project documentation.
- effectively enables users to administer, create, classify and manage both paper and electronic information and data.
- ensures accurate information delivery and DM required functionalities like version control capabilities, item level access control and checking in-and-out features.
- is used by almost all departments for storage and filing.
- has no separate archival server in place but planned for the very near future.
- has the functionality for metadata to be predetermined and set up to manage proper document life cycle management and to ensure forced registration processes that are not currently in place.
- can be slow due to the allocation of improper individual access instead of group access allocation.

During the interview Ms Smook (2009) also clarified the difference between categorisation and classification. Categorisation is needed when there may be more than one type of document, for example it may entail a plan, a report, Bill of Material, etc. The categorisation is therefore in other terms a form of metadata. For this to be meaningful, the generic minimum fields needs to be pre-identified. Classification (which is a separate module within Livelink), may entail information about the content of the subject, for example which plant, the equipment or the material, etc.

A brief description was also given on Microsoft SharePoint, which is the medium used to collaborate with external providers whereas Livelink access is for Sasol employees only. It is important to note that SharePoint is especially valuable for collaboration with live documentation over long distances to reduce document transmittal and turn-around times, but does not serve as a replacement for Livelink due to Livelink's enhanced archival properties, although these are not yet in place. The constraint of Livelink is the fact that you need to be connected to the Sasol server to have access. The controlled environment in which Share-Point information can thus be shared globally with all parties who are given permission and access, without transmitting or e-mailing the documentation, is however an added benefit to project teams with internal and external team members spread all over the world.

5.2.4 Project Management

A structured interview was held with Mr Ian Wilson, a senior project manager in Sasol Technology, in February 2010. Mr Wilson also has experience in managing projects for other owner companies and therefore has a wider perspective to assess how Sasol Technology and

in particular the DM department is efficient in managing project documentation.

Mr Wilson (2010) is of the opinion that Sasol Technology is overall doing well in terms of the management of project documentation in relation to best practices. There are, however, a few areas where improvement to the existing structure and procedures can make the service delivery to the project team even better.

There is a degree of uncertainty in the boundaries of the roles and responsibilities of the different functions within the different Sasol businesses which all have some accountability in the management of documentation. The Sasol Technology DM department, the Portfolio and Function Governance group, Plomic, the EDC and KM all have some role to play and it is not always clear which function to contact for certain documentation issues. Mr Wilson (2010) feels that there are opportunities to optimise the current work procedures, maximise synergies and eliminate duplication, and by doing this have more resources available to deliver the same results. Mr Wilson also suggested that the documentation should be available on the Livelink server as well. Currently the Plomic department compiled a new draft proposal of the project documentation flow where the EoJ is not transmitted to DM but goes directly to the EDC who loads the EoJ onto SAP.

Mr Wilson (2010) is in general satisfied with the service received from DM and with the Livelink workspace for projects, but still keeps project documentation on his hard drive as well. It is easier to retrieve documentation when not in the vicinity of the Sasol server.

Mr Wilson only recently got to know the benefit of having metadata and is not aware of the required archival, retention and disposition practices in Sasol.

Valuable information was gathered and a brief summary of the findings from the interview held can be summarised as the following:

- Sasol Technology is overall doing well in terms of the management of project documentation in relation to best practices.
- Distinction between roles needs to be investigated, for DM function, the Portfolio and Function Governance group, Plomic, the EDC and KM and integration should be implemented to avoid duplication and better resource availability.
- Requires EoJ being stored on Livelink system before transmitting it to the EDC.
- Mr Wilson was in general satisfied with the DM service received.
- Mr Wilson stores project documentation on his PC's hard drive.
- Mr Wilson does not use Livelink at all due to lack of Livelink knowledge and training.
- Mr Wilson recently became aware of the benefits of metadata.

- Mr Wilson has no knowledge of retention, disposition and archival strategies in the Project Management Environment.

5.2.5 Planning and Scheduling

The Planning and Scheduling department is responsible for creating, updating and tracking schedules to track the progress on projects as well as to assist in managing and levelling the resources of the Sasol Technology project group at large. The management of schedules by a contractor, and execution of these projects are also done by this function. During an interview held in December 2009 with Mr Polly Massyn, team leader of the Planning and Scheduling department, the following information was gathered.

The Planning and Scheduling department makes use of the Livelink project workspace and project folder, and uses the DCs as per the requirements. Mr Massyn (2009) experiences the cooperation and document integration between Planning and Scheduling department and DM as satisfactory. There are currently planning deep dives (in depth quality inspections) designed according to IPA requirements to audit the deliverables of the Planning and Scheduling department. The results of these deep dives confirm the statement by Mr Massyn that the DM support is in place. There is, however, a need for an integrated document deliverable schedule that is not currently in place. Such an integrated document deliverable schedule will empower a DC to proactively drive and harvest project documentation according to the indicated milestones, leading to on-time document population and better support to the project manager.

The key findings of the interview with Mr Massyn (2009) are as per the bullets below. The Planning and Scheduling department:

- is satisfied with DM cooperation, service and integration.
- is satisfied with the layout of the standard project filing structure.
- makes use of the DCs for filing on Livelink project workspace and structure.
- knows the metadata requirements and recognises that this is not in place and can add value to document categorisation.
- identifies the need to properly plan and implement an integrated document deliverable schedule, which is not currently in place, to enable the DC to proactively harvest project documentation.

5.2.6 Cost Estimating

The Cost Estimating department is responsible for providing/determining an independent estimated cost for a specific project. These estimates are derived from historical cost contained in the in-house Sasol Technology database, as well as factors to be applied to suit specific project objectives. Data from previous estimates and actual project costs in relation to as built information gets used to determine estimated project costs. In an interview held with Mr Neels Botha, a senior cost estimator, on 15 December 2009, he explained the cost estimating role as very similar to quantity surveying (with the exception of monthly measurements done on site by the quantity surveyors, which are not done by the Cost Estimating department.)

Mr Botha (2009) verified that the Cost Estimating function does have a Livelink workspace where estimates get stored and makes use of the Livelink functionality. This is separate from the project Livelink structure and not accessible to other project team members. The back-up information of the completed estimates is, however, stored as hard copies in cupboards in various offices. Due to cost cutting initiatives there are no resources available to do the data capture of the backup information of these estimates. Although the accountability of the department is to have estimates in place for project sanctioning, and not so much thereafter, the function relies on the DCs for project specific cost information and retrieval thereof in the project's Livelink workspace during the life cycle of the project.

Mr Botha (2009) stated that he is not aware of any archival or retention policies in place. There seems to be a general conception that data should be kept for 5 years. The Cost Estimating department, however, would like to keep certain estimating information for longer periods to assist with decision making.

The key findings of the interview with Mr Botha (2009) are as summarised below. The Cost Estimating department:

- makes use of their own space on Livelink for filing of estimates.
- stores estimates in hard copy format in offices and due to cost cutting initiatives there are no resources available to data capture the backup information of the estimates.
- relies on DC for project specific cost information and retrieval thereof.
- has no archival or retention policies in place.
- has no knowledge of metadata.

5.2.7 Commercial and Legal

The Sasol Technology Commercial and Legal department is primarily responsible for concluding, administrating and close-out of contracts to enable the execution of projects. In an Interview held on 4 January 2010, with Ms Tania Hartman and Ms Sylvia van Dyk from the Commercial and Legal department, the following information was gathered:

Ms van Dyk (Hartman and van Dyk, 2010) indicated that in an attempt to move away from duplication and storing documentation on hard drives, their own Livelink workspace was set up and made available for storage and updating of working documentation for the department.

Ms Hartman (Hartman and van Dyk: 2010) said that restricted access is in place for project contractual documentation (contracts, purchase orders and change orders) on their Livelink workspace. Final project contractual documentation is scanned by the Commercial and Legal department and is sent to KM with an accompanying form indicating the required metadata for the information. KM then registers and saves the documentation on another Livelink workspace and in return send the URL link to the Commercial and Legal department. There is uncertainty around the access requirements to this site and the link is not forwarded to the DC and thus not available to the project team. The signed contractual documents are required to be accessible to the project team to enable proper management of contractual requirements and to practise efficient cost control.

Regarding Request For Quotation (RFQ) to and quotations from service providers, Mrs Hartman (Hartman and van Dyk, 2010) felt it is the responsibility of the commercial officer to either load onto the project's Livelink workspace or to provide it to the project DC to scan and store the documents. This (distributing responsibility) is not, however, stipulated in any procedure as of yet.

Hard copy storage facilities are available on the Sasolburg site, but the contract/document safe is currently full and there is not any disposal strategy in place to free space for current and new contractual documentation. There is at this stage no disposition and destruction strategy in place but the general feeling is to keep original contracts between 7 and 10 years, once proper control is being exercised.

Ms Hartman (Hartman and van Dyk, 2010) identified one area as a concern and possible grey area with regard to the management of documentation and this is for Engineering, Procurement, Construction managing (EPCm) contracts, where an external consultant or contractor is managing the contracts for and on behalf of Sasol. To improve and ensure a better DM service and alignment, it was suggested to further investigate the procedures

and governance of these documentation, since commercial project documentation are kept with the EPCm contractors and not Sasol.

Valuable information was gathered and a brief summary of the findings from the interview conducted can be summarised as follows:

- Sasol Technology Commercial and Legal department uses their own Livelink workspace as storage medium.
- Restricted access is in place for project contractual documentation.
- Metadata is in place and done by KM on behalf of the project.
- Agreement with KM is that once registered and stored, a link is to be distributed to the project team.
- There is misalignment between the Commercial and Legal department and Project Management's accessibility requirements.
- It is the responsibility of the Commercial and Legal department to load RFQs and quotations onto the project Livelink workspace or to provide it to the project DC. This (distributing responsibility) is not, however, stipulated in any procedure as of yet.
- EPCm contractual documentation is not available on the Sasol System.
- Physical hard copy storage facilities are limited with minimum space available.
- There is no disposition strategy in place for any hard copy documents.

5.2.8 Cost Engineering

During an interview held with Ms Charmaine Allison, team leader of the Cost Engineering department, the following information was gathered regarding the way in which the Cost Engineering department operates with regard to their documentation. A brief summary of the findings from the interview conducted with Ms Allison (2010) can be summarised as follows:

- Most of the project cost documentation is kept in hard copy box files in the offices of the different cost engineers.

- The Cost Engineering department has their own Livelink workspace for the filing of cost reports categorised with each cost controller's name/folder.

- Mrs Allison (2010) mentioned that the department anticipates keeping documentation for five years, though there is currently no disposition or archiving policies or practices in place. All documentation is stored in boxes and retrieval of any cost information is a cumbersome process. There is also no indexing of boxes and their content in place.

- The Cost Engineering department does not keep any invoices as it is retained by the Financial Department and approval of invoices is done on the SAP system.

- The cost engineers do not receive a link from KM to have access to the project contracts. Cost controllers obtain the original contract from the Commercial and Legal department, make a copy of it and keep the hard copy document in the project box file for reference purposes.

- Informing the DC regarding project close-out and capitalisation is not addressed in any costing procedure. This therefore never reaches the DCs and electronic storage and archiving can not be done.

- Because the Cost Engineering department keeps hard copies of all costing documentation, the DCs currently have to obtain the files from cost control to be able to scan in the documentation and file it on the projects' Livelink workspace for other team members to have access to it.. This is a problematic and manual process with no checks or balances in place and is not addressed in any procedure.

- Mrs Allison (2010) feels the ideal solution is to receive tenders from service providers on CDs which can be downloaded onto the projects' Livelink server with restricted access to applicable team members only. This may ensure better safety and confidentiality and be more cost and environmentally effective.

- In the interview a number of good ideas were exchanged to optimise the cost engineering project DM filing structure.

5.2.9 Environmental and Risk Engineering

An interview with Ms Adele Meyer, a safety, health and environment site leader and Dr Carin Tredoux, a senior industrial engineer, was conducted on 08 January 2010. The Environmental and Risk Engineering department's organisational structure was explained and discussed.

The department makes use of their Livelink workspace as a storage medium and has its own standard filing structure in place. This is required for ISO 14000 auditing purposes. There is some duplication of information between DM and the Environmental and Risk Engineering department.

Some documents are still retained as hard copies, but the focus is primarily to move towards full electronic filing. Livelink as a storage medium is a satisfactory solution to the department. Access to their own system is open to the whole group and there are no Livelink administrators. Where access rights are required, Dr. Tredoux (Meyer and Tredoux, 2010) is responsible for assigning access rights. In some instances the project DC provides assistance in assign group access, as she already has the details of the project team.

There is no immediate policy or strategies for the department to move and/or archive redundant/on hold projects from the Livelink site. The group does not have any metadata in place and the group agreed that the advantages of metadata and the benefits of using metadata are essential to ensure archival and disposition is done as required.

A brief summary of the findings from the interview (Meyer and Tredoux, 2010) can be summarised as the following:

- The Sasol Technology Environmental and Risk Engineering department uses their own Livelink workspace as storage medium.
- They are satisfied with Livelink as the filing and storage medium for documentation.
- There is duplication of information between the project DM and Environmental and Risk Engineering department.
- Documents are retained as hard copies but the focus is primarily to move towards full electronic filing.
- There is no immediate policy or strategies for the department to move and/or archive redundant and on-hold Projects from the Livelink site.
- There is no metadata in place.

5.2.10 Commissioning

During an interview with Mr Andrew Oosthuizen, Sasol Technology's Chief Commissioning Engineer, on the 21st of January 2010, he confirmed that the commissioning engineers store project related documentation in the standard project Livelink workspace. The Commissioning Engineering department makes use of Livelink and non-project related documentation gets filed on their own Livelink workspace. There is no hard copy storage or facilities in the department. In general, the department has no access to the SAP system and any document or technical requirements are requested from the project manager, who in turn makes use of the DC to retrieve these documents.

Commissioning is usually done by the Sasol Business Units themselves with support from the Sasol Technology Commissioning Engineering department. The storage of commissioning documentation for the other Sasol Businesses on Livelink is problematic since other businesses are not all licensed Livelink users. Access is therefore not possible. The distribution of project and commissioning documentation therefore poses challenging dilemmas due to both the technical misalignment and indefinite sharing and transmittal practices and differ amongst the various business units.

Mr Oosthuizen (2010) also expressed his concerns about the uniformity of the End of Job specifications. There is currently a separate specification for documentation in the Electrical Engineering department and in sometimes contradicts the overall End of Job specifications. The current specifications do not make provision for, nor include any Process and Safety Management (PSM) master data requirements, which constitute misalignment with the other Sasol Business units.

The information gathered in the interview with Mr Oosthuizen (2010) can be summarised as follows:

- The Commissioning Engineering department utilises their own as well as the projects' workspaces on Livelink.
- The Commissioning Engineering department is satisfied with Livelink as the filing and storage medium for project documentation.
- There is no hard copy storage or facilities available
- Other Sasol Business units are unlicensed to view documentation on Livelink.
- The contradiction in specifications as well as the misaligned roles and responsibilities between role players lead to much frustration
- The Commissioning Engineering department experience difficulties in providing or receiving international commissioning documentation.

5.2.11 Engineering Management

Dr Pieter Fick, a programme engineering manager for projects in the Sasol South African Energy sector, was selected to be the representative for the Engineering Management department due to his years of experience and his in-depth knowledge of the discipline and of Sasol Technology. Dr Fick was interviewed during January 2010. There is a matrix reporting structure in Sasol Technology, with reporting to a line function per discipline and also reporting to a project management system. This interview is representative of all the different engineering disciplines as well, because all engineering disciplines reside under Engineering Management for the execution of projects.

For project related communication and documentation Dr Fick (2010) makes use of the DC and the project Livelink workspace. There is no hard copy storage available and in use by the Engineering Management group. Dr Fick is of the opinion that hard copy storage has the risk of information being outdated and that it is also costly to store documentation in this format. His focus is rather on electronic filing and storage.

Dr Fick stores and files documentation on his PC's hard drive and has developed his own filing structure and breakdown according to his own identified requirement areas. He explained his filing structure according to a MindManager illustration that he had designed. These areas all entail legal aspects that are related to the Engineering Management department and include the following:

- Project Execution Plan (PEP), containing the Engineering Execution Plan (EEP)
- Philosophies
- Reviews - QMS 909W
- Standards and specifications
- Estimates
- Resource plan
- Engineering track quality plan
- Technical risk management plan
- Construction and commissioning support
- Meetings
- Scope
- Value Improvement Practices (VIPs) - QMS 923
- End of Job documentation
- Interface Management- QMS 503P (Fick, 2010)

Dr Fick justified the decision to store documentation on his hard drive and not on Livelink, due to access restrictions to the Livelink workspace. He travels on a regular basis to

consultants in Pretoria where there is no access to the Livelink server available. Dr Fick makes regular back-ups of his information to ensure continuation in case of any unforeseen circumstances or emergencies.

The benefits of metadata were discussed with Dr Fick as well as the advantages of electronic retention, disposition and archival practices. Dr Fick (2010) indicated that Basic Engineering Packages are kept for 5 years (preferably in electronic version).

To ensure improved alignment between DM and the Engineering Management department it is felt that it is of the utmost importance for the DC to attend the project kick-off meetings and that the document requirements, scope and quality aspects be clearly defined and understood by all parties involved. Dr Fick also stressed the importance of proper renaming of documentation for easy document retrieval in the Livelink structure.

The Plomic department resides within the Engineering Management portfolio. Dr Fick (2010) is however of the opinion that Plomic should be part of the DM function. He has the interesting view that, due to all the legal document requirements, DM should rather reside within the Engineering Management portfolio and not with the Project Management and Control portfolio.

The following is a summary of the valuable data gathered at this interview:

- No hard copy storage available and focus is on electronic filing and storage.
- Storage on PC's hard drive to have access when not connected to the Sasol server.
- It is of the utmost importance for the DC to attend the project kick-off meetings.
- It is important to rename documentation for easy document retrieval in the Livelink workspace.
- Plomic should be part of DM, and DM should reside under the Engineering Management portfolio and not with Project Management and Control.

5.2.12 Plomic

The Plomic department currently resides under the Sasol Technology Engineering portfolio. Plomic ensures the availability of Engineering Documentation (ED) throughout the life cycle of Sasol Technology projects. Engineering documentation consists of drawings, data sheets, operational, maintenance and engineering manuals, manufacturing manuals, catalogues, etc.

A Teleconference with the Engineering portfolio and Project Management and Control

portfolio was held in April 2009 to clarify the different roles and responsibilities between DM and Plomic. The following information was documented and discussed during the teleconference. The roles and responsibilities of the Plomic function were discussed and the following information provided. This function mainly focuses on:

- "Specify ED requirements.
- Identify and retrieve ED.
- Management of ED.
- Quality assurance and quality control on all ED during the life cycle of a project:
  - On all ED for Sasol Technology projects.
  - Ensure all ED is compatible with existing systems.
  - Specify ED requirements.
  - Ensure quality of ED, but not engineering integrity. Engineering integrity remains with the engineering disciplines.
- Ensure quality of ED is maintained through the BD&I gates, from Basic Engineering (gate 3) to hand over (gate 5).
- Handover of documentation for ED:
  - Ensure documentation deliverables are agreed upfront at project kick-off.
  - Ensure checklist for ED deliverables completed, comprehensive and correctly delivered.
  - Ensure redline drawings are incorporated into drawings.
  - Ensure ED is delivered as per Sasol specifications.
- Transmitting of ED to the Sasol Technology DC.
- Single point of entry for all Managing Contractors (MC)/Engineering Contractors (EC)/Evergreen Contractors and Sasol Technology engineers for ED.
- Identify drawings that are not available on the system or Micro-cards and ensure these drawings are developed.
- All project ED goes through the Plomic Inbox for MC/EC/Evergreen Contractors and Sasol Technology staff.
- Close out all unused ED during a project.
- Issue prints for Sasol Technology engineers, as well as MC/ECs.
- Retrieve drawings from SAP DMS and Micro-cards.
- Assist MC/EC/Evergreen Contractors and Sasol Technology staff to view ED." (Heineman: 2009).

During an interview held in December 2009 with Mrs Lea Diederiks, a Plomic technical officer, it was confirmed that the Plomic group also uses their own Livelink workspace to store their internal documentation, workflows, templates, etc. The Plomic function does not have any archival or disposition policies in place.

Plomic also has access to the SAP EDMS as illustrated earlier in the findings for the EDC. Plomic employees have SAP access rights to draw reports, check drawing statuses, view reserved drawings and can print drawings from SAP.

The information gathered from Mrs Diederiks (2009) as well as the findings from the teleconference (Heineman, 2009) can be summarised follows:

- Plomic focuses mainly on technical and engineering information and End of Job documentation.
- Plomic resides under the Engineering Management portfolio.
- Plomic makes use of its own Livelink workspace for storage of internal documentation.
- Plomic is not aware of any disposition policies or strategies.
- Plomic has access to SAP EDMS to draw reports, check drawing statuses, view reserved drawings and can print drawings from SAP.

5.2.13 Approved Inspection Authority (AIA)

Sasol Infrachem has an inspection function for projects that require an independent 3rd party inspection department to fulfil all statutory inspection requirements. Some of these statutory requirements are that this authority, the AIA, retains project documentation for certain periods of time. An interview was held in February 2010 with Mr Otto Wenholdt from the Sasol Infrachem AIA.

The AIA department resides within the Sasol Infrachem Business. Electronic storage gets done on the SAP system with object linking to equipment numbers. There is no formal indexing available and no metadata in place.

The AIA has a hard copy store that is gas protected and access restricted. Storage racks are marked and numbered to ensure retrieval of information. Mr Wenholdt (2010) explained the term co-data as a photo of an event at a period of time and that one piece of equipment may have thousands of co-data books. The AIA mainly focuses on keeping co-data books and inspection reports, which are kept for the duration equal to the life span of the equipment. Legislation requires documents to be kept for 12 years.

Although the hard copy archive store is well kept and maintained, Mr Wenholdt (2010) experiences version and revision control as problematic, since there is no guarantee that he has received the latest information. Documentation is transmitted directly to the AIA and not through the formal agreed project document flow via the DCs.

The information gathered in the interview with Mr Wenholdt (2010) can be summarised as:

- AIA is part of the Infrachem Business in Sasol.
- The AIA uses SAP DMS as storage medium.
- There is no metadata in place.
- Documents are stored in a well controlled, gas free and access restricted area.
- Data is kept for duration equal to the lifespan of the equipment.
- There is no version and revision control in place.

5.2.14 Conclusion of interviews

The gathering of information from the interviews held with the key role players and experts gave good insight into areas where improvement and re-design are required. It became clear that different departments are responsible for various categories of documentation and duplication of information happens on a regular basis. There is a project Livelink workspace and also an internal workspace for the different functions working on a project. Documents are not uniformly managed by the different functions. Some functions make use of the project workspace, others use their function's own workspace and some even their own computers.

Documentation life cycle management is not in place and should be addressed in the Sasol Technology environment. Integration of the documentation management of these various departments, functions and structures will enable better, improved DM and accountability.

5.3 Primary Findings from Electronic – Survey Results

5.3.1 Introduction

The survey was designed, developed and sent out during February 2010 to the Project Management and Control portfolio group of Sasol Technology, consisting of approximately 300 members located in Secunda, Sasolburg and Rosebank.

The time allowed for the survey to be completed was one week, starting from one Wednesday to the next Wednesday to ensure availability of respondents is spread over two different weeks. The returned and completed surveys totalled 92 and represent 31% of the target population of the survey. This section summarises the results that were obtained from the e-survey questionnaires and responses are reflected in different charts and as percentages of the total responses.

5.3.2 Primary Findings

- ***Question 1: To which degree to you consider the project Livelink filing system user friendly?***

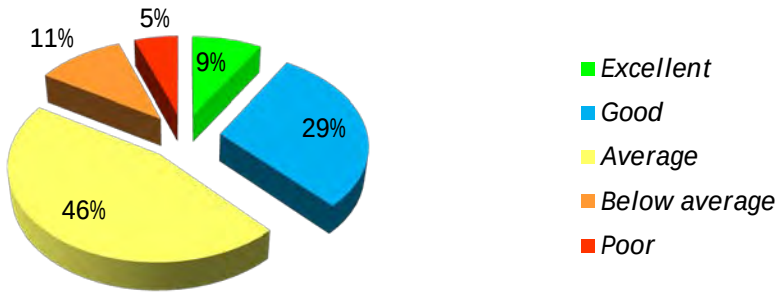

Figure 5.2: User friendliness of Livelink filing system

Most of the the Livelink system users (46%) experience the system as an average user friendly DM system and 29% of the survey population is of the opinion that it is good. Only 9% experience the system as extremely user friendly and on the other end of the scale, 5% feel the filing system is poor in this regard.

- ***Question 2: To what degree does your Document Controller provide you with Livelink assistance?***

The majority (48%) respondents to this question indicated that DCs provide good Livelink assistance in the Project environment, and 28% indicated they experience excellent Livelink assistance. 5 % of the respondents felt Livelink assistance was below average and only 1% indicated it to be poor.

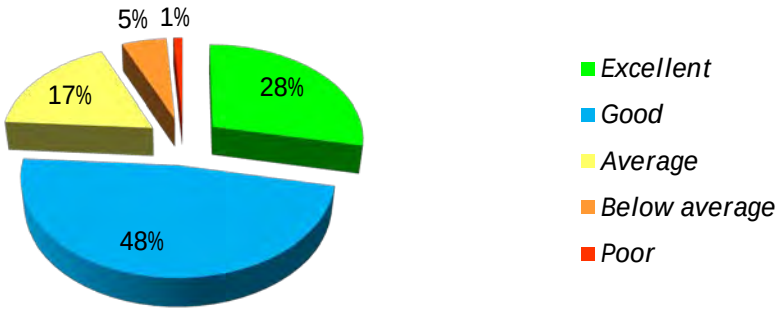

Figure 5.3: Document Controller providing Livelink assistance

- ***Question 3: Please rate the execution of the following basic Document Management practices:***

Table 5.1 and the column chart of Figure 5.4 indicate the overall satisfaction from the respondents on the basic services currently rendered to the project teams by the DCs.

Table 5.1: Table indicating overall satisfaction of basic DM practices

	Verification that documentation and /or communication are issued or received	Registering of project documentation on Livelink	Preparing Livelink reports on request	Tracking of documents	Scanning	Copying	Filing	Squad checking process	SPIR list coordination	Meeting document turn-around times	Proactive document harvesting
Excellent	15%	15%	14%	15%	38%	38%	34%	15%	11%	14%	15%
Good	51%	39%	34%	45%	39%	39%	38%	34%	28%	38%	33%
Average	23%	27%	36%	26%	18%	16%	23%	40%	51%	36%	40%
Below Average	8%	9%	10%	9%	3%	5%	3%	7%	4%	11%	10%
Poor	3%	10%	7%	5%	1%	1%	2%	4%	5%	1%	2%

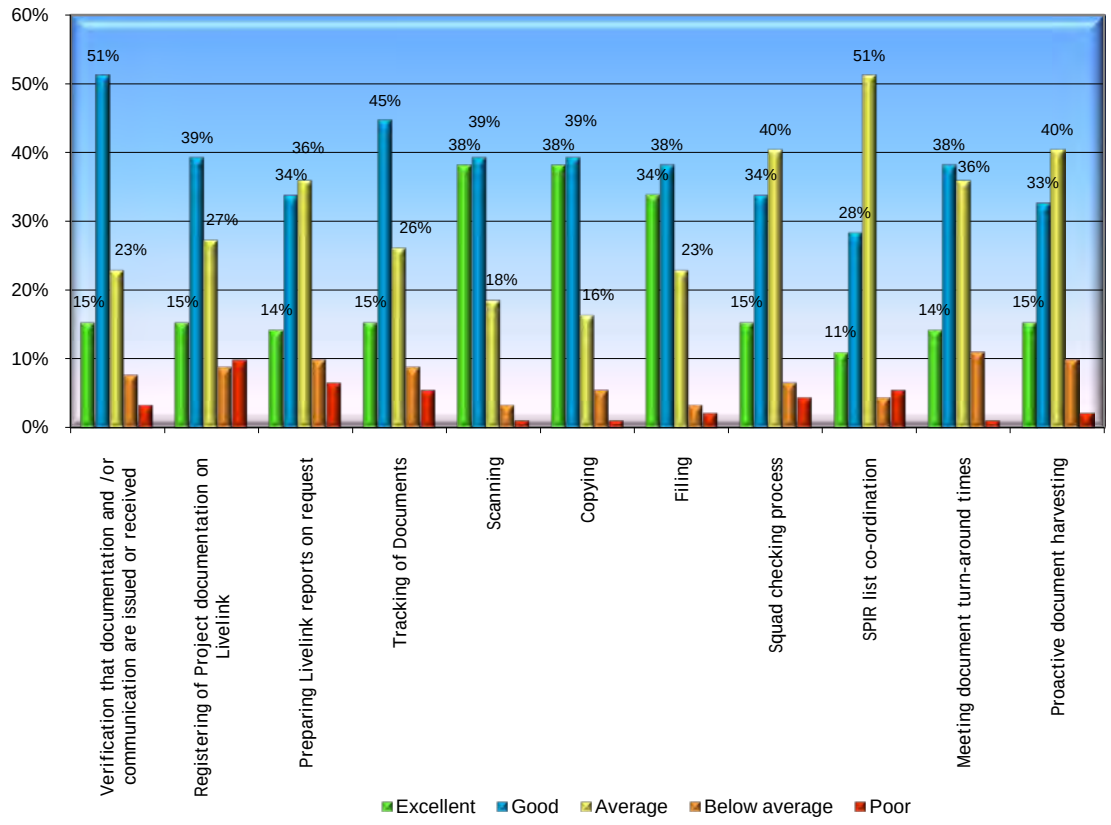

Figure 5.4: Overall satisfaction of basic Document Management practices

By applying a percentage as indicated below to the satisfaction ratings, these findings can be graphically illustrated in a scattered chart with a trend line to indicate the average satisfaction by the respondents for each of the DC deliverables.

The following criteria are followed:

Exceptional	= 90%
Good	= 70%
Average	= 50%
Below Average	= 30%
Poor	= 10%

Using the criteria, three of the DC services yield an average of more than 70% and can thus be indicated as the functions in which the DCs are performing really well. These three are the scanning, copying and filing functions. **Scanning** achieved an average of 73% and **Copying** 74% with 38% of the respondents rating both these services as excellent and 38% as good. **Filing** achieved an average of 74% with 34% of the respondents rating the service as excellent and 38% as good.

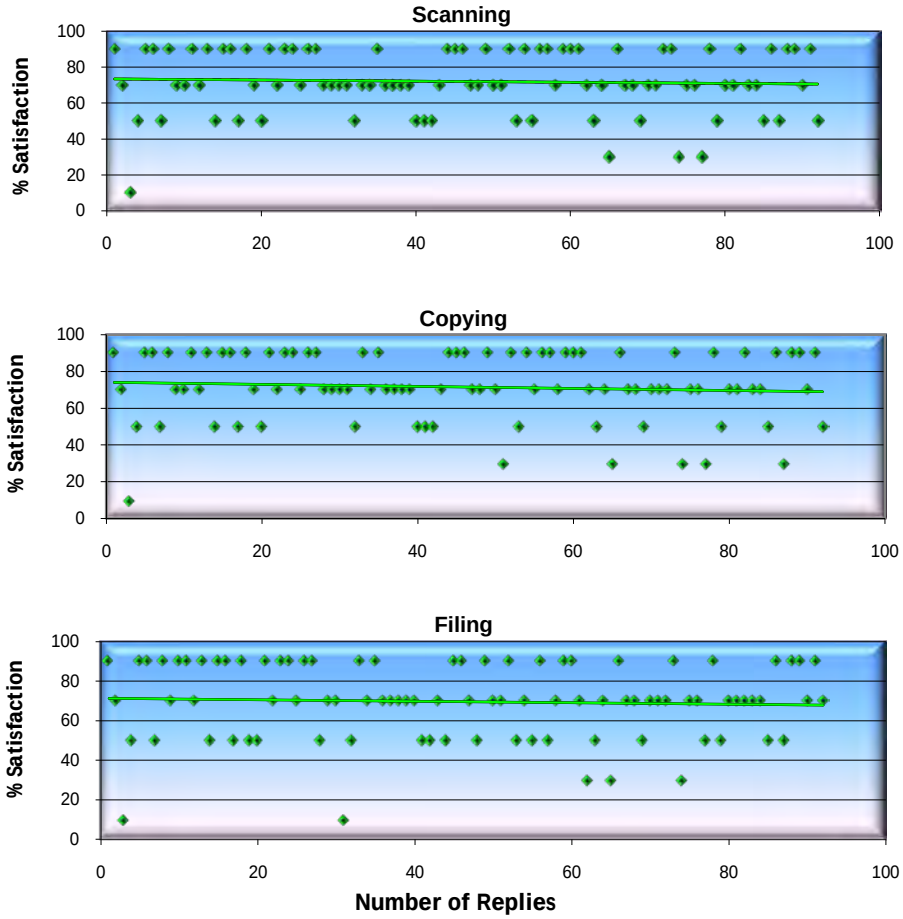

Figure 5.5: Satisfaction of Top 3 Services - Scanning, Copying and Filing

The following four services yield an average of 60% or more.

Verification that documentation and communication are issued or received achieved an average of 64% and **Tracking** of documents, the **Squad Check** process and meeting document **Turn-around times** all achieved a 60% average.

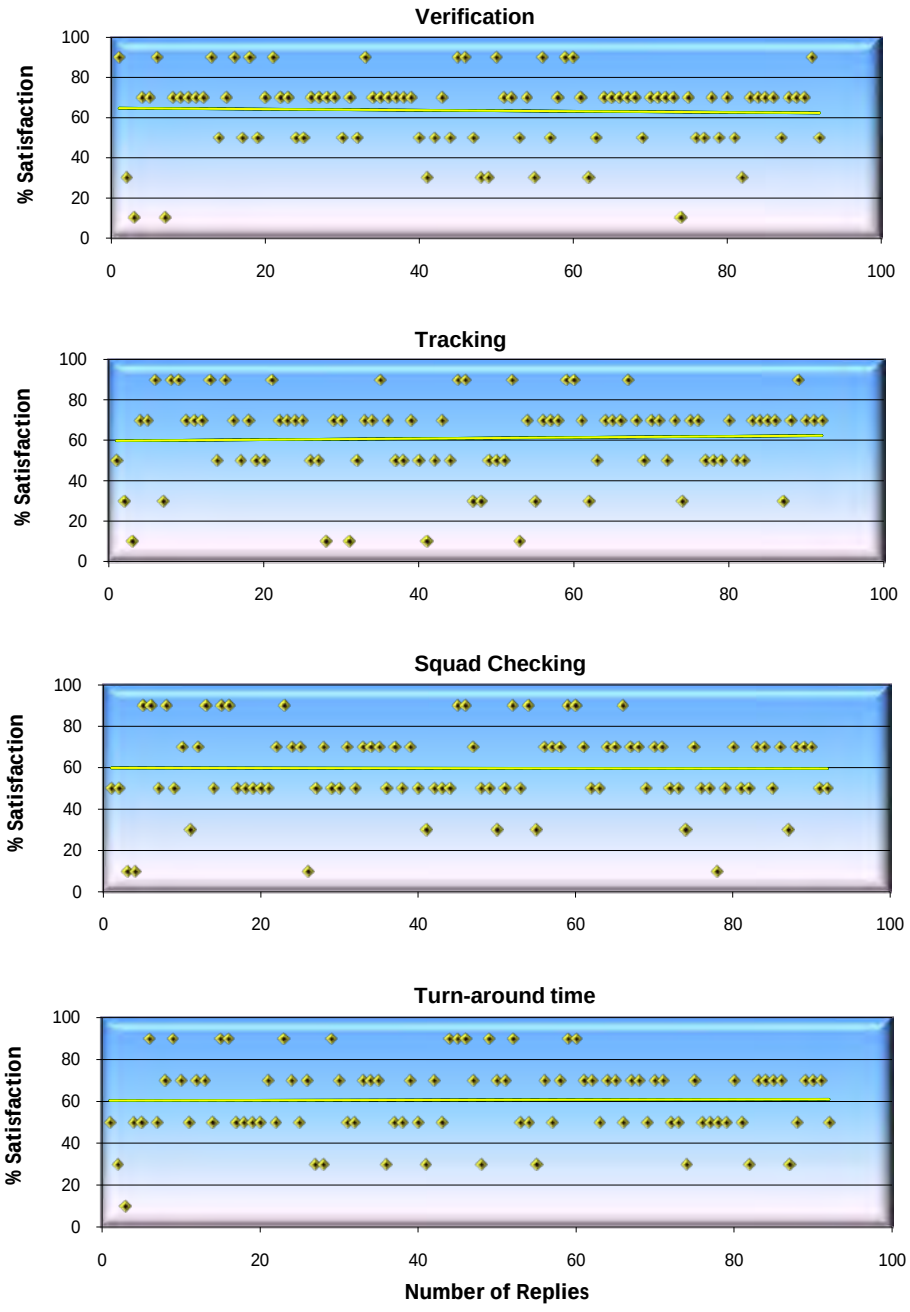

Figure 5.6: Satisfaction of Middle 4 Services - Verification, Tracking, Squad Checking and meeting Turn-around times

- 15% of the respondents rated **Verification** as excellent, 51% as good and 22% as average.

- 15% of the respondents rated **Tracking** as excellent, 45% as good and 26% as average.
- 15% of the respondents rated the **Squad Check process** as excellent, 34% as good and 40% as average.
- 14% of the respondents rated the meeting of **turn-around times** as excellent, 38% as good and 36% as average.

The four services included in Figure 5.7 yielded an average of 50% or more.

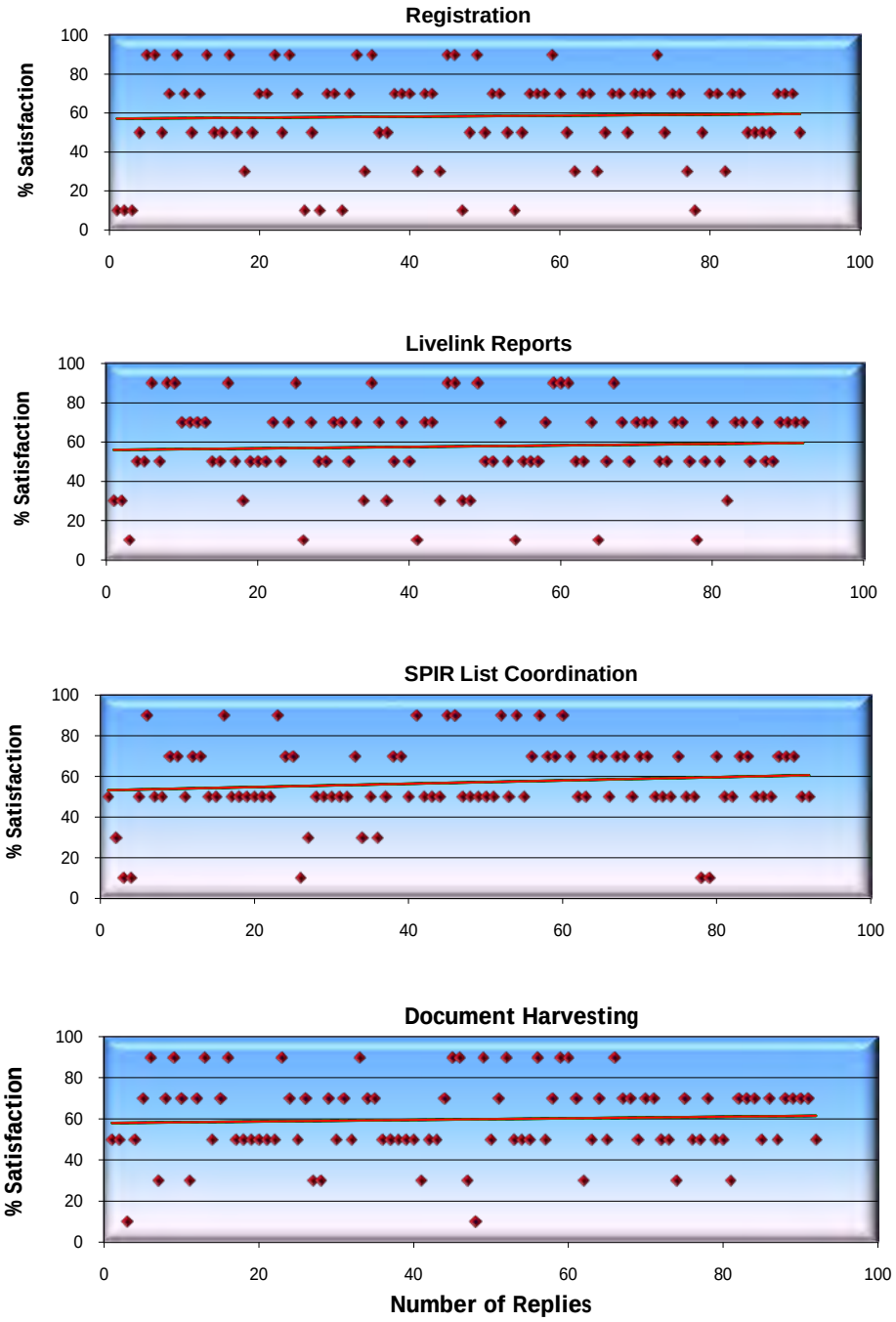

Figure 5.7: Satisfaction of Lowest rated services where development is required

- **Registering** of project Documentation on Livelink (57%). 15% of the respondents rated the service as excellent, 39% as good and 27% as average.
- Preparing **Livelink reports** on request (56%). 14% of the respondents rated the service as excellent, 34% as good and 36% as average.
- **SPIR List coordination** (53%). 15% of the respondents rated the service as excellent, 28% as good and 51% as average.
- Proactive **Document Harvesting** (58%). 15% of the respondents rated the service as excellent, 33% as good and 40% as average.

The **Registering** of project documentation on Livelink and preparing of **Livelink reports** on request are the only two services where more than 15% of the respondents rated the service as either below average (9% and 10% respectively) or poor (10% and 7% respectively).

- ***Question 4: To what extent do you rate the importance of the following statements:***
  - ***It is compulsory for DCs to attend project kick-off meetings***
  - ***Document Management service adds value to the overall project objective through the different phases***
  - ***It is important for project team members to have access to view the signed project contractual documents (without the rates) stored/filed in the DM project filing structure on Livelink***

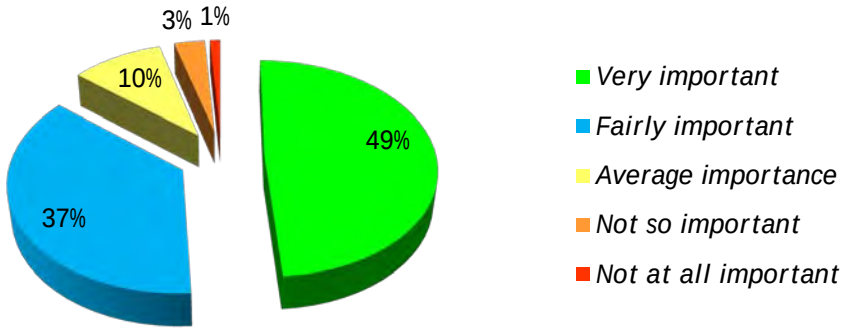

Figure 5.8: Document Controller to attend project kick- off meetings

The majority of the respondents (49%) indicated that they do agree with the statement that it is indeed very important that a DC attend the project kick-off meetings. 37% considered it as fairly important and 10% indicated the requirement as of average importance.

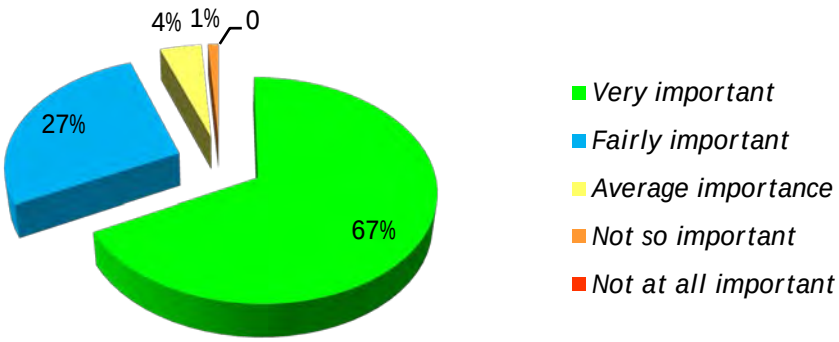

Figure 5.9: Document Management service adds value to the overall project life cycle

A large percentage of the respondents (67%) reflected the DM service adds value and deem it very important and 27% of the respondents indicated the service as fairly important. Only 5% of the target population fall in the bottom three ratings of importance and do not see the value of the DM service.

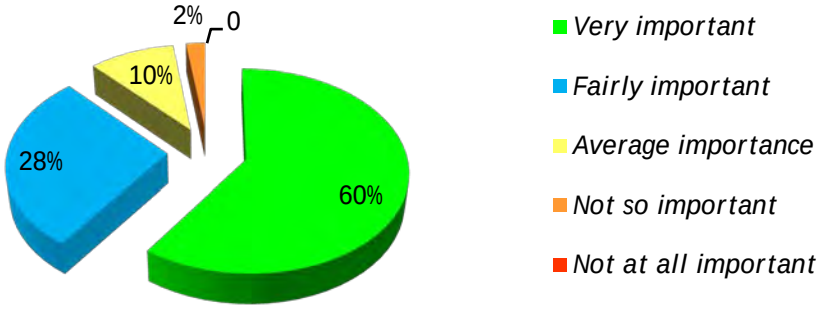

Figure 5.10: Access to project contractual documents

The majority of the respondents (60%) indicated it very important for team members to be able to have access to view signed contractual documents and 28% indicated the statement to be fairly important. 10% of the respondents rated the statement as average importance and only 2% reflected it as not so important.

- ***Question 5: Do you know which documents should be kept as records?***

The vast majority of the respondents (70%) indicated that they know which documents should be kept as records and 30% indicated that they do not know.

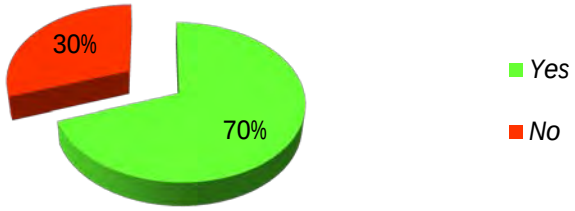

Figure 5.11: Knowledge of which documents should become records

- ***Question 6: Are you aware of any of the following in your environment?***
  - ***Project document retention schedules.***
  - ***Project document disposal policies.***

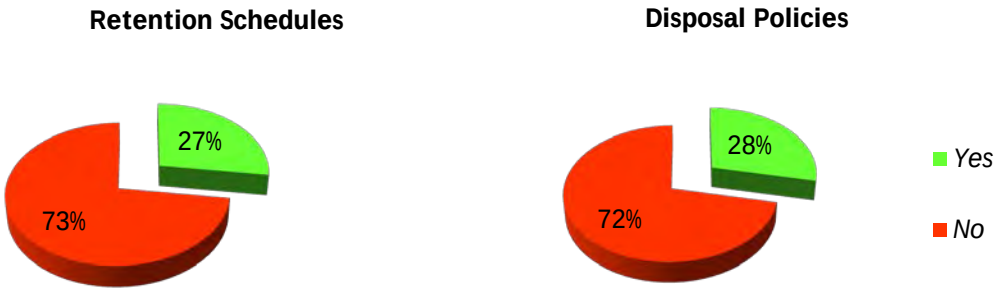

Figure 5.12: Knowledge regarding document retention and disposal

The majority of the target population (73%) are not aware of any project documentation retention schedules in their working environment and 27% indicated that they are aware of such schedules.

The finding is similar where a large percentage of the respondents (72%) indicated that they are not aware of any document disposal policies and 28% indicated that they are aware of document disposal policies.

- ***Storage/archival policies and facilities.***
- ***Metadata requirements (data describing context, content and structure of records and their management through time).***

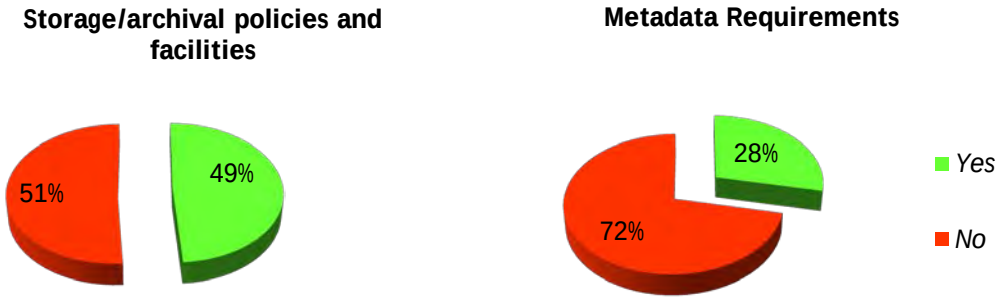

Figure 5.13: Knowledge regarding archival and metadata

51% of the returned questionnaires indicated that the respondents are not aware of storage and archival policies and facilities and 49% revealed that they are aware of storage and archival policies and facilities. This equal distribution may be due to the fact that the Secunda environment does have a hard copy paper bank facility for archival and the Sasolburg site does not have a general archival and storage facility. Many departments may have various storage rooms for hard copy storage but there is not a common facility or contract in place yet.

72 % of the respondents are not aware of any metadata requirements and 28% reported that they are aware of metadata requirements. The 28% response population are consistent with the groups that replied that they are aware of retention and disposal policies that go hand in hand with metadata.

- ***Question 7: Has your Document Controller explained his/her roles and responsibilities to you?***

The majority (78%) confirmed that the DC did explain their roles and responsibilities to the project team members and 22% indicated that it still does not happen.

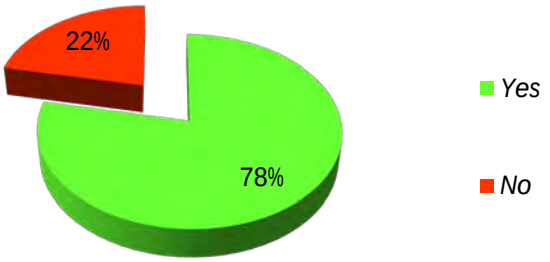

Figure 5.14: Knowledge regarding a Document Controller's roles and responsibilities

- ***Question 8: Do you still keep project documentation on your PC hard-drive?***

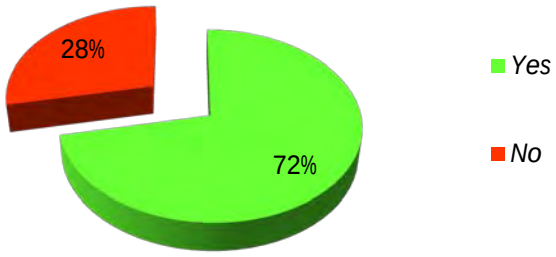

Figure 5.15: Storage of project documentation on Personal Computers' hard drives

The majority of the respondents (72%) still keep project documentation on their PCs' hard drives and 28% indicated that they do not store on their hard drives. There is a major information risk involved and project team members do not consider the risk of data loss when a computer hard drive crashes, or for any other unforeseen circumstances that might happen. It seems that the value of using a central depository where daily backups are done is not realised yet.

- ***Question 9: Do you receive a link from Knowledge Management to view Commercial and Legal's documents including signed contracts, change orders and purchase orders stored with Knowledge Online on behalf of Commercial and Legal?***

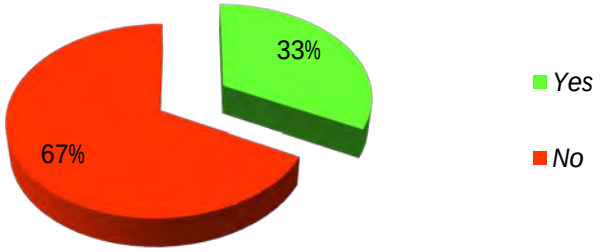

Figure 5.16: Link from Knowledge Management to view Commercial and Legal documentation

It was gathered from the interview with the Commercial and Legal department that commercial project documentation is stored by KM in the Knowledge Online workspace and that the link is sent to project team members for access to the document. The majority of the respondents (67%), however, indicated that they do not receive the link to the documents and 33% indicated that they do receive the link. This matter needs further exploration, since it is of the utmost importance for project team members to know and understand the content of contractual documentation to enable good project management.

- ***Question 10: To ensure availability of integrated project documentation, should each project function be made responsible for storing applicable project documentation directly into the Livelink project filing structure?***

A large sector (72%) agreed with this statement while 28% did not agree with it. Since the majority agreed, it is a good indication of integration and alignment opportunities between the various Sasol Technology departments.

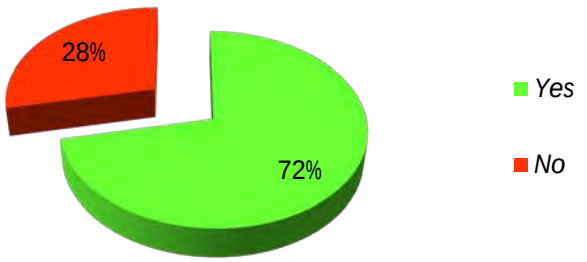

Figure 5.17: Functional integrated project documentation responsibility

- ***Question 11: Document Management service is currently limited to projects in the SA Chemical and Energy cluster, including NWT. To be able to take control of all project related documentation, do you agree/disagree that the following should be included:***

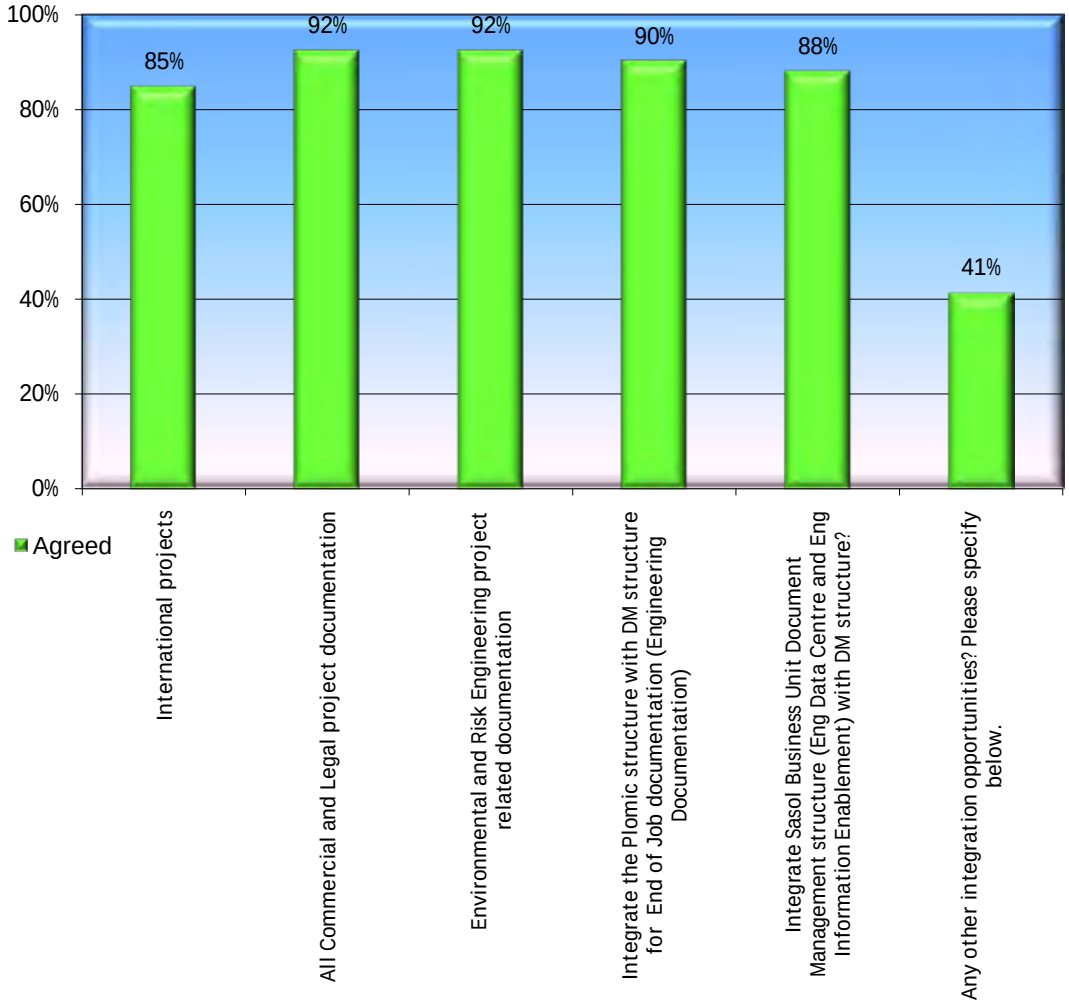

Figure 5.18: Document Management to take accountability for all project related documentation

The majority of the 92 respondents (85% or more) agreed that documentation which is currently not under the Sasol Technology Document Management's function or certain tasks done by other functions in support of the project team should be integrated into one management structure. The findings conclusively indicate the integration of the following project related documentation and or functions:

- DM for international projects (85%).
- Commercial and Legal documentation (92%).
- Environmental and Risk Engineering documentation (92%).
- Plomic (EoJ documentation) (90%).
- Sasol Business Unit Document Management Structure (EDC and EIE) (88%).

- ***Question 12: Please specify any other integration opportunities***

The following answers are directly quoted and taken from the open-ended question in the e-survey, in support of the findings from the previous question to test the need for integration opportunities.

- All DM and RM related functions should be managed by ONE department. The different departments can still co-exist but you need to have a centralised management area to exploit synergies and avoid duplication.

- Other 'disciplines' not purely Sastech - business, financial, etc.

- Currently we are having more than enough work, we cannot add.

- Does not have any integration opportunities to specify.

- It is difficult to centralise document control department. Working within teams is a good thing for high performance work teams. Our document support system is miles away from where things are happening and I think they are not adding value to us like before.

- All project document related functions to be managed under one management structure.

- Sasol Technology and the other Sasol Business Units for which Sasol Technology execute projects should be aligned with all project related standards and procedures. It is difficult for contractors to change their project deliverables for each and every Business Unit and thus creates frustration and at the end of the day Sasol pays more for the same result.

- All project related documentation management should be under one umbrella.

- On international projects where there is at least one partner that is not Sasol, we

need to have a way to integrate the document systems-this obviously in consultation with the business and JV partners. Also JVs on the international projects are independent of the Sasol Systems and require a separate DM system.

- ***Question 13: Please indicate the optimal workload for a DC for Tier 1 projects.***

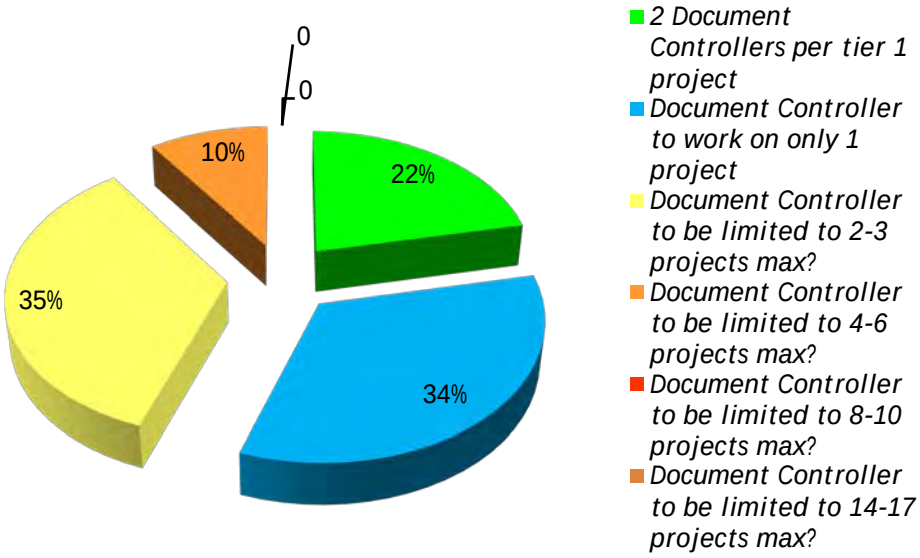

Figure 5.19: Optimal workload for a Document Controller on Tier 1 projects

The different tier classifications are indicated in Chapter 4 and one criteria for a Tier 1 project is that it may be interdependent projects within the project or programme with many interfaces and a cost of more than R3bn. With this in mind, 35% of the respondents indicated that the DC workload on a Tier 1 project should be limited to manage no more than 2-3 projects. 34% of the respondents were of the opinion that a DC should manage only one project when it is classified as a Tier 1 Project and 22% indicated that at least 2 DCs are required to manage the workload of a Tier 1 project. There are also respondents of the opinion that 10% can manage a basket of 4-6 projects Tier 1 projects.

- ***Question 14: Please indicate the optimal workload for a DC for Tier 2 projects.***

The majority (51%) indicated that a DC should be limited to manage no more than 2-3 projects with a Tier 2 classified project. 26% of the target population indicated that a DC should be limited to 1 Tier 2 project and 20% indicated that a DC should be limited to handle no more than 4-6 projects.

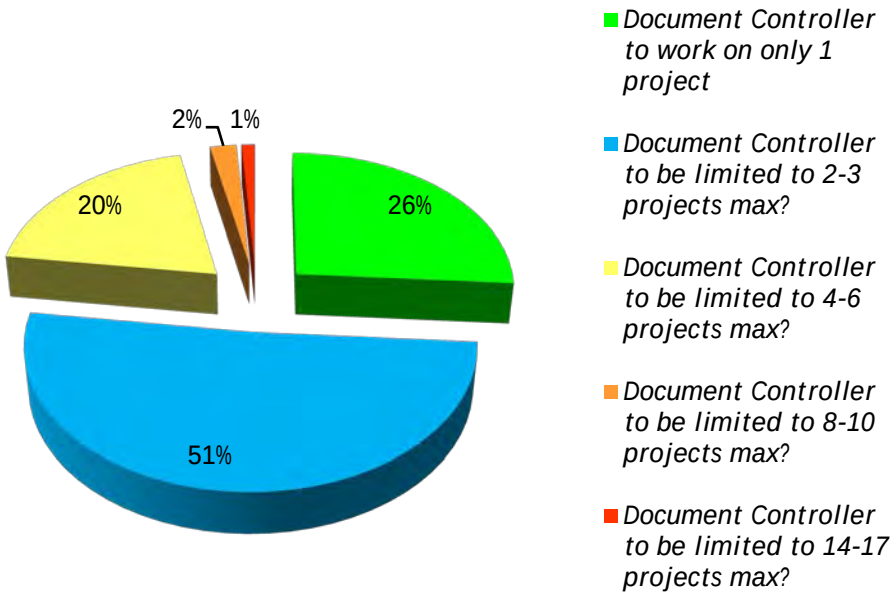

Figure 5.20: Optimal workload for a Document Controller on Tier 2 projects

- ***Question 15: Please indicate the optimal workload for a DC for Tier 3 projects***

39% of the respondents agreed that a DC should be limited to handle between 4-6 projects when working on Tier 3 projects. 32% of the target population indicated the projects should be either 2 or 3, while 17% indicated a DC can manage between 8-10 Tier 3 classified projects.

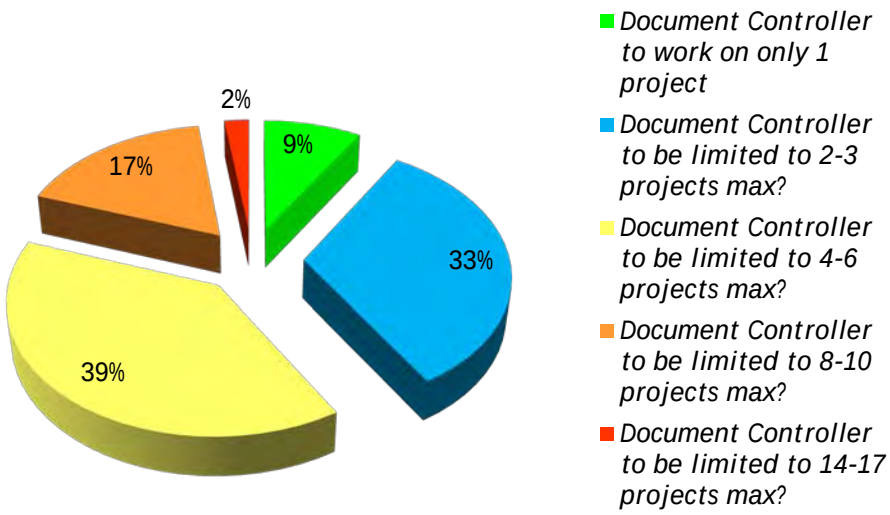

Figure 5.21: Optimal workload for a Document Controller on Tier 3 projects

- ***Question 16: Please indicate the optimal workload for a DC for Tier 4 projects.***

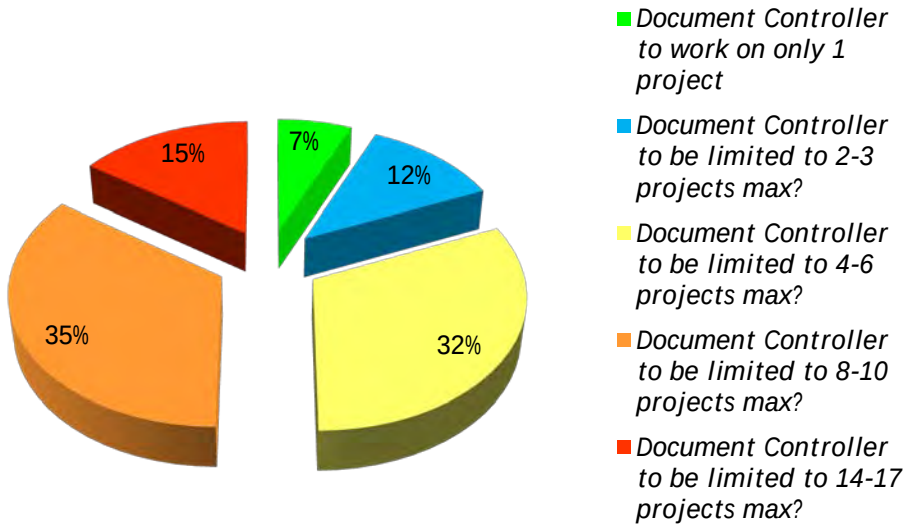

Figure 5.22: Optimal workload for a Document Controller on Tier 4 projects

The majority of the respondents (35%) indicated that a DC workload should be limited to 8-10 projects and 32% indicated that Tier 4 projects to 4-6 projects per DC.

- ***Question 17: To what degree of importance should the following processes be investigated?***

  - ***Automated Registration Process.***
  - ***Improved document tracking.***
  - ***Electronic Squad Checking.***
  - ***Optimise Version/Revision Control.***
  - ***Automated work flow as per a predetermined work flow design.***
  - ***Automated retention schedules notices and practices.***
  - ***Automated disposal notices and practices.***
  - ***DM requirements to be clear and captured at project kick-off meeting.***
  - ***Request a document deliverable schedule from Engineering Contractors/Planners at project kick-off.***
  - ***Move away from hard copies when electronic version is available/obtainable.***
  - ***Improved project Close-out procedure.***

- ***Keep on using Livelink as the storage medium and develop more functionality.***
- ***Investigate integration of SharePoint and Livelink functionalities.***

The responses to investigate the different options to optimise and in some cases automate the DM processes received a favourable result. The following 'very important' category responses can be used to rate the order of importance of the suggested areas for further investigation according to the results as indicated on the graph:

- Improved project Close-out procedure (59%).
- Move away from hard copies when electronic version available/obtainable (58%).
- DM requirements to be clear and captured at project kick-off meetings (58%).
- Request a document deliverable schedule from engineering contractors/planners at project kick-off (57%).
- Improved document tracking (55%).
- Optimise version and revision control (52%).
- Keep on using Livelink as the storage medium and develop more functionality (50%)

The responses indicating that these areas are not important are nearly negligible for all the different questions.

Although automated registration processes are indicated as only 38% of importance, it is a highly important factor, since registration needs to be done before improved document tracking and optimised version and revision control are possible.

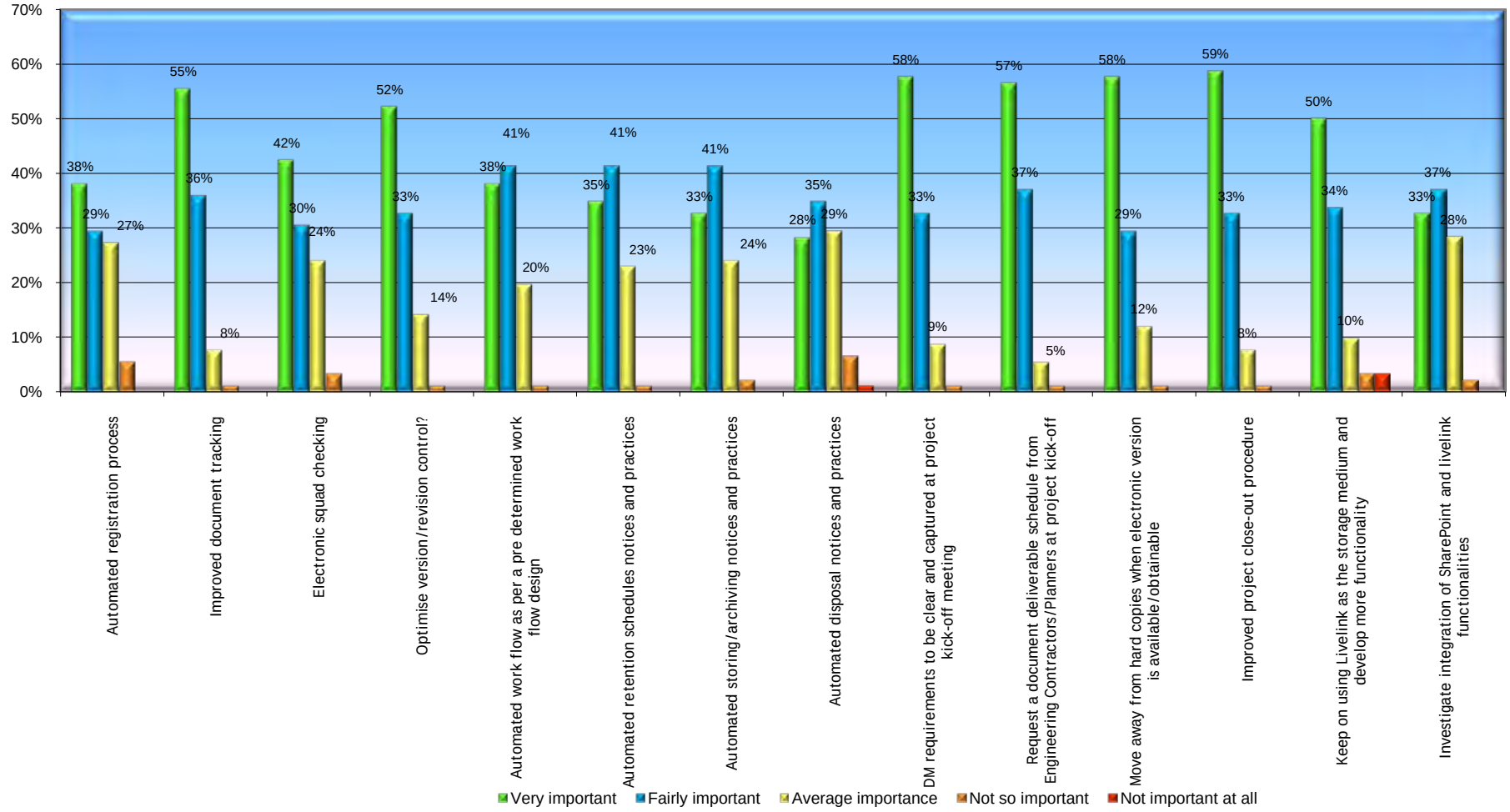

Figure 5.23: Processes to be investigated in Sasol Technology Document Management environment

- ***Question 18: How important do you consider the DC's role when assistinge with the following***:

  - ***Gate reviews***.

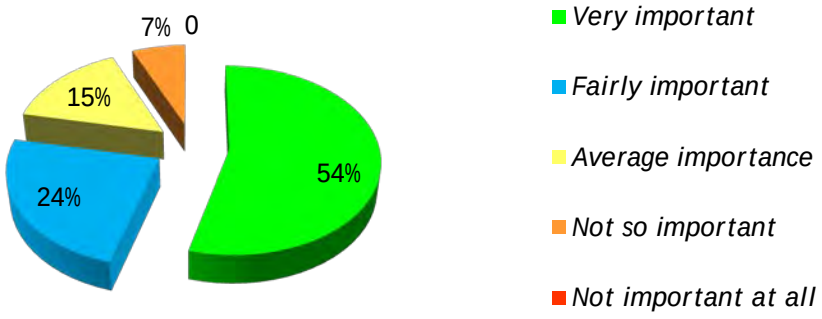

Figure 5.24: Document Controller's role during gate reviews

More than half of the respondents (54%) indicated that the DC's role is very important with gate review assistance and 24% agreed that DC's role is fairly important. 15% indicated a DC's role as of average importance.

  - ***Audits.***

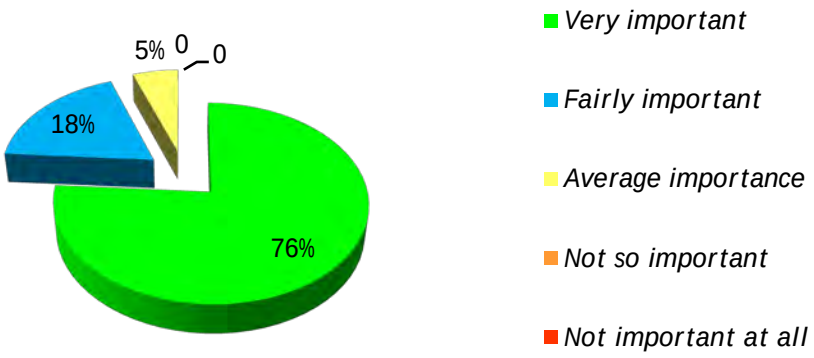

Figure 5.25: Document Controller's role during audits

Most of the respondents acknowledged the importance of a DC during audits and 76% indicated a DC's role is very important during audits and 18% of the respondents deemed it fairly important.

- ***Project document reports from Livelink.***

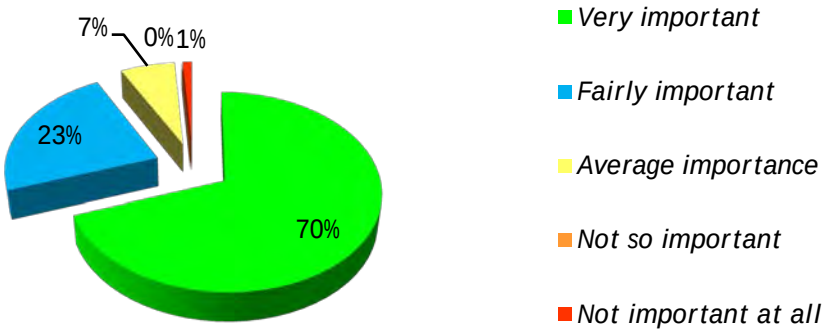

Figure 5.26: Document Controller's role in providing Livelink reports on project documentation

The fast majority (70%) of respondents also indicated the importance of a DC's role with regards to assisting project team members to obtain project documentation reports from Livelink and 23% rates it fairly important.

- ***Question 19: A document becomes a record when information is created, received and maintained as evidence and information by an organisation or person, in pursuance of legal obligations or in the transaction of business. Taking this into account, do you agree or disagree with the following Records Management (RM) statements?***

While only just more than half (62%) of the respondents are aware of the distinction between records and documents and claim to know which project documentation should be retained as records, nearly all the respondents recognised the importance of RM. The following excellent responses agree with the individual RM related statements:

- RM should be able to meet legislative and regulatory requirements including archival and audit activities (97%).
- RM should be able to provide required documentation to ensure business continuity in the event of a disaster (99%).
- RM should be able to provide protection and support in litigation including the management of risks associated with the existence of, or lack of evidence of project activities (99%).
- RM should be able to provide evidence of business (96%).
- RM should be able to maintain corporate memory (97%).

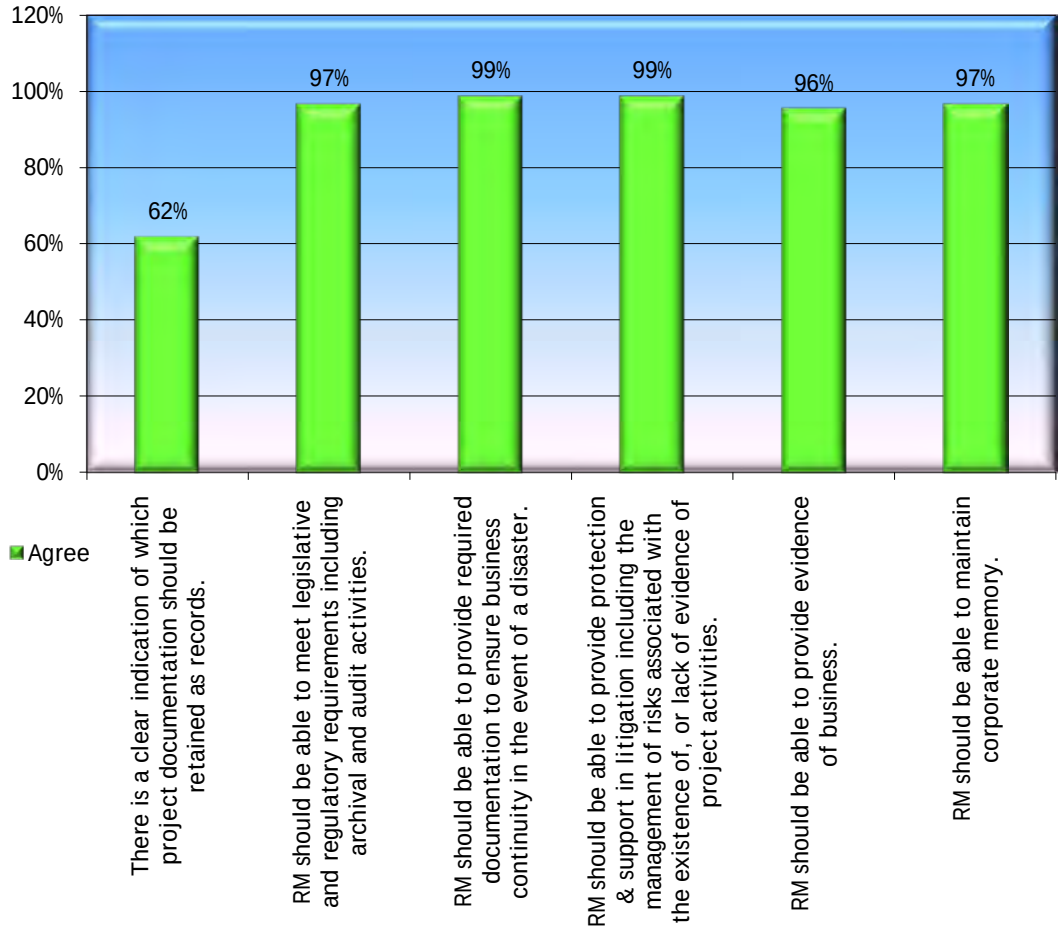

Figure 5.27: Record Management statements

5.3.3 Conclusion from the electronic survey

The results obtained from the analysis of the questionnaires are an augmentation of the information gathered during the interviews. The key findings are that the target population, which is a mix of different role players in the project environment, is in general satisfied with the service they currently receive from the DM function. There is, however, room for improvement to deliver a world class service. In sync with the interviews is the finding that documentation life cycle management is not in place and should be addressed in the Sasol Technology Environment. Integration of the documentation management of the various functions and structures will enable better, improved DM and accountability.

5.4 Conclusion of Primary Data Findings

Whereas the scrutiny of the secondary sources in Chapter 4 provides a background and the progress made with regard to setting requirements for a standardised DMS for the execution of projects, the primary data findings is an indication of how the project team members perceive the existing Sasol Technology DMS to be.

The findings from the electronic-survey substantiate some of the responses received in the interviews held with regard to service delivery. Opportunities for improvement and integration of various functions, areas and systems associated with the management of project documentation also emanated from the findings. This will be substantiated in the validation of the findings that follows in Chapter 6.

CHAPTER 6 VALIDATION OF SASOL TECHNOLOGY DOCUMENT MANAGEMENT SYSTEM AGAINST THE FRAMEWORK OF REQUIREMENTS

6.1 Introduction

Chapter 6 is a combination of: (1) a Framework of Requirements for a DMS philosophy, pertinent to owner companies executing projects, and (2) the validation of the Sasol DMS against this framework. After careful consideration the researcher designed and assembled the Framework of Requirements from knowledge gained during the literature survey in Chapter 2. The framework (illustrated in Fig 6.1) provides high level trigger points to be included when designing, optimising or implementing a DMS. The aim of the validation of the findings is to assess the comprehensiveness of the current Sasol DMS against the compiled best practices included in the Framework of Requirements. The validation should accentuate areas where recommendations can be made to improve the system. The validation of the findings will be done for the four main groups of the Framework of Requirements under the following headings:

- Governance
- Organisation
- Strategies and Systems
- Processes

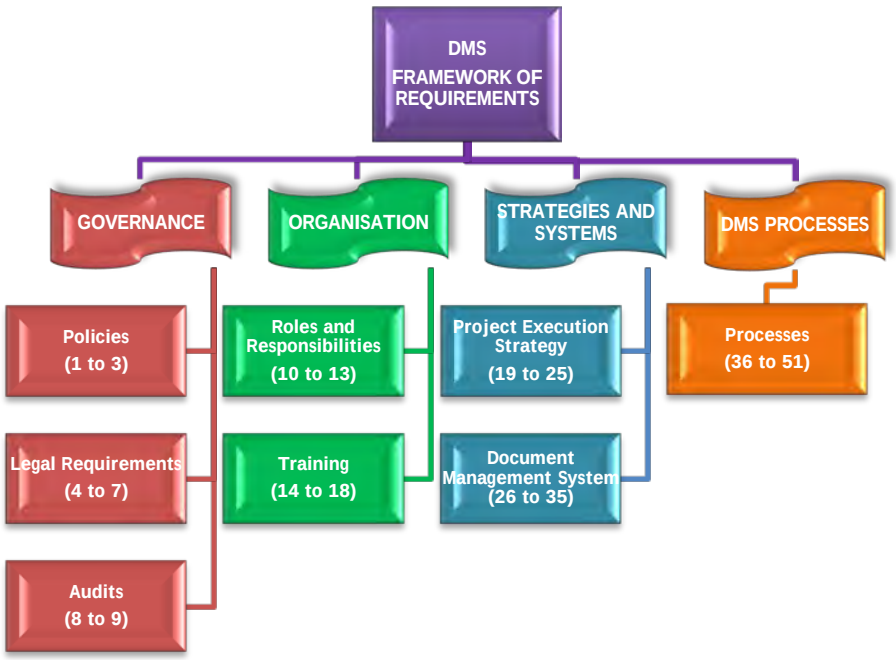

Figure 6.1: Requirement Framework Structure and Content

Each of the four categories is divided into subcategories with a number for each of the requirements. The validation of the Sasol findings is done for a single or group of requirements, based on the connection of either the requirements and/or the findings. The requirements also have a unique number (from 1 to 51) with the numbering continuing all the way through the four main categories. The chart illustrated in Figure 6.1 gives an overview of the structure and content of the requirement framework. The different aspects to be considered for the trigger points (which represent requirements) are provided in more detail in the Literature Study and are not duplicated in the high level requirements in this chapter.

6.2 Framework of Requirements and Validation of Sasol Document Management System (DMS)

6.2.1 Governance

Policies

1. *The owner company should promote a policy for the management of documents and records that is a forward-thinking dynamic directive, focusing on key project drivers, the company's strengths and opportunities, and the strategies it intends to pursue to benefit from these strengths and opportunities.*
2. *The owner company should ensure the policy is based on the minimum requirements of the applicable South African Standards (ISO 15489).*
3. *The owner company should ensure that well defined procedures are in place for efficient project support by guiding and establishing standard methods of managing information from various sources.*

- **Validation**

Sasol as the owner company does have a DM and retention policy for the Sasol Group of Companies. The objective of the policy is to "outline the efficient and systematic control of the creation, receipt, maintenance, use and disposition of information, documents and records, including processes for capturing and maintaining evidence of and information about business activities and transactions in the form of documents irrespective of their form, format or storage media." (Kruger, 2007:3.) This policy is in line with ISO 15489.

The Sasol Technology DM department has well defined procedures in place to indicate what standards are to be followed and how these practices should be executed. Several areas as indicated and discussed in Chapter 4, Table 4.1, need more design, development and

optimisation, but the general foundation of DM is present and sturdy. Special attention is, however, required to improve the RM capabilities within the current DMS. More than 70% of the respondents in the e-survey indicated that they are not aware of project document retention schedules or disposal policies and practices. Although they are not aware of the policies and procedures, nearly all the respondents agree that the RM practices are vital and should be implemented. The importance of communication of these RM policies and procedures ensures that everyone is aware of them.

Legal Requirements

4. *The legal system is a specialist area and legal advisers should be appointed to be responsible for creating a proper legal business framework which will be captured in the DMS when executing projects.*
5. *Identify the regulatory conditions that affect project execution activities and the legal requirements to document these activities.*
6. *Compile a checklist with the legal requirements to guide the project team through the maze of intricacies normally encountered when dealing with legislation, including audit and archival activities.*
7. *Each business Unit should determine which records are to be kept and for how long. Business activities should be analysed and legislative and regulative areas and statutory document requirements should be pre-identified and documented for each business area of the organisation. These identified requirements then have to be incorporated into the Project DMS to ensure ownership of all project related documentation and records.*

- **Validation**

Fig 4.2 in Chapter 4 demonstrates the holistic approach to RM in Sasol. A policy is in place that affirms that it is necessary for all companies within the Sasol Group of Companies to responsibly manage and retain documents. Taken from the interviews with the various role players, this policy conversely is not reinforced or rolled out to the entire Sasol Technology, which is the agent which executes projects for the other Sasol business units. This statement is amplified by the number of interviewees who is also not aware of the legal requirements for documentation.

The Sasol specification indicates the statutory requirements for documents during different milestones in a project (Form F617). Retention of this data is however nowhere addressed in the specifications. The exception is the Approved Inspection Authority (AIA), which has a retention strategy for all data sheets and inspection reports. Because the AIA falls within

the Sasol Infrachem Business unit, another interface is therefore created which diversifies the location and accountabilities of documentation. This is justified in terms of the responsibility and accountability of the AIA function retaining these statutory documents.

It was gathered from interviews with the various Project Management and Control functions that few departments have identified what documents need to become records with retention, disposition and archival requirements linked to them. 30% of the respondents indicated that they do not know which documents should be kept as records. It is anticipated that this requirement should be known by and communicated to everyone involved with project documentation, and therefore the 30% is indicative of a lack of knowledge.

Audits

8. Internal company governance structures and roles should be in place and reviewed and improved where necessary to align DM practices for all business sections and at all the different management levels.
9. The DC needs to assist the project manager by ensuring all pre-agreed documentation deliverables are signed off and that the documentation is populated in the project filing structure to ensure project documentation compliance during gate reviews and audits.

- **Validation**

An internal project document control review system is in place (QMS/307P, discussed in Chapter 4, Clause 4.5.6.6). In Sasol Technology, DM team leaders do monthly in-depth quality inspections to ensure DM compliance to required standards. This is followed by the pre gate document reviews done by the Portfolio and Function Governance group, all to ensure project documents support the gate readiness review. Should any further audits be conducted by internal or external parties, it is very likely that compliance is guaranteed.

In Sasol Technology the project manager indicates to the DC the expected and applicable project document deliverables and the agreement get signed off by the project manager at the beginning of each new phase of a project, and stored in the filing structure as confirmation in case of future reviews and for audit purposes.

Nearly all the respondents confirmed that the DM function is assisting the team when audits are performed and rated this function of the DCs as very important.

6.2.2 Organisation

Roles and Responsibilities

10. *Establish a DM functional structure with a mandate, budget, with well defined roles and responsibilities.*
11. *Ensure efficient and effective resource loading and levelling in relation to workload.*
12. *Identify all role players in the life cycle of a project who will contribute to the development and integration of deliverables to fulfil the objective of the project.*
13. *Integrate all records and DM related functions under one DM structure to capitalise on possible synergies and to eliminate duplication.*

- **Validation**

DM was never a function on its own, since the DCs reported to various project managers. The investigation to make DM a business function started in 2004 and the function only came to life as an individual business function in September 2008. Since then, Sasol Technology has a self-governing functional DM structure, with its own budget and clearly defined roles and responsibilities.

One of the big concerns is the workload, given the amount of live projects in relation to the DCs in the organisation. DCs are overworked and there is not enough provision to level the workload in relation to the amount of resources available. World class DM practices may be neglected or not executed at all due to time availability and resource constraints in relation to the workload.

Table 6.1: Sasol Technology Resource Matrix

Tier Classification	DCs per project	Number of Projects	Required DCs	Available DCs
Tier 1	1	11	11	-
Tier 2	2	26	13	-
Tier 3	5	88	18	-
Tier 4	10	186	19	-
Total		311	61	23

The e-survey results indicated on average that 1 DC should be able to manage either one Tier 1 project, two Tier 2 projects, five Tier 3 projects or ten Tier 4 projects. Considering

the amount of projects currently managed by the Sasol Technology Project Management and Control group as indicated in the secondary findings in Chapter 4 and allocating DCs as per the results of the e-survey is indicating a shortage of resources as per Table 6.1:

This is a clear indication that the current 23 DCs are managing the workload of 61 DCs as indicated by the respondents in the e-survey. Due to this shortage in resources, DCs currently work on a mix of projects (different tiers) and therefore there is not a demonstrable indication of how many DCs are currently working on specific tier projects. The good response on customer satisfaction in spite of the high workload is satisfying but also warns that more work should be done in terms of additional resources to sustain the growth in the newly established department.

However, the complexity of projects varies across the different phases and even more DC involvement might be required during the execution phase of projects and less during the FEL phases.

Sasol Technology has recently rolled out a system, Enterprise Project Management (EPM), that reflects the resource loading for all the different disciplines in Sasol Technology, but the system is still in its early phases and needs manual input and loading via the planning group. Not all resources are loaded, or loaded correctly, in relation to the projects, which results in the wrong reflection with regard to resource loading. Although the EPM is not a perfect system yet, it can be developed and optimised and is at least a start to level the workload.

From the interview findings it was clear that most functions on Project Management and Control were filing their own requirements in their own workspaces, resulting in a lot of duplication.

In Sasol Technology, as the execution agent for the owner company, the DM department handles project documentation through the life cycle of the project. EoJ documentation are handled through the Plomic function and lastly transmitted to the EDC in Sasolburg and the Engineering Information Enablement Department in Secunda where the technical information and documents get uploaded to SAP DMS systems for future use and retrieval purposes. There is thus not a single point of contact for project and technical documentation. The majority of the respondents indicated that all project related documentation which is not currently under the Sasol Technology Document Management's function should be incorporated into a single project depository. They also indicated that certain document related tasks done by other functions in support of the project team (such as Plomic and the EDC) should be integrated and managed within one management structure.

Training

14. *Employ personnel with the required professional qualifications.*
15. *Introduce and train new employees to applicable standards and specifications.*
16. *Implement a training programme for all personnel providing a DM service to the project team.*
17. *Implement a training programme for all the other team members using the system or with some kind of responsibility for documents and/or records.*
18. *Communicate DM roles and responsibilities to project team members to ensure alignment and understanding amongst all project team members.*

- **Validation**

The importance of the management of project related documentation through the life cycle of a project will be part of the success of a project and therefore puts a lot of accountability on the DCs in the project teams. Literature indicated the importance of adequate qualifications for personnel in these positions. It is clearly identified in the findings that Sasol Technology does not put the required emphasis on qualifications when evaluating positions for DCs within the organisation.

DM is in the process to internally rectify the situation and embarked on the design and development of detailed training modules for the function as illustrated in Figure 4.4. Various other internal training courses have also been identified and get incorporated into the DC's Performance Development Plans.

Project managers have to sign off the roles and responsibilities document, agreed to by top management to ensure that a DC does not perform additional tasks not included in their performance agreement plans as indicated in Appendix C. The aim of this document is for DCs to be assertive towards delivering a focused and detailed DM service. Nearly 80% of the respondents indicated that their DC has explained his/her roles and responsibilities, but it is a matter of concern that just more than 20% of project team members are not made aware of what the role of one of the integral team members in the project team is.

6.2.3 Strategies and Systems

Project Execution Strategies

19. *The owner company should have strategies in place to execute projects according to world best practice systems.*
20. *Compile and implement a benefit register to enable achieving RM objectives in the DMS.*
21. *The systems to manage project documentation should fully support the project execution strategy.*

- **Validation**

The BD&I Model is Sasol specific and structured in line with world best practices. The model uses internationally accepted terminology and methodologies. It provides a master plan with focus, project stages, phases, objections, main deliverables and gate criteria that must be followed during execution of capital projects.

No benefit register is in place in Sasol Technology in the current DMS and needs to be designed and implemented when RM capabilities are assigned to the DMS, to assure RM objectives are met.

The Sasol DMS is aligned with the BD&I Model's governance requirements for the various tracks. The validation for the Livelink system is done as part of the DMS requirement validation. The BD&I Model and DM team add value to a project by establishing a platform for project visualisation to enable improved project managing, collaboration and communication between project team members, decision makers and other stakeholders.

22. *Investigate and implement a strategy to address external DM delivering and downloading capabilities for off-site and international project stakeholders.*

- **Validation**

Sasol uses a program called (Microsoft) SharePoint which is used by giving access to outside contractors and consultants and can be utilised as a 'post box' by both parties when submitting large documents. The only requirement is for outside Sasol users to have Internet access and access to the SharePoint server can be given. 70% of the respondents in the e-survey fully supported further investigations into Microsoft SharePoint capabilities.

One of the open-ended question replies also emphasised the complexity of international projects and especially when doing projects with joint venture partners.

23. *Design and implement a strategy document to establish and maintain the project workspace on the DMS.*

- **Validation**

QMS313/P has been designed to address the maintenance of the project workspace for Project Management and Control in Sasol Technology and is circulated for final approval and sign-off.

24. *Design and implement a project documentation retention and disposition strategy.*
25. *Design and implement a project documentation archival strategy for hard copy as well as for electronic archiving.*

- **Validation**

Although Information Management has laid down guidelines to determine retention and disposition activities, it is still not in place in Sasol Technology's Project Management and Control departments and should urgently receive attention to help manage the project documentation life cycle.

It was gathered from the interviews that archival and especially retrieval of hard copy documentation is currently a source of great frustration. There is no formal project documentation archival strategy or practices in place for Sasol Technology in Sasolburg and this issue should urgently be addressed. More than 70% of the e-survey respondents are not aware of any project documentation retention schedules or document disposal policies. Half the respondents indicated that they are not aware of storage and archival facilities. This equal distribution may be due to the fact that the Secunda environment does have a hard copy paper bank facility for archival and the Sasolburg site does not have a general archival and storage facility.

Document Management System

26. *Select and implement systematically an electronic document and RM system, using project planning and methodologies appropriate to the situation and with a view to integrate the operation of records systems with business processes and related systems.*
27. *Ensure selected system is capable of reflecting an audit trail.*

- **Validation**

Sasol Technology selected Livelink for its electronic document and RM system requirements. Taking all the information gathered in the findings into account, it is fair to say that the Livelink functionality is of great advantage to Sasol Technology and adds value to project teams. There is, however, room for optimisation and exploiting of synergies because of the different workspaces used in Livelink by the different functions, as indicated in various interviews. The e-survey also revealed the fact that Livelink is experienced as being user friendly for the majority of the project team members. This is in spite of the e-survey result indicating the good assistance given by the DC on Livelink. Interpreted differently; the fact that the system is not user friendly or the lack of training to the other project team members, forces the DC to provide the required assistance, thus using up valuable time to do other important DC functions.

The DM department currently runs a DMS but ineffective registration processes and the absence of retention, disposition and archiving strategies, procedures and processes is some of the fields are not implemented yet. The common denominator for the inadequacies in the current DMS is related to the transition of documents to records and the subsequent RM functionalities.

Figure 6.2 demonstrates that Livelink has audit trail capabilities and can reflect and support decision making strategies.

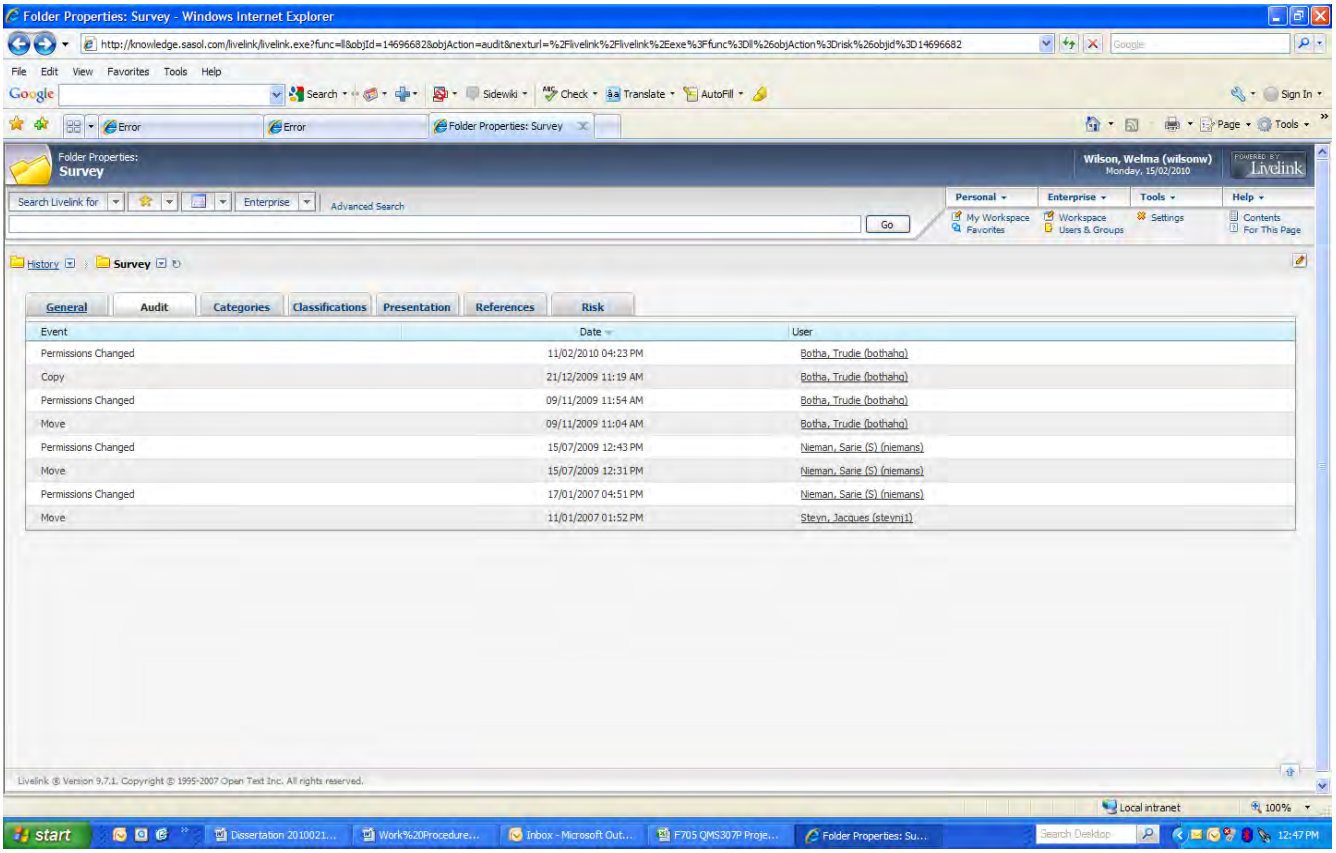

Figure 6.2: Typical Livelink Audit report

28. Create a clear understanding of the definitions and differences between

- *documents and records,*
- *DMS and RMS,*
- *document management and document control, and*
- *electronic and paper documents and systems.*

Validation

The fact that Sasol Technology DM does not distinguish between documents and records is a weakness in the current DMS which further creates inadequate life cycle management of project documentation. There is also not a clear indication of electronic and hard copy DM requirements and this is done differently for the various sites and also projects.

29. Align the DM deliverables with the specific phases of the project throughout the life cycle of the project.

Validation

Document deliverables are pre-agreed at the beginning of each new project phase

according to the BD&I Model. DM involvement starts at Gate 2 in the project Life cycle. BD&I deliverables for the specific phase are indicated and signed-off by the project manager. There seems to be a lot of duplication of information with the various forms which are required to be populated with links to the applicable project documentation. The Front End Loading form (FEL/IPA) also needs to be agreed upfront with the project manager and signed off by him on a monthly basis. The DC assists the project team members and Plomic representative whom are responsible to determine which documentation will be applicable for the specific project by using form F617. Before reviews are being conducted the Portfolio and Function Governance group issue the Mandatory Gate Documentation Acceptance form which the DC must also populate with the required links to the project documentation. The DC scans all these different agreed documents and then files these relevant forms in the project folder structure together with the signed-off and agreed roles and responsibilities.

30. *Determine minimum metadata requirements and implement. Metadata enables the management of records, in combination with good system search functionality, to support access and retrieval of records within business content across organisations. For further reading see ISO 23081-2:2009(E) and ISO 15836:2009(E).*

- **Validation**

Metadata is an important feature where the information of documents is captured and can thus be utilised to determine how well an organisation is managing its records. Although already identified as a flaw in the Sasol Technology DMS environment, this important aspect of managing documents is still not in place and it is therefore imperative to invest in good metadata to enhance the functionality and productivity of the organisation. One of the consequences of not having metadata in place results in poor productivity in document retrieval which in turn adds to frustration levels and the time wasted ultimately affects two important drivers of a project, namely cost and schedule. More than 70% of the e-survey respondents are not aware of any metadata requirements. The lack of metadata knowledge can also be attributed to poor knowledge of retention and disposal policies and procedures that go hand in hand with metadata, in other words, the requirements for RM.

31. *Compile and set up a classification scheme to represent the grouping of business activity documents with a minimum of three levels. It is considered good practice to link disposition information and access control to the classification scheme.*
32. *Categorisation (indexing) of information contributes towards searching and ease of retrieval by the DC and project team members.*

- **Validation**

The DM classification scheme of Sasol Technology was designed and set up according to all the various requirements identified during workshops held with various groups of role players. The structure was designed to align with Project Management requirements and it is fixed to three levels. There currently are no disposition requirements linked to the classification scheme. The consequence is that stored data is not managed, is kept indefinitely and although it becomes outdated, is not destroyed and uses up space, albeit physical storage or server workspace.

33. *Identify and document specific business process and transactional flows when setting up and designing automated workflows.*

- **Validation**

Livelink is the formal DMS for Sasol Technology as the owner company. The Livelink system has integrated workflow capabilities which allow flexible and influential automated processes. This automated option is not currently utilised and can help to relieve high workload experienced by the limited DM resource availability by administering certain predetermined workflow processes.

34. *Create/capture: All generated or received documents through the project life cycle should follow a process of registering the document as a record, deciding which classification to be used, and adding metadata to it before it gets stored in the electronic system.*

- **Validation**

The current DMS has no RM capabilities. The fact that registration is not enforced and therefore often neglected as well as the absence of metadata results in the creation of an environment where documents do get stored, but efficient tracking and retrieval are jeopardised by not following world best standards of registering, classification and adding metadata. The implementation of the classification scheme is, however, in place and optimisation of the structure is currently taking place with the involvement of all relevant stake holders.

35. *Ensure and establish exact distribution requirements with the project and engineering managers at the start of a new project to ensure all documents are distributed on time and that turn-around times can be met according to the NEC requirements. See Sasol QMS 340/P for further reading.*

- **Validation**

The distribution matrix is determined, set up and maintained by the project manager and engineering manager in relation to the team members of the specific project.

36. *Determine, set up and implement (automatic) retention, disposition and archival actions and notices.*

- **Validation**

There are no formal methodologies implemented to manage retention, disposition and archival of hard copy or electronic documentation in the Sasol Technology Project Management and Control environment. This insufficiency is also confirmed in the e-survey. This is a problematic area within the already limited storage facilities in Sasol and servers become slow when overloaded with unnecessary documentation.

6.2.4 DMS Processes

Processes

37. *Register a project on the DMS and set up the filing structure and control access to the project (Livelink) folder by assigning restrictions or permissions to identified users.*
38. *To ensure security in case of system failure, system backups of the stored records are available.*
39. *File (store) documentation in central repository and maintain the integrity of the filing structure, while keeping documents safe and secure, sustaining document confidentiality.*
40. *Set up a project mailbox for all project related communication to ensure business continuity.*
41. *All project documentation received and transmitted should be verified by the DCs.*

- **Validation**

Sasol Technology uses a work procedure to ensure uniformity in the execution of DM processes. QMS340P is the approved guideline used by DCs in the DM environment. DM uses Livelink as the central storage area and for managing documentation. Access to project sites are set up with permission to team members and signed off by the project manager. This practice prevents unauthorised access and it ensures and supports safekeeping and

confidentiality of project documentation within the EDMS. A project mailbox is set up per project and for small projects a mailbox is set up per DC. Livelink runs daily system backups and the DCs maintain the folder structure as well as verification of documentation on a daily basis.

42. *Registration: provides evidence that a record has been captured/created in the DMS. The registration process records brief descriptive information about the record while assigning a unique identifier to the record, allowing users to locate records and to assist with distinguishing between versions.*
43. *To enable document tracking and identification of the exact location, key information should be recorded when registering the documents. Search functions and a project outline can be used as reporting tool of exact location of documentation in the project structure.*
44. *Ensure retrieval of documents and records through mandatory registration processes, linked to metadata and by practicing correct renaming of documents.*

- **Validation**

Registration in Sasol Technology DM is challenging and not set up to be a forced process as advised in best practices for electronic DMS. The DCs have the option to register later, and registration often never happens and therefore search and retrieval are problematic. No metadata is implemented to documents stored in the standard filing system.

An outline report of all the documents stored in the register can be drawn, but when the project folders are very large the outline report times out and this option then becomes unusable and ineffective.

The electronic survey analysis to determine customer satisfaction indicated that the registration and tracking of documentation processes are two of the areas where improvement is required.

45. *Support Project Management by coordinating required DM actions on all project documentation through the lifecycle of the projects. These actions may include:*
    - *Scanning*
    - *Copying*
    - *Filing*
    - *Squad checking*
    - *Document tracking*
    - *SPIR list management*
    - *Revision control*

- *Meeting turn-around times*
- *Proactive document harvesting, etc.*

Validation

As mentioned in a previous validation, Sasol Technology uses QMS340P to ensure uniformity in the execution of DM processes. The e-survey analysis to determine the customer satisfaction rated the scanning, copying and filing top of the processes executed by the DCs. Verification that documentation and communication are issued or received, the tracking of documents, the squad checking process and meeting document turn-around times were also rated as good. SPIR List coordination and pro active harvesting of documents were identified as areas with opportunities for improvement.

46. All DCs should have access to printers and scanners. Ensure that the integrity of documents are intact when making copies, prints or when scanning.

Validation

The DM department issued a formal communication to inform the Project Management and Control group in Sasol Technology of the roles and responsibilities of a DC. QMS 340/P further supports and explains the actions required from a DC to support the project management team and is performed accordingly by the DM group of DCs.

The set-up and layout of floor plans at Sasol Technology make provision for shared printer and scanning facilities between all occupants sharing offices per floor level. Due to their role, DCs need to occupy the scanners and printers for large parts of the day, and this interferes with the printing requirements of the rest of the people utilising the same equipment. The DCs often have to work overtime to have uninterrupted access to the printers and scanning facilities on the floor. There is no printing or scanning facilities for A1- A0 drawing sheets and these requests have to be sent to the EDC on the Midlands Site in Sasolburg. An additional interface is thus created between different functions and the management of time and meeting turn-around times should always be carefully considered.

The document tracking process is problematic due to the fact that immediate registration is not always performed, leading to the inability of the system to locate the document and its current status.

47. *Implement electronic squad checking processes and methodologies to save time and to ensure all project related commentaries are captured electronically.*
48. *DC to inform all project team members of the latest revision and version released.*

- **Validation**

Electronic squad checking is done in the Secunda area and only on some identified projects in Sasolburg. The Natref site does manual squad checking. There are no documented Electronic squad checking procedure or work instructions in place to help enforce the electronic squad checking process. The e-survey also indicated the need to investigate this in more detail.

Going hand in hand with the development of engineering drawings is in general a predetermined revision strategy with the required approvals by the Sasol engineers. This means there are different actions required from the project team and these actions are dependant on the revision type. This requires great discipline from the contractors who transmit these documents and thereafter the DCs to ensure the different discipline engineers are fully aware of the actions required from them. At Sasol all documents are distributed and notices of documents that should be squad checked are also, in some cases, sent to the team. It seems there is not always a clear indication of the revision and version of these documents. There is thus room for improvement to ensure the DC informs all project team members of the latest revision and version to ensure this requirement and the requirement to meet contractual turn-around time is met.

49. *Ensure documentation is distributed to all internal and external stakeholders within agreed timeframes.*

- **Validation**

It is the responsibility of the project team to set the requirements and a matrix to ensure the DC knows who should be included in the internal distribution lists for the different types of documents. This is subsequently incorporated in a distribution matrix which is managed and amended as the team dynamics and requirements change. Turn-around times for document distribution to and from outside parties, mostly to and from contractors and consultants, are determined by the terms and conditions as agreed in the contracts. Not meeting these contractual turn-around times can have a huge cost and schedule impact on a project and should be vigorously managed. Some DCs assist the project managers, who are accountable to conform to the contractual terms, by setting up reminders, but in most cases this is an area where better cooperation, well defined procedures and the use of technology can ensure the DC plays a huge role in the contractual obligation of Sasol in the

execution of projects. The electronic survey indicated that the satisfaction of the DC meeting document turn-around times is on average 60% and can therfore be improved.

50. *Ensure workflow set-up in such a way that the DC receives notice of financial project close- out.*
51. *Transfer the closed project to the archival server. Metadata and audit trails should be taken into consideration with the affected project records they relate to.*
52. *Close the project mailbox and delete the user service with IM.*

- **Validation**

It was gathered from the interview with Mrs Allison (2010) that DCs are not on the distribution list when financial close-out notifications are issued. The project workspace can only be updated and maintained when the DM department is involved with the project close-out procedure to ensure closed projects are moved to the archival server. Metadata is not linked to electronically archived projects and therefore no retention, disposition notices or actions can be performed. Sasol Technology can benefit from well defined metadata to help manage and control archived projects on the archival server. It was gathered from the interview with Mrs Smook (2009), that IM is in the process of buying and implementing an archival server which can be utilised by the Project Management and Control group to manage electronic project archival for Sasol Technology. The electronic survey also points towards investigations to improve the project close-out procedure.

6.3 Conclusion

There are frequent similarities in the procedures included in the literature survey and those followed by Sasol to ensure that a DMS is available to support Sasol project teams in the execution of capital projects. The framework compiled from the literature survey and used to assist in validating the findings from the primary and secondary findings also confirmed the predominance of practices included in the Sasol DMS.

The validation of the newly established Sasol Technology DM function with its governance and organisational structures, strategies, systems and processes did however establish areas where improvement is required to allow the different functions within Sasol Technology and the other Sasol Business Units to have access to an integrated system, which includes all relevant documentation during the life cycle of projects.

The framework of requirements used to assist in the validation can also be included in a DM philosophy, not only in Sasol, but also for other owner companies during project execution.

CHAPTER 7 CONCLUSION, RECOMMENDATIONS AND FUTURE RESEARCH

7.1 Conclusion

The objective of this research, as stated in the research question and objectives (paragraph 1.3), is to investigate the current Sasol Technology DMS in the Project Management and Control environment. The research was done to provide Sasol, being the owner company, with recommendations for an improved and integrated document system to ensure effective and sufficient project execution support during the different project life cycles and various document life cycles.

A literature review was done in Chapter 2 to achieve the 1st specific research objective, namely to quantify what is considered as best DM practices by recognised DM and RM institutions. Insight was gained by exploring different subject definitions, terminologies, standards, various procedures, existing and available systems, qualification requirements and best practices. The focus was to identify the differences between Document Control, DM, and RM. It was found that by understanding and executing all-inclusive DM and RM practices, owner companies can comply with legal and social requirements by providing a footprint of authentic evidence and compliance during project execution.

Chapter 4 and 5 include the findings to substantiate the 2nd specific research objective of determining how Sasol Technology as the project execution agent manages project documentation. In essence it was found that the role players in project execution are aware of and satisfied with the way that the Sasol Technology DMS manages project documentation and that the DM function adds value to project teams.

An investigation was done in Chapter 4 to gather secondary findings in the Sasol Organisational area to better understand project execution in relation to the DM environment. Insight was gained of how the DM department was conceptualised and the growth and progress made up to the present (2010). The appreciative investigation highlighted the complexity of delivering an exceptional service to all project related stakeholders in Sasol as the owner company. It was found that there is a large number of role players with document related roles and responsibilities.

The primary findings of this research, captured in Chapter 5, were compiled to determine how the various project role players of the owner company interact with each other when conducting business in the project environment, as well as determine how they experience the current DM service. Various interviews were held with different pre-identified project participants and subject experts. An e-survey was distributed to the whole Sasol Technology, Project Management and Control group, and the responses from the e-survey

accentuated the areas of good performance and also the areas where improvement is required to deliver a world class service to the project teams. The highlights of these are:

- that the target population, which is a mix of different role players in the project environment is in general satisfied with the service they currently receive from the DM function.
- that there is, however, room for improvement in order to deliver a world class service.
- that documentation life cycle management is not in place and should be addressed in the Sasol Technology Environment.
- that integration of the documentation management of the various functions and structures will enable better, improved DM and accountability.

The 3rd specific objective necessitated the development of a DMS Framework of Requirements that owner companies can tailor and implement to improve their document management processes during the execution of projects, should they want to do so. A framework of requirements with high level identified trigger points for an effective and well designed DMS was compiled from the literature study and is included in Chapter 6. These trigger points were summarised under the following main subject areas:

- Governance
- Organisation
- Strategies and Systems
- Processes

The Framework of Requirements was used in setting a benchmark standard against which the validation of the secondary and primary findings of the existing Sasol Technology DMS was done and to satisfy the 4th specific research objective. It was concluded that the majority of the population interviewed or surveyed are in general satisfied with the current DM service. Sasol Technology made good progress since 2004 when there was no formal and central organisational structure in place for the management of project documentation. The numerous correlations between the compiled framework from the literature survey and the existing Sasol Technology DMS are indications that the newly established DM function is already able to support the capital project execution teams in Sasol Technology.

More important is the fact that various areas where improvement is required were pointed out during the validation of the Sasol Technology DMS and this information can now be used for further development of the DMS. This finding is therefore in accord with the 5th specific research objective which is to provide Sasol with recommendations for an improved and integrated DMS.

The validation process in relation to the newly compiled framework revealed that a DMS without RM capabilities is incomplete and cannot deliver a world class DM service due to deficient project documentation life cycle management. Documentation life cycle management for project related documentation is not as yet adequately addressed in the Sasol Technology DM function and needs further investigation with subsequent implementation. The focus should be on setting a standard for RM and metadata requirements and to implement these in the project environment. There was also an indication of several opportunities to integrate various functions and structures to simplify the DM structure to optimise on possible synergies, and to eliminate duplication. Specific recommendations to optimise the current Sasol Technology DMS are included later on in this chapter.

It may therefore be concluded that the specific research objectives have been met by the compilation of the Framework of Requirements for an effective DMS (from the literature survey) and the validation of the findings of the Sasol Technology DMS against this framework. The Framework of Requirements as set out in Chapter 6.2, can be utilised (and tailored) as a guideline by any project management owner company, to ensure and support successful project execution, by implementing these recommended DM/RM processes.

7.2 Recommendations

Section 7.2 consists of recommendations to improve and integrate DM in the project environment for Sasol Technology as the owner company to effectively govern and manage all project related documentation to the satisfaction of all project stakeholders. The following recommendations are derived from the validation of the primary and secondary findings against the compiled Framework of Requirements.

7.2.1 Governance

Policies and Procedures

- Initiate Information Management (IM) involvement and ensure awareness in Sasol Technology's Project Management and Control environment of existing document retention and disposition policies.
- Endorse the compilation of document retention and disposition requirements to enable a complete DMS with RM capabilities to each functional business within the project environment.
- Initiate, investigate and compile an archival strategy and policy for the Project Management and Control Function.
- Communicate and roll out all the different policies and procedures to the entire Project Management and Control Group in Sasol Technology.

Legal Requirements

- Initiate IM involvement and ensure awareness of legal and statutory documentation requirements.
- Ensure compilation of required and identified schedules of statutory documentation.
- Determine life cycle management time frames and link it with applicable metadata.
- Ensure good communication and awareness of these compiled statutory documentation and that life cycle management schedules are rolled out to each business function.

Audits

- Negotiate a project documentation deliverable schedule to assist the DC with improved proactive documentation harvesting with Engineering Contractors (ECs) and all the

other functions involved in the execution of projects. This will provide better assistance to project team members to obtain even better DM audit and review results.

7.2.2 Organisation

Roles and Responsibilities

- Compile and distribute an official DM resource matrix to the entire Project Management and Control group.
- Communicate, motivate and document resource shortages accordingly and get corporate buy-in to alleviate the resource constraint.
- Identify, prioritise and document amended and optimised DM processes to level and cope with the high workload as an alternative to ensure a proper service is delivered in a resource constraint environment.
- Communicate these amended and optimised DM processes clearly to all project stakeholders.
- Eliminate document duplication by means of integration with other project functions within Sasol Technology and by using the standard Livelink filing structure on the project workspace.
- Drive the establishment of a single point of contact for DM by integrating the Plomic function and the Business Units (EDC and EIE) under one management structure.

Training

- Re-evaluate DC job evaluations and link the minimum required qualifications to the required deliverables.
- Identify lack of skill and encourage DCs to further their qualifications and improve their career opportunities.
- Complete internal DM training modules and material and role training programme out to the entire DM group.
- Encourage the wider Project Management and Control group to attend overview modules of the DM training to encourage better understanding and documentation ownership per discipline.
- Identify and ensure minimum training courses are incorporated in DC's development plans. Examples are the BD&I Model courses, Assertiveness skills, Approved Fundamentals of Project Management (AFPM), etc.

- Enforce DCs to communicate and get project managers to sign off on their roles and responsibilities.

7.2.3 Strategies and Systems

Project Execution Strategies

- Design and implement a benefit register to ensure RM objectives are met when record management capabilities are added to the EDMS.
- Investigate, motivate and encourage the use of a system with large downloading capabilities. (Microsoft SharePoint)
- Maintain the project workspace on a monthly basis as per QMS 313P.
- Design and implement a project documentation retention and disposition strategy.
- Design and implement a project documentation archival strategy for the hard copy environment.
- Design and implement DM strategies for all project areas (International Projects, Local Programmes and Natural Working Teams.)

Document Management System

- Ensure the DC trains and coaches the project team members how to find, retrieve and view project related documentation in the Livelink project workspace.
- Determine and implement minimum metadata requirements for project documentation.
- Identify and compile generic lists which clearly indicate which documents should become records. These lists should be tailored for each project.

Processes

- Implement forced registration processes.
- Role out Adobe Professional to all DCs to enable the implementation of electronic squad checking processes.
- Enforce strict revision and version control of project documentation.
- Use daily Livelink reports to track documents, thus meeting and ensuring better document turn-around times.

- Provide Dm department with own facilities for scanning and copying.
- Identify, set up and train team members on automated workflows.
- Ensure DM is included in project close-out workflow.
- Ensure the closed project gets moved to an archival server and the project mailbox is closed to free up space on the Livelink workspace for active projects.

Easy document tracking and retrieval will be guaranteed when metadata is linked with document registration and the implementation of proper document life cycle management will ensure legal and authentic project documentation accountability. It is therefore recommended that Sasol Technology uses these *specific recommendations* to improve the current DMS and ensure RM capabilities are efficiently implemented.

An integrated document focus linked to organisational objectives is required to further develop the current DMS. Sasol Technology needs to align, use and manage its project related documentation in such a manner that it satisfies all stakeholder needs.

7.3 Recommendations for Future Research

The developed Framework of Requirements is applicable to internal DM processes of the project execution owner company and does not consider or recognise any service provider needs, requirements or any other system integration possibilities. A huge volume of document flow in projects takes place between the project teams of the owner company and the service providers or contractors. Future research is therefore recommended to align and integrate document requirements between owner companies and contractors/service-providers to ensure greater dividends towards successful execution of capital projects.

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APPENDICES

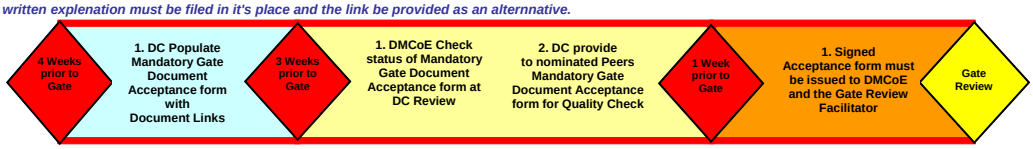
Appendix A: Mandatory Gate Documentation Forms, Gate 2-4

Mandatory Documents for submission prior to Gate 2 Reviews

The objective of the QMS/903P Gate readiness review, is to determine the completeness of the deliverables achieved in the current phase and to support the gate keepers to assess the readiness of the project to proceed to the next phase. One of the steps in the process preparing for the gate readiness is to confirm the status of the documentation deliverables prior to be Gate keeping process.

As part of the Document Control review process which takes place 3 weeks prior to Gate review, the Document Managment CoE will request the Mandatory Gate Document Acceptance form from the DC with populated links. They will then establish if the mandatory documentation are in place. This acceptance form will then be provided by the DC to the independent peer review team. The peer review team should be allowed adequate time to confirm the quality of documentation and one week prior to the gate review the signed acceptance form must be provided to the DMCoE and the Gate review facilitor. The following sheet must be signed as confirmation that the quality of documentation was verified and accepted.

It is required that a link be provided for each document. However, should the document not be applicable or refered to within another document, a written explenation must be filed in it's place and the link be provided as an alternnative.



Description	Mandatory	Designation	*Print Name*	*Signature*	Location / Remarks
Business track					
Business Case and/or Business related documents such as:- • Sustainable competitive advantage • Assumptions lists • Risk areas and killer concerns • Economic evaluation • Market assessment • Business track execution plan	Preliminary				
Clearly defined business objectives Stategic fit	Final				
Minutes of Framing Meeting/Session	Final				
Minutes of Phase 2 Kick-off meetings	Final				
Engineering Track					
Preliminary Engineering Proposal	Preliminary				
EIA Roadmap	Preliminary				
Technology Survey	Preliminary				
Partnering agreements already conducted or drafted e.g. Confidentiality, Memorandum of Understanding, Letter of Intent	Preliminary				
Interface Documents	Preliminary				
IP Landscaping Document	Preliminary				
Legal/Environmental aspects	Preliminary				
New technology content	Preliminary				
Engineering execution plan for feasibility phase	Final				
Alternatives to be investigated	Final				
Project Track					
Project execution plan and/or Project execution related documents such as:- • Budget for feasibility phase • Scope of facilities • Scope of services • Resources • Financing plan	Preliminary				
Project charter/mandate	Preliminary				
Project Risks/Killer concerns	Preliminary				
Team development • Roles and responsibilities • Key people “on board” (cost engineer, estimator, control specialist, contract and legal, scheduling specialist	Preliminary				

Business Track: _____ Date: _____

Project Track: _____ Date: _____

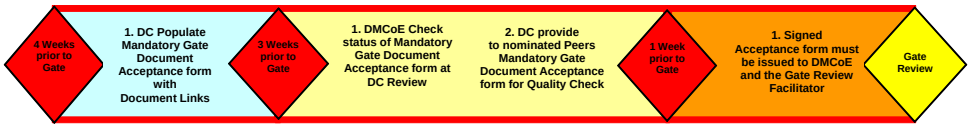
Engineering Track: _____ Date: _____

Mandatory Documents for submission prior to Gate 3 Reviews

The objective of the QMS/903P Gate readiness review, is to determine the completeness of the deliverables achieved in the current phase and to support the gate keepers to assess the readiness of the project to proceed to the next phase. One of the steps in the process preparing for the gate readiness is to confirm the status of the documentation deliverables prior to be Gate keeping process.

As part of the Document Control review process which takes place 3 weeks prior to Gate review, the Document Managment CoE will request the Mandatory Gate Document Acceptance form from the DC with populated links. They will then establish if the mandatory documentation are in place. This acceptance form will then be provided by the DC to the independent peer review team. The peer review team should be allowed adequate time to confirm the quality of documentation and one week prior to the gate review the signed acceptance form must be provided to the DMCoE and the Gate review facilitor. The following sheet must be signed as confirmation that the quality of documentation was verified and accepted.

It is required that a link be provided for each document. However, should the document not be applicable or refered to within another document, a written explenation must be filed in it's place and the link be provided as an alternnative.



Description	Mandatory	Designation	*Print Name*	*Signature*	Location / Remarks
Business track					
Business Case and/or Business related documents such as:- • Clearly defined business objective including final business solution • Strategic fit signed off • Sustainable competitive advantage demonstrated • Organisational design • Final assumptions lists aligned with economic model • Business risks and killer concerns with mitigating actions taken to eliminate them • Economic model with sensitivities • Business readiness execution plan • Commissioning plan • Final business case and plan • Market assessment (final)	Final				
Previous gate 2 results	Final				
Recommendation from the capital committee	Final				
Engineering Track					
Conceptual Engineering proposal and/or Conceptual Engineering related documents such as:- Scope of facilities description Technology Package Process engineering package Other engineering packages Final frozen scope (IBL and OBL) based on one selected alternative Site and soil investigation – preliminary Completed H&MB, PFD(MFD) and plot plans Major equipment specification	Final				
EIA ROD	Final				
Engineering execution plan (Current phase plan & overall plan for following phases	Final				
Engineering track ***quality plan***	Final				
Minutes of VIP session	Final				
Interface Documents	Final				
Design-, Operating- & maintenance philosophies	Final				
Technology Survey	Final				
Partnering agreements already conducted or drafted e.g. Confidentiality, Memorandum of Understanding, Letter of Intent	Final				
IP Landscaping Document	Final				
Final site selection	Final				
PFD's	Final				
Assumptions list	Final				
SHER assessment report	Final				
Project Track					
Project execution plan and/or Project execution related document such as:- • Execution summary (Project purpose & mandate; Business objectives, Project objectives, Roadmap) • Frame (Framing report, project charter etc.) • Basic development phase execution plan • A complete networked, schedule that covers all project phases • A factored –level estimate, including major equipment pricing based on quotes. • Business and project objectives must be aligned • Team development • Roles and responsibilities • Key people "on board" (cost engineer, estimator, control specialist, contract and legal, scheduling specialist	Final				
Project charter/mandate	Final				
Integrated risks and killer concerns with mitigating actions taken to eliminate them	Final				
Team development • Roles and responsibilities • Key people "on board" (cost engineer, estimator, control specialist, contract and legal, scheduling specialist	Final				
Minutes of Phase 3 Kick-off meetings	Final				
Project RASCI	Final				

Business Track: _____ Date: _____

Project Track: _____ Date: _____

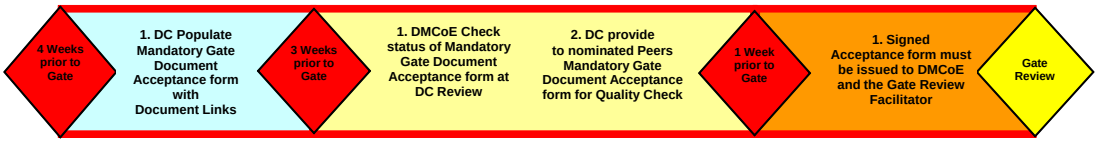
Engineering Track: _____ Date: _____

Mandatory Documents for submission prior to Gate 4 Reviews

The objective of the QMS/903P Gate readiness review, is to determine the completeness of the deliverables achieved in the current phase and to support the gate keepers to assess the readiness of the project to proceed to the next phase. One of the steps in the process preparing for the gate readiness is to confirm the status of the documentation deliverables prior to be Gate keeping process.

As part of the Document Control review process which takes place 3 weeks prior to Gate review, the Document Managment CoE will request the Mandatory Gate Document Acceptance form from the DC with populated links. They will then establish if the mandatory documentation are in place. This acceptance form will then be provided by the DC to the independent peer review team. The peer review team should be allowed adequate time to confirm the quality of documentation and one week prior to the gate review the signed acceptance form must be provided to the DMCoE and the Gate review facilitor. The following sheet must be signed as confirmation that the quality of documentation was verified and accepted.

It is required that a link be provided for each document. However, should the document not be applicable or refered to within another document, a written explenation must be filed in it's place and the link be provided as an alternnative.



Description	Mandatory	Designation	*Print Name*	*Signature*	Location / Remarks
Business track					
Business Case and/or Business related documents such as:- • Clearly defined business objective • Strategic fit • Sustainable competitive advantage • Organisational design • Final assumptions lists • Business risks and killer • Economic model with sensitivities • Business readiness execution plan • Commissioning plan • Final business case and plan • Market assessment (final)	Final				
Previous gate 3 results	Final				
Recommendation from the capital committee	Final				
Engineering Track					
Basic Engineering Package	Final				
EIA ROD	Final				
Engineering execution plan (Current phase plan & overall plan for following phases	Final				
Engineering track ***quality plan***	Final				
Minutes of VIP session	Final				
Interface Documents	Final				
Design-, Operating- & maintenance- & Control philosophies	Final				
Plot or site plan	Final				
PFD's & MFD's	Final				
Equipment-; Tie-in-; Lines lists	Final				
SHER aspect register	Final				
Site and soil investigation complete	Final				
Project Track					
Project execution plan and/or Project execution related document such as:- • Execution summary (Project purpose & mandate; Business objectives, Project objectives, Roadmap) • Frame (Framing report, project charter etc.) • Completed detailed, networked, resource loaded schedules to cover all project phases • Complete detailed control level estimate based on quantity take-offs for all scope elements • Team development • Roles and responsibilities • Key people "on board" • Plans for commissioning, start-up, operation, manpower, quality assurance. • Cost and schedule controls	Final				
Cost Estimate for final authorisation	Final				
Integrated project risks and killer concerns with mitigating actions taken to eliminate them	Final				
Minutes of Phase 3 Kick-off meetings	Final				
Project RASCI	Final				

Business Track: _____ Date: _____

Project Track: _____ Date: _____

Engineering Track: _____ Date: _____

(Botha, Steyn, 2009)

Appendix B: DM Survey

Document Management Service Survey - Welma Wilson

Please indicate how effective the Document Management service is to the Project Management team.

1. To which degree to you consider the Project Livelink Filing system user friendly?*
   - ○ Poor
   - ○ Below Average
   - ○ Average
   - ○ Good
   - ○ Excellent

2. To what degree does your document controller provide you with Livelink assistance? *
   - ○ Poor
   - ○ Below Average
   - ○ Average
   - ○ Good
   - ○ Excellent

3. Please rate the execution of the following basic Document Management practices:*

	Poor	Below Average	Average	Good	Excellent
Verification that documentation and /or communication are issued or received	○	○	○	○	○
Registering of Project documentation on Livelink	○	○	○	○	○
Preparing Livelink reports on request	○	○	○	○	○
Tracking of Documents	○	○	○	○	○
Scanning	○	○	○	○	○
Copying	○	○	○	○	○
Filing	○	○	○	○	○
Squad checking process	○	○	○	○	○
SPIR list co-ordination	○	○	○	○	○
Meeting document turn-around times	○	○	○	○	○
Proactive document harvesting	○	○	○	○	○

4. To what extend do you rate the importance of the following statements: *

	Not at all important	Not so important	Average Importance	Fairly Important	Very Important
It is compulsory for Document Controllers to attend project kick off meetings.	○	○	○	○	○
Document Management service adds value to the overall project objective through the different phases?	○	○	○	○	○
How important is it for project team members to have access to view the signed project contractual documents (without the rates) stored/filed in the	○	○	○	○	○

DM project filing structure on Livelink?

5. Do you know which documents should be kept as records? *
   - Yes
   - No

6. Are you aware of any of the following in your environment: *

	Yes	No
Project document retention schedules?		
Project document disposal policies?		
Storage/archival policies and facilities?		
Metadata requirements? (data describing context, content and structure of records and their management through time)		

7. Has your document controller explained her roles and responsibilities to you? *
   - Yes
   - No

8. Do you still keep project documentation on your pc's hard-drive? *
   - Yes
   - No

9. Do you receive a link from Knowledge Management to view Commercial and Legal's documents including, signed contracts, change orders and purchase orders stored with Knowledge Online on behalf of Commercial and Legal? *
   - Yes
   - No

10. To ensure availability of integrated project documentation, should each project function be made responsible to store applicable project documentation directly into the Livelink project filing structure? *
    - Yes
    - No

To achieve an Integrated DM function taking control over all project related documents, please provide answers to the following questions.

11. Document Management service is currently limited to Projects in the SA Chemical and Energy cluster, including NWT. To be able to take control of all project related documentation, do you agree/disagree for the following to be included: *

	Agree	Disagree
International Projects		
All Commercial and Legal Project documentation		
Environmental and Risk Engineering project related documentation		
Integrate the Plomic Structure with DM structure for End of Job Documentation (Engineering Documentation)		
Integrate Sasol Business Unit Document Management Structure (Eng Data Centre and Eng Information Enablement)		

with DM structure?
Any other integration opportunities? Please specify below.

12. Please specify any other integration opportunities?

13. Please indicate the optimal workload for a Document Controller for Tier 1 projects.*
- Document Controller to work on only 1 project
- Document Controller to be limited to 2-3 projects max?
- Document Controller to be limited to 4-6 projects max?
- 2 document controllers per tier 1 project

14. Please indicate the optimal workload for a DC for Tier 2 projects.*
- Document Controller to work on only 1 project
- Document Controller to be limited to 2-3 projects max?
- Document Controller to be limited to 4-6 projects max?
- Document Controller to be limited to 8-10 projects max?
- Document Controller to be limited to 14-17 projects max?

15. Please indicate the optimal workload for a DC for Tier 3 projects.*
- Document Controller to work on only 1 project
- Document Controller to be limited to 2-3 projects max?
- Document Controller to be limited to 4-6 projects max?
- Document Controller to be limited to 8-10 projects max?
- Document Controller to be limited to 14-17 projects max?

16. Please indicate the optimal workload for a DC for Tier 4 projects.*
- Document Controller to work on only 1 project
- Document Controller to be limited to 2-3 projects max?
- Document Controller to be limited to 4-6 projects max?
- Document Controller to be limited to 8-10 projects max?
- Document Controller to be limited to 14-17 projects max?

17. To what degree of importance should the following processes be investigated?*

	Not important at all	Not so important	Average importance	Fairly important	Very important
Automated Registration Process?					
Improved document tracking?					
Electronic Squad Checking					
Optimise Version/Revision Control?					
Automated work flow as per a pre determined work flow design?					
Automated retention schedules notices and practices?					
Automated storing/archiving notices and practices?					
Automated disposal					

notices and practices?					
DM requirements to be clear and captured at project kick off meeting?					
Request a document deliverable schedule from Engineering Contractors/Planners at project kick off?					
Move away from hard copies when electronic version is available/obtainable?					
Improved project Close - out procedure					
Keep on using Livelink as the storage medium and develop more functionality?					
Investigate integration of SharePoint and livelink functionalities					

18. How important do you consider the Document Controllers role when assistance with the following:*

	Not important at all	Not so important	Average importance	Fairly important	Very important
Gate reviews					
Audits					
Project document reports from Livelink					

19. A document becomes a record when information is created, received and maintained as evidence and information by an organisation or person, in pursuance of legal obligations or in the transaction of business. Taken this into account, do you agree or disagree with the following Records Management (RM) statements?*

	Agree	Disagree
There is a clear indication of which project documentation should be retained as records.		
RM should be able to meet legislative and regulatory requirements including archival and audit activities.		
RM should be able to provide required documentation to ensure business continuity in the event of a disaster.		
RM should be able to provide protection & support in litigation including the management of risks associated with the existence of, or lack of evidence of project activities.		
RM should be able to provide evidence of business.		
RM should be able to maintain corporate memory.		

Done Cancel

Appendix C: Tables with E-Survey Results

To which degree to you consider the Project Livelink Filing system user friendly?	To what degree does your DCs provide you with Livelink assistance?
Excellent	Excellent
8.70%	28.26%
Good	Good
29.35%	47.83%
Average	Average
45.65%	17.39%
Below Average	Below Average
10.87%	5.43%
Poor	Poor
5.43%	1.09%

Please rate the execution of the following basic Document Management practices:										
Verification that documentation and /or communication are issued or received	Registering of Project documentation on Livelink	Preparing Livelink reports on request	Tracking of Documents	Scanning	Copying	Filing	Squad checking process	SPIR list co-ordination	Meeting document turn-around times	Proactive document harvesting
Excellent	*Excellent*	Excellent	Excellent	Excellent	Excellent	Excellent	Excellent	Excellent	Excellent	Excellent
15.22%	15.22%	14.13%	15.22%	38.04%	38.04%	33.70%	15.22%	10.87%	14.13%	15.22%
Good	Good	Good	Good	Good	Good	Good	Good	Good	Good	Good
51.09%	39.13%	33.70%	44.57%	39.13%	39.13%	38.04%	33.70%	28.26%	38.04%	32.61%
Average	Average	Average	Average	Average	Average	Average	Average	Average	Average	Average
22.83%	27.17%	35.87%	26.09%	18.48%	16.30%	22.83%	40.22%	51.09%	35.87%	40.22%
Below Average	Below Average	Below Average	Below Average	Below Average	Below Average	Below Average	Below Average	Below Average	Below Average	Below Average
7.61%	8.70%	9.78%	8.70%	3.26%	5.43%	3.26%	6.52%	4.35%	10.87%	9.78%
Poor	Poor	Poor	Poor	Poor	Poor	Poor	Poor	Poor	Poor	Poor
3.26%	9.78%	6.52%	5.43%	1.09%	1.09%	2.17%	4.35%	5.43%	1.09%	2.17%

To what extend do you rate the importance of the following statements?		
It is compulsory for DCs s to attend project kick off meetings.	Document Management service adds value to the overall project objective through the different phases	How important is it for project team members to have access to view the signed project contractual documents (without the rates) stored/filed in the DM project filing structure on Livelink
Very Important	Very Important	Very Important
48.91%	67.39%	59.78%
Fairly Important	Fairly Important	Fairly Important
36.96%	27.17%	28.26%
Average Importance	Average Importance	Average Importance
9.78%	4.35%	9.78%
Not so important	Not so important	Not so important
3.26%	1.09%	2.17%
Not at all important	Not at all important	Not at all important
1.09%	0	0

Are you aware of any of the following in your environment:								
Do you know which documents should be kept as records?	Has your DCs explained her roles and responsibilities to you?	Do you still keep project documentation on your pc's hard-drive?	Do you receive a link from Knowledge Management to view Commercial and Legal's documents including, signed contracts, change orders and purchase orders stored with Knowledge Online on behalf of Commercial and Legal?	To ensure availability of integrated project documentation, should each project function be made responsible to store applicable project documentation directly into the Livelink project filing structure?	Project document retention schedules	Project document disposal policies?	Storage/archival policies and facilities?	Metadata requirements? (data describing context, content and structure of records and their management through time)
Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
69.57%	78.26%	71.74%	32.61%	71.74%	27.17%	28.26%	48.91%	28.26%
No	No	No	No	No	No	No	No	No
30.43%	21.74%	28.26%	67.39%	28.26%	72.83%	71.74%	51.09%	71.74%

Document Management service is currently limited to Projects in the SA Chemical and Energy cluster, including NWT. To be able to take control of all project related documentation, do you agree/disagree for the following to be included?					
International Projects	All Commercial and Legal Project documentation	Environmental and Risk Engineering project related documentation	Integrate the Plomic Structure with DM structure for End of Job Documentation (Engineering Documentation)	Integrate Sasol Business Unit Document Management Structure (Eng Data Centre and Eng Information Enablement) with DM structure	Any other integration opportunities? Please specify below.
Agree	Agree	Agree	Agree	Agree	Agree
84.78%	92.39%	92.39%	90.22%	88.04%	41.30%
Disagree	Disagree	Disagree	Disagree	Disagree	Disagree
15.22%	7.61%	7.61%	9.78%	11.96%	58.70%

Please indicate the optimal workload for a DCs for Tier 1 projects.	Please indicate the optimal workload for a DC for Tier 2 projects.	Please indicate the optimal workload for a DC for Tier 3 projects.	Please indicate the optimal workload for a DC for Tier 4 projects.
2 DCs s per tier 1 project			
21.74%			
DCs to work on only 1 project	DCs to work on only 1 project	DCs to work on only 1 project	DCs to work on only 1 project
33.70%	26.09%	8.70%	6.52%
DCs to be limited to 2-3 projects max	DCs to be limited to 2-3 projects max	DCs to be limited to 2-3 projects max	DCs to be limited to 2-3 projects max
34.78%	51.09%	32.61%	11.96%
DCs to be limited to 4-6 projects max	DCs to be limited to 4-6 projects max	DCs to be limited to 4-6 projects max	DCs to be limited to 4-6 projects max
9.78%	19.57%	39.13%	31.52%
	DCs to be limited to 8-10 projects max	DCs to be limited to 8-10 projects max	DCs to be limited to 8-10 projects max
	2.17%	17.39%	34.78%
	DCs to be limited to 14-17 projects max	DCs to be limited to 14-17 projects max	DCs to be limited to 14-17 projects max
	1.09%	2.17%	15.22%

To what degree of importance should the following processes be investigated?													
Automated Registration Process	Improved document tracking	Electronic Squad Checking	Optimise Version/Revision Control	Automated work flow as per a pre determined work flow design	Automated retention schedules notices and practices	Automated storing/archiving notices and practices	Automated disposal notices and practices	DM requirements to be clear and captured at project kick off meeting	Request a document deliverable schedule from Engineering	Move away from hard copies when electronic version is available/obtainable	Improved project Close - out procedure	Keep on using Livelink as the storage medium and develop more functionality	Investigate integration of Share Point and Livelink functionalities
Very important	Very important	Very important	Very important	Very important	Very important	Very important	very important	Very important	Very important	Very important	Very important	very important	Very important
38.04%	55.43%	42.39%	52.17%	38.04%	34.78%	32.61%	28.26%	57.61%	56.52%	57.61%	58.70%	50.00%	32.61%
Fairly important	Fairly important	Fairly important	Fairly important	Fairly important	Fairly important	Fairly important	Fairly important	Fairly important	Fairly important	Fairly important	Fairly important	Fairly important	Fairly important
29.35%	35.87%	30.43%	32.61%	41.30%	41.30%	41.30%	34.78%	32.61%	36.96%	29.35%	32.61%	33.70%	36.96%
Average important	Average important	Average important	Average important	Average important	Average important	Average important	Average important	Average important	Average important	Average important	Average important	Average important	Average important
27.17%	7.61%	23.91%	14.13%	19.57%	22.83%	23.91%	29.35%	8.70%	5.43%	11.96%	7.61%	9.78%	28.26%
Not so important	Not so important	Not so important	Not so important	Not so important	Not so important	Not so important	Not so important	Not so important	Not so important	Not so important	Not so important	Not so important	Not so important
5.43%	1.09%	3.26%	1.09%	1.09%	1.09%	2.17%	6.53%	1.09%	1.09%	1.09%	1.09%	3.26%	2.17%
Not important at all	Not important at all	Not important at all	Not important at all	Not important at all	Not important at all	Not important at all	Not important at all	Not important at all	Not important at all	Not important at all	Not important at all	Not important at all	Not important at all
0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	1.09%	0.00%	0.00%	0.00%	0.00%	3.26%	0.00%

How important do you consider the DCs s role when assistance with the following?		
Gate reviews	Audits	Project document reports from Livelink
Very important	Very important	Very important
54.35%	76.09%	69.57%
Fairly important	Fairly important	Fairly important
23.91%	18.48%	22.83%
Average importance	Average importance	Average importance
15.22%	5.43%	6.52%
Not so important	Not so important	Not so important
6.52%	0.00%	0.00%
Not important at all	Not important at all	Not important at all
0.00%	0.00%	0.00%

A document becomes a record when information is created, received and maintained as evidence and information by an organisation or person, in pursuance of legal obligations or in the transaction of business. Taken this into account, do you agree or disagree with the following Records Management (RM) statements?					
There is a clear indication of which project documentation should be retained as records.	RM should be able to meet legislative and regulatory requirements including archival and audit activities.	RM should be able to provide required documentation to ensure business continuity in the event of a disaster.	RM should be able to provide protection & support in litigation including the management of risks associated with the existence of, or lack of evidence of project activities.	RM should be able to provide evidence of business.	RM should be able to maintain corporate memory.
Agree	Agree	Agree	Agree	Agree	Agree
61.96%	96.74%	98.91%	98.91%	95.65%	96.74%
Disagree	Disagree	Disagree	Disagree	Disagree	Disagree
38.04%	3.26%	1.09%	1.09%	4.35%	3.26%

Appendix D: Roles and Responsibilities of a DC in the Sasol Technology Project Environment

Document Controllers in the Project Environment

A document controller manages all required documentation, as indicated by the project manager, according to the procedures within a project. Document controllers are essential in the success of Sasol Technology's execution of projects.

Document management entails the management of all project related documentation from the start of a project through to handover of Master Data at operational phase, including closure and archiving of documentation. One of the main functions of a document controller is to support project management in the contractual requirements of the NEC.

A document controller is not a project assistant/secretary/co-coordinator.

The generic job outputs of document controllers entail the following:

- Registration of documents
- Distribution of documents
- Co-ordination of documents
    - squad checking
    - SPIRs
    - Scanning
    - Copying
    - Draw reports from Livelink
    - Filing of documents
    - Retrieving documents from filling system
    - Revision control
    - Conduct regular reviews
- Document tracking and follow-up
- Correspondence and issue follow up system
- Classification of documentation
- Documentation management effectiveness measurement
- Documentation duplication control
- Master documentation (EOJ)
- Oversee junior document controllers

Please cooperate to utilize the document controllers in your area for the appropriate tasks, as mentioned above.

Welma Wilson
Manager Document Management

Louis Bruwer
Manager Project Management and Control

(Wilson, 2009)