DEVELOPING A SCALEABLE INFORMATION ARCHITECTURE FOR AN ENTERPRISE WIDE CONSOLIDATED INFORMATION MANAGEMENT PLATFORM.

by

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Abstract

This research addresses the concept of "information architecture" as a way of visualising and describing the various information assets and interaction of these assets within the organisation. The research further provides definitions of information and contextualises the information audit and information model as key tool for the information manager in establishing the information architecture.

The establishment of the information architecture is illustrated through a case study within a large conglomeration of companies requiring a scaleable information architecture in order to address its information requirements. Through a process of interviews the information requirements of key decisions makers are established. These requirements are translated into an information architecture that forms the basis of support in delivering future information requirements for the company.

The results of this research have been successfully implemented and now form the foundation of all future information management projects within this particular case study.

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1.1 Introduction

The development of information technology and specifically the revolution of the Internet and the world-wide web (WWW or Web) implemented as part of most organisation's technological backbone, has played an increasingly important role over the past few decades by making access to information easier. The advent of the Internet in 1969 and the popularisation of the Web through the use of graphical user interfaces in the mid nineteen nineties opened up doors for standardised Internet based technology to be deployed throughout the organisation and between organisations (Berners-Lee, 1999:62; Cockburn & Wilson, 1995; Hafner & Lyon, 1996: 244).

Through a simple web browser and the use of standardised Internet protocols users have been given greater access to a multitude of information resources both internally and externally from the organisation. This trend of using a web interface or web browser has spilled over to many applications used within the organisation and the simplified use of a browser to server model has been commonplace ever since. Typically, this has been referred to as being "web enabled", implying that access to the particular application can take place via a web browser using standardised Internet technologies or protocols. Legacy applications that were previously inaccessible via the Internet or are very restrictive in the way they could be accessed are being exposed to the outside through middleware applications (Edwards, 2002).

Legacy systems are integrated with other legacy or even new systems through newly developed technologies, protocols and standards that evolved out of the formation of the Internet and the Web. These technologies range from the transmission control protocol/internet protocol (TCP/IP), hypertext transfer protocol (http), component object model (COM), Java (J2EE) and extensible mark-up language (XML) – to name but a few (Vecchio *et al*, 2001:1). In addition, it is via these new technological developments that, what is sometimes considered "non-Internet friendly" or "not Internet ready" or legacy system data and information can be made available in its

simplest form via a simple interface, namely a Web browser, to the end-user. It is no longer a situation of only legacy data being exposed to the web, but legacy information co-existing with information sources that are being built on Internet or Web technologies.

The Microsoft school of thought advocating concepts such as the "digital nervous system" and ".net" (dot net) as the new wave of integrating and interacting electronically with the systems and the environment around us is starting to demonstrate how easily information can be made available to the end-user, irrespective of his/her location and/or the device to which the information is being delivered (Gates, 1999:114; Gates, 2004; Microsoft, 2001:10).

The mobility of the Internet has made access to electronic information sources virtually effortless irrespective of the location of such information sources. Simply by having access to the Internet a user can access information sources in order to support daily decision-making processes, or purely for entertainment depending on his/her needs. The user is no longer exclusively bound to the desktop personal computer or PC, but may use virtually any capable device, for example, a personal digital assistant (PDA) or a cellular phone using the Global System for Mobile Communication or GSM, wireless access protocol (WAP), general packet radio services (GPRS) or third generation services (3G) to access Internet enabled information sources whilst being mobile. The trend is to move towards a scenario of being "always on", "always connected" or "always there", whereby the access device (PDA or cell phone) is in a constant state of communication with information resources or providers to ensure that any notifications or critical messages are sent immediately to the receiving device.

Since 1995, the interaction with the Internet by use of the web browser has moved beyond purely informational activities to more interactive commercialised transactions (Cockburn & Wilson, 1995; Ng *et al*, 1998; Schwartz, 1999:5). At first the Web, according to Schwartz (1999:5) was an unformed mass of thoughtless expression, with free publications, brochures and masses of pornography. Essentially the Web evolved from a base of sharing of information generated from the scientific research community. Soon what was thought to be experimentation led to areas of commercial transacting between consumers and online book and music stores. This

caused the general consumer to take serious the product and pricing information presented to them on the Web and thus other areas of commercial exploitation took off from purchasing cars, homes to large-scale organisational procurement.

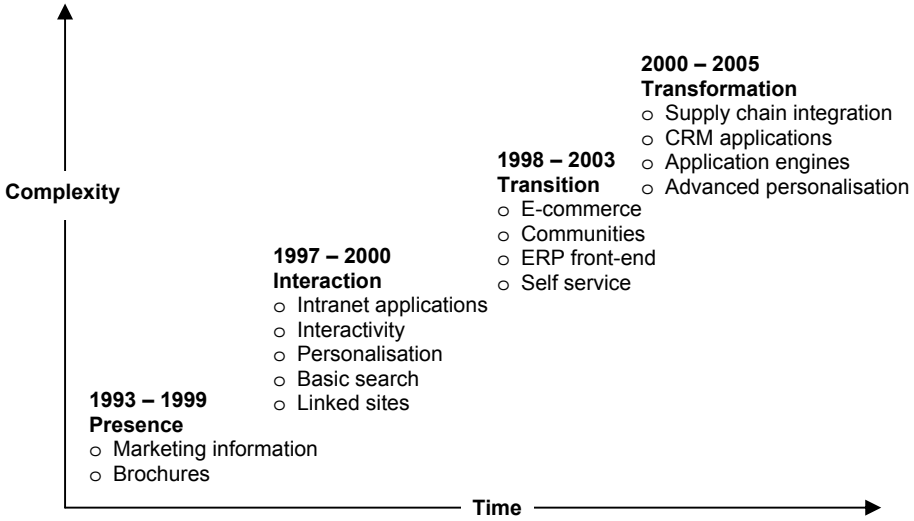


Figure 1: The evolution of web content (Adapted from Rozwel & Berg, 1999).

The cost, sophistication and business value of the Web as a pervasive delivery mechanism of information has increased dramatically across most industries since the commercialisation of the Internet in early 1996 as depicted in Figure 1. Web sites evolved from being a basic web presence to content that is more sophisticated and integrated with organisational processes through to the transformation of key business processes such as supply chain management (SCM). Rozwel and Berg (1999) points out that the primary vehicle to bring about this increase in value is the integration of web applications and enterprise-operations applications, including manufacturing, inventory management and transportation. In other words the majority of an organisation's supply chain, as well as sales, marketing and customer service processes. Not only through the facilitation of data flow through integration amongst applications, but the increase in business value by virtue of its use as a common front-end to virtually all networked applications. It is via web-based technology that information is moved through value chains, bringing together previously separate applications or groups to communicate more effectively and efficiently with each other. Hence the term "e-business" or more applicably "efficient

business". Web based technology has the capacity to provide information instantaneously to the end-user at a low cost and the ability to distribute this information to a wider audience than previously possible (Norris *et al*, 2000:35; Rozwel & Berg, 1999).

The acceptance of the Web and the technologies that came out of the evolution of the web has been phenomenal due the fact that the Web is based on principles that provide a powerful basis for communication. Standardised and open protocols that evolved with the Internet provide for hardware and software interoperability and implemented at costs far less than older technologies such as electronic data interchange or EDI (Norris *et al*, 2000:42). This does not imply that technology such as EDI is outdated or obsolete; in fact, EDI is still implemented as an effective transaction mechanism in many organisations.

The Internet and ultimately the Web has been responsible for a number of technologies that have enabled integration of what is perceived to be as totally separate applications. The capability of these integrated applications to instantaneously deliver information to the end-user by means of a simple web based graphical interface, poses a number of challenges to the information manager. As access to information becomes a critical catalyst in the organisation's way of conducting business and forms a strategic part of the organisation's business strategy, the information manager needs to take into consideration the potential effect that information architecture has on his/her role as information manager and ultimately the implementation of the organisation's information policy and strategy.

Apart from the Internet and the various technologies that have evolved from its advancement, other aspects have also influenced the way information is viewed and managed within the organisation. Point events such as September 11, 2001 and the downfall of large organisations such as Enron, WorldCom and others, have placed more emphasis on regulatory and corporate governance measures to ensure that information is effectively managed and delivered to all relevant stakeholders. These measures may focus on information security, privacy, disclosure or simply what information is made available to outside parties.

In South Africa, recent legislation such as the Promotion of Access to Information Act 2 of 2000, the Electronic Communications and Transactions Act 25 of 2002 (ECT Act), the Regulation of Interception of Communications and Provision of Communication-related Information Act 70 of 2002 and the Financial Intelligence Centre Act 38 of 2001 (FICA), including corporate governance guidelines as recommended by the King Commission in the King I & II reports, are effectively highlighting the importance of information management within the organisation. Similar legislation or controls have been put into place elsewhere in the world to ensure proper management and delivery of information. Although not specifically entitled the management or governance of information, but in most cases focussing on some aspect of the management of information, for example the Data Protection Act of 1984 in the United Kingdom and the Homeland security Act of 2002 in the United States of America.

The effective management of information as a strategic resource within an organisation, the prevention of information overload and delivery of information to stakeholders require that organisations put into place an information policy. Orna (1999:9) defines an information policy as a dynamic tool that can be used to provide the necessary guidance on how information should be utilised within an organisation and by using these guidelines information can be managed in line with the organisation's overall objectives. Additionally, the policy can be used to enable effective decision-making, assist in resource allocation and to promote interaction, communication and mutual support between all parts of the organisation including outside stakeholders. As part of the policy, the information strategy is defined as the detailed expression of the information policy in terms of objectives, targets and actions to be achieved within a defined period. The information strategy provides the framework for the management of information and therefore the necessary guidance for an organisation to manage effectively the variety of information resources within the organisation and a methodology to react on information gathered from outside the boundaries of the organisation.

Orna (1999:10) points out that information management is the application of an information strategy in order to meet the objectives of the organisation within the overall constraints of available resources and is primarily concerned with aspects such as;

- How is information obtained, recorded and stored?
- What information resources are located within the organisation and who is responsible for them?
- How information flows through the organisation and the environment in which the organisation operates?
- How is information consumed within the organisation?
- How is information technology applied to support the end-users of information?
- How effectively does all these information related activities contribute towards the objectives of the organisation?

It is commonly accepted that information is considered a potentially profitable or valuable resource and should be managed accordingly (Laney, 2002:1; IT Governance Institute; 2000:6; Orna, 1999:139; Parsons, 1996:59). However, without a policy addressing the management of information as a resource and ultimately to link with the organisation's strategies and objectives it is difficult to estimate how information is utilised and what the contribution of information is or potentially could be in meeting the organisation's overall objectives (Orna, 1990:18). With policies and governance in place, organisations are able to take full advantage of its information resources, thereby maximising benefits, capitalising on opportunities and gaining competitive advantage (IT Governance Institute, 2000:7).

Some dangers that might lurk in the absence of an information policy are the risk of having decentralised information activities and systems. Another example is the inability to bring together relevant information from sources and disciplines in an articulated form to address relevant problems within the organisation (Orna, 1990:20).

Nevertheless, numerous advantages can be realised through the implementation of an information policy (Orna, 1990:21). By having an information policy in place, it becomes possible to integrate all information activities, and thereby be able to mobilise these integrated activities to contribute to the organisation's objectives. The policy provides a basis for objective decision making on the managing of information resources, due to the fact that it is integrated into the organisation's objectives. In view of the fact that an information policy is developed through bringing together

distributed knowledge of all information resources and activities within the organisation it is capable of promoting co-operation, communication and the sharing of information as opposed to causing any suppression of information sharing. The unrestricted flow of information provides for innovation, and it reduces uncertainty and risks. An information policy provides a basis for decisions about investment in information technology (IT) as it allows technology options to be evaluated in relation to the organisation's objectives and human resources. Developments in information technology have a significant impact on how individuals and organisations cope with information. Continuous innovation in the field of information technology leads to new and better ways of presenting, analysing and selling information (Linden *et al*, 2003:1). Through the process of continuous monitoring by means of an information policy the organisation is capable of adapting to changes in its operating environment both internally and externally.

Figure 2: Environmental factors influencing the organisation (adapted from Abell & White, 1999).

Figure 2 depicts a wide variety of possible environmental factors that can influence the organisation. This multitude of factors can have a positive or negative influence on the organisation depending on the particular nature of the organisation. The magnitude of the impact of the influence is usually determined by the industry in

which the organisation functions. However, some aspects influence the functioning of the organisation regardless of the industry in which the organisation functions. No organisation can exist as an island alone and requires input from a multitude of environmental factors, be they internal or external. Having sufficient sensors to gather information from the environment and the ability to effectively accumulate all the information gathered through this interaction requires an information policy that will allow organisations to filter out noise and to concentrate on factors directly affecting it.

The application of technology to assist organisations to accumulate information as it flows in from the environment needs to take place in an integrated fashion in order to ensure the effective use of this information by its intended users. However, this can only take place if an organisation has in place an information policy that stipulates how information is gathered, accumulated and ultimately managed.

The underlying information architecture plays an important supporting role in how this information policy is sustained. The information architecture involves the logical design for a specific application system or set of systems. This may involve business models, organisational models, process models, or data models. Through this process the organisation can ensure that the relevant systems are put into place to support the information policy that is maintainable and sufficiently responsive to support the organisation's informational requirements.

The use of the term "information architecture" should not be confused with the way in which a web site is designed or with the detail required in the putting together of organisation's technology architecture, i.e. the components such as servers, networks and desktops. Rather the high-level detail of the information flows within or between applications or systems. Data flow diagrams or DFDs are seen as the semantic bridge between end-users and systems developers and can be described as the graphical representation modelling how information flows through a system (Kozar, 1997a; Kozar, 1997b). It is seen as a structured, diagrammatic technique for showing the functions performed by a system and considers data flows into, out of and within the system (Drewry, 2001). This technique is widely used in systems analysis, systems development or business process redesign. DFDs should not be confused with flow diagrams of flow charts. Flow charts outline the sequence of

control and are part of a single program with consistent timing. The use of a graphical representation of a model provides a good basis for understanding how an information architecture can support an organisation's information policy. Thus ensuring that all relevant role players within the organisation have a clear understanding of how the information policy is being executed.

Advantages gained from the implementation of an information policy shows characteristics of various e-business activities, of which the underlying concepts relate to the integration of information systems and business processes and thereby affecting all information activities within the organisation.

The popularisation of "e-business" as a shorthand way of describing the integration of business strategies, processes and technologies has further emphasised the requirement of putting an information policy into place. Additional sources of information have become available to the organisation and its stakeholders through this process of integration and the end-user has a wider variety of information sources available for decision-making processes. In order to ensure proper integration and exposure of these "new found" sources of information, the organisation needs to put into place an information strategy. The information policy together with the information architecture should provide a supporting framework for the management of information within any organisation's business strategy, and thereby assist in meeting the organisation's objectives.

E-business implies primarily the integration and streamlining of business processes, which allows more information to become readily available to the organisation and outside parties that has an interest in the organisation for example shareholders, customers or suppliers. This could easily lead to an over exposure in information.

By putting into place an effective information architecture as a supporting framework for an organisation's information strategy it is believed that the risk of information overload could be minimised and could allow for the effective flow of information within and outside of the organisation. This in itself helps with better decision-making, strategic and performance related management, as there is now a clear strategy on how information flows through the organisation, what areas are affected and how it should be managed in line with the organisation's initiatives and strategy.

Through the above process, the role of the information manager becomes even more evident as he or she provides the necessary support in implementing this information policy and the necessary guidelines concerning information management. As a result, the information manager is more involved in the organisation's business strategy by playing a crucial part in the streamlining of information flow within the respective business processes of the organisation. The information manager becomes a crucial catalyst in translating the requirements as put forward in the information architecture to the rest of the organisation. Thereby ensuring that all relevant role players provide the necessary support in building and maintaining the information landscape within the organisation.

As the definition of information is complex, there is a need for a strategy to allow for the effective flow of information within the organisation as well as the management of these information sources uncovered through the implementation of information technologies and processes. This can only be accomplished through the implementation of an information architecture that fully supports the organisation's information strategy and ultimately the organisation's business strategy.

The aim of this study is not to define an information strategy. However, sources discussing this aspect will be researched extensively, in order to determine aspects of information policy and how it relates to the information strategy, thereby providing the necessary guidelines in putting a supportive framework for an information architecture in place that can in turn provide support for the organisation's information strategy.

In order to do this it would be necessary to explain and define the components of information architecture and how an information strategy relates to these components for the purpose of this study. A number of literature resources will be researched in order to define an encompassing definition of information architecture. Similarly, the concepts information strategy, policy, management and delivery will be defined.

1.2 Problem Statement

The main objective of this research is to determine by means of a case study the information architecture required for an enterprise wide consolidated information management platform for a large conglomerate of companies. This information architecture framework should ensure that information is effectively managed within the organisation and that the necessary vehicles, be this through policies or technological means, are in place to deliver the correct information to all stakeholders concerned.

In order to solve this problem, the following sub problems have been identified;

- What techniques can be utilised to identify an organisation's information resources?
- What is the relationship between an organisation's information policy, information strategy and technology strategy?
- How should an information strategy and information architecture strategy contribute to an organisation's business strategy?

1.3 Latest research

To date there have been a number of articles, books and reports published on the creation of an information strategy and separately on information architecture and data flow diagrams as it relates to systems integration processes. In contrast, a limited number of publications could be retrieved relating to information strategies with relevance to information architecture.

In addition, a number of publications have been published addressing aspects of information overload that could be attributed to the lack of possible collaboration between different disciplines for instance business science, information science and computer science in effectively addressing the situation.

A report published by Reuters in 1997 (Bird, 1997), entitled "*The Reuters guide to good information strategy*" makes mention of the Internet and other related technologies such as Intranets and data warehouses as valuable sources of information that combined adds additional pressure on the end-user in the decision

making process. Similar studies or surveys have been published by research institutions such as Butler, Gartner, Forrester and the Meta Group. All these studies address aspects such as information overload, business activity monitoring or corporate performance management, intellectual capital management, content management and the impact of convergence, globalisation and technological innovation. An indication that organisations are pressured into actively accessing information not only from their internal processes but also to be able to understand the impact of information systems external to the organisation and how these can be integrated into the greater information value chain of which the organisation is a part.

The Joint Information Systems Committee's Information Strategies Steering Group (ISSG) provides a set of guidelines for academic institutions to develop an information strategy (JISC, 2000). These guidelines where developed jointly by Coopers & Lybrand with the aim of providing guidance and advice to institutions to develop their own information strategies. These guidelines could be adapted and utilised within the context of this study.

Other areas that received attention are publications on information auditing, which are considered a necessary step in putting an information strategy into place within an organisation. Although it is not the aim of this study to define an information strategy *per se*, these publications will be utilised within the literature study (Bird, 1997; Buchanan & Gibb, 1998; Burk & Horton, 1988).

Orna (1999) in her second edition of "*Practical information policies*" provides an in depth look into the process of developing information policies for a variety of organisations. This publication will be used extensively in this study, as this is to date the most complete work on information policy development and application.

It is worth mentioning that a number of publications claiming to provide guidelines to set up or develop an information strategy are focussing primarily on the technological aspects and is thus rather seen as developing an information technology (IT) strategy as opposed to an information strategy. These publications have not been totally excluded from this study as IT is considered a crucial

foundation for support in the implementation and execution of information strategies and ultimately the information architecture.

Due to pressures being placed on organisations to disclose certain information to the marketplace or industry sector as prescribed within certain legislative and governance publications the impact thereof will also be included in this study.

No specific articles related to information strategy and information architecture in the same context could be found. It is commonly accepted that the Internet and Web is being used as a ubiquitous way of carrying out most business processes in the new economy. The fact that no concrete research could be found regarding the implementation of information strategies within this context provides the basis for further research in this area (Graboi, 2000).

1.4 Research methodology

As mentioned earlier numerous articles have been published addressing the aspects of information strategy and to a lesser extent, the field of information architecture is addressed. An extensive literature overview will be provided on both aspects that will form the basis of this study.

The opinion that the information strategy should serve as the supporting framework for an organisation's information architecture in order to sustain the overall business strategy will be tested by applying findings from the above literature study to a locally based listed company. This holding company operates within the telecommunications, electronics, information technology, multimedia and financial services industry. At the corporate level, certain services are provided to the various sub-holding and operating units and information is of key importance to the different levels higher up in the hierarchy. Especially for purposes of corporate performance management, disclosure of certain information, governance principles and overall strategic management. The fact that this entity does not manufacture any particular product or is reliant on any specific resources to be able to manufacture a product, but serves as an investment company, provides an additional challenge to understand the role of information architecture and information strategy formulation in this particular context.

1.5 Chapter layout

- Chapter two of this study will provide the necessary overview of an information strategy.
- Chapter three will define the concept of information architecture and discuss the alignment of information strategy and information architecture.
- The chapter four will provide the basis for the study by setting the scene for the empirical research and the results obtained from the empirical study will be interpreted and discussed.
- Finally, chapter five will address future areas of research and conclude this study.

Chapter two: Information policy and strategy

2.1 Introduction

Chapter one provided the relevant background and basis of this study. This chapter will define and put into perspective the concept of "information" and the relevant need for an information strategy. The aim of this study is ultimately to demonstrate the relationship that may exist between an organisation's information strategy and information architecture as supporting framework for the overall organisational strategy. As a result, it is necessary to correlate an organisation's information strategy to its overall business strategy. As Parsons (1996:62) points out, the organisation's information strategy is a key component of the overall business strategy. Burk and Horton (1988:5) quotes the 1986 publication of Marchand and Horton entitled *"Infotrends: profiting from your information resources"*, where Marchand and Horton put forward with the following prophetic statement;

> "*The firms that just survive in the information economy will be the ones that use information resources and computer technology only as cost displacement and labor-saving tools. The firms that compete effectively and flourish in the information economy will be the ones that use information technologies and information resources in strategic ways to manufacture new and better products, find new markets and enlarge their share of existing markets, and distribute products and services in creative ways. These will be the intelligent organizations of the future*." (Burk & Horton, 1988:5)

Today it is almost unlikely to pick up a business textbook or article that does not echo the above statement and continues to underscore the importance of the availability of information to the organisation in every business process (Bird, 1997:12). However, this overabundance in the availability of information in itself creates its own set of challenges to the organisation.

Historically information technology development between the late 1950s and mid-1970s resulted in the creation of "islands of automation". During the late 1950s and 60s most applications focussed on routine activities and procedures such as accounting, payroll, order processing, sales ledger, stock recording, basic personnel systems and fast mathematical calculations based on large volumes of data. The adoption of IT was primarily to cut down on labour costs and increase efficiency through the automation of some routine information activities and procedures.

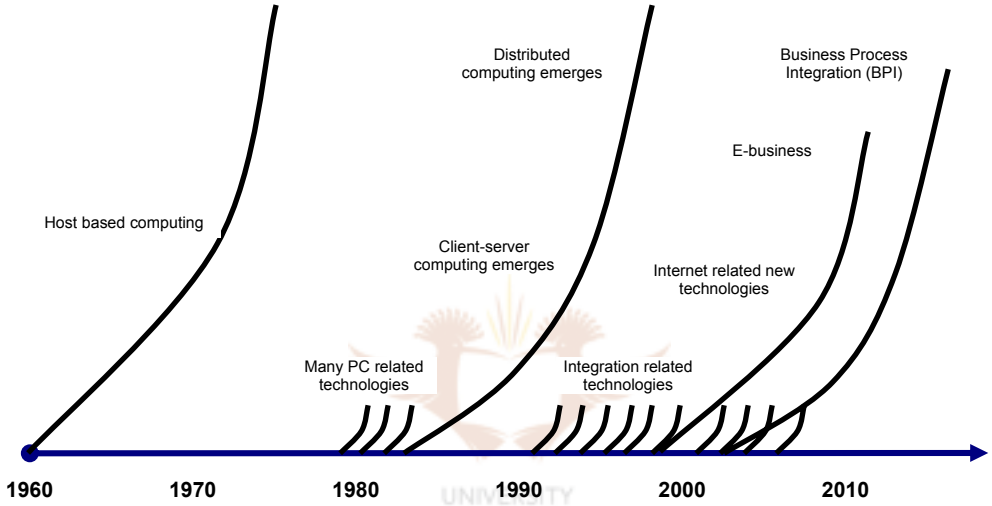


Figure 3: The development and maturity of information technology (Amoroso, 2003).

Since the mid-1970s, networking technologies were increasingly introduced into large organisations to connect the "islands of automation" (See Figure 3). In the mid-1980s, the automation of information activities continued to develop with increased sophistication in expanded business areas, but no longer represented the main features of IT development. Full time IT specialists were increasingly employed to maintain and develop the IT infrastructure, and in many cases, data processing departments were formally created. Although IT was still primarily regarded as a cost centre, its role in the organisation was progressively raised to "corporate utility" level, similar to the role of water and electricity. In many cases, the new IT systems were becoming so deeply entrenched in various business activities and procedures that without them the operation of the organisation was no longer possible. The

automation of information connections was extremely important in the evolution of organisational IT systems, and in fact signalled the beginning of the "IT revolution" within the organisation characterised by the technological convergence between the workplace technology of computing and telecommunication (Smith, 1993:84).

According to Li (1995:45), the automation of information connections can take place on three levels:

1. "Intra-establishmental" (local area network or LAN),
2. "Inter-establishmental" (multi-site organisations only, wide area network or WAN) and
3. "inter-organisational" (extranet)

The intra- and inter-establishmental connections are mostly based on the rationale of cost reduction and efficiency by improving coordination and control within the establishment and organisation. The inter-organisational linkages are very often meant to extend the internal gains of computer networking to its immediate environment, namely suppliers and customers, to reduce the cost of final products and improve the responsiveness of the entire value chain to market changes. This has given rise to many new and popular organisational innovations such as lean production and just-in-time (JIT) systems in manufacturing and retailing organisations. By bringing together order processing, stock control, invoicing and the sales ledger, the efficiencies and reductions in costs can be significant. Through this, IT systems can improve the competitive position of the organisation. The automation of external information connections (inter-organisation) has mostly been developed as natural extensions of internal IT systems so that the efficiency and effectiveness gains can be extended to the entire value chain. For example, the in-flow of external information sources into the organisation's IT systems.

The automation of external information connections, through technologies such as electronic data interchange (EDI), has been particularly well developed between organisations along the lines of value chains that have implemented JIT strategies. These linkages serve to speed up production and delivery as well as reducing the costs of the final product. Some large organisations have used the automation of these information linkages to lock in existing customers and suppliers.

Just as automating internal information linkages is an effective way to reduce costs and improve coordination and control within the organisation, automating external linkages can serve to extend the internal benefits of networking to suppliers and customers, to improve the efficiency of the entire value chain and reduce costs of the final product. Ultimately, this will also strengthen inter-organisational relations.

The role of IT at this stage has been significantly different since the 1970s. As technology is used to automate existing information relationships, the functions of coordination and integration within the organisation and between the organisation and its stakeholders are increasingly incorporated into the organisational information system (Li, 1995:49).

With the revolution of the Internet since the mid-1990s and the technologies that have evolved from it, greater emphasis has been placed on the integration and automation of existing and potentially new information relationships and technologies not only within the organisation but also between organisations (Murphy, 2002:12). Organisations must understand the impact of a bewildering range of new technologies such as:

- Customer relationship management (CRM),
- Supplier relationship management (SRM),
- Middleware and systems integration or enterprise application integration (EAI),
- Computer/telephony integration (CTI),
- Convergence in electronic messaging into unified messaging or instant messaging (IM), and
- Device proliferation and supporting technologies to name but a few.

The Internet and the Internet based communications revolution is accelerating into a hyper state of information flow, or "hyperflow" (Rosser, 1999:1). According to Murphy (2002:xii), this technological shift is causing five major upheavals in business operations. The speed, intensity and ease of access to information are affecting:

- the overall speed of business performance or increase in business velocity,
- sales and marketing through a surge in buyer power,
- internal decision making,
- the use of external sources for business process outsourcing; and

- the leveraging of intellectual capital via knowledge management, not to mention the dispersion in the workforce.

Information hyperflow is the result of a major shift in the availability of information due to Internet technology (Goodman, 1994:7; Murphy, 2002:xii; Rosser, 1999:1). Radical changes have occurred in the number of individuals that can be reached with information, in the richness of information content, in its immediate availability, in the ability to respond directly, and in the relatively low cost to do all this. Organisations are rapidly embracing this technological capability to gain a host of potential advantages. The impact on business has been enormous (Rosser, 1999:1).

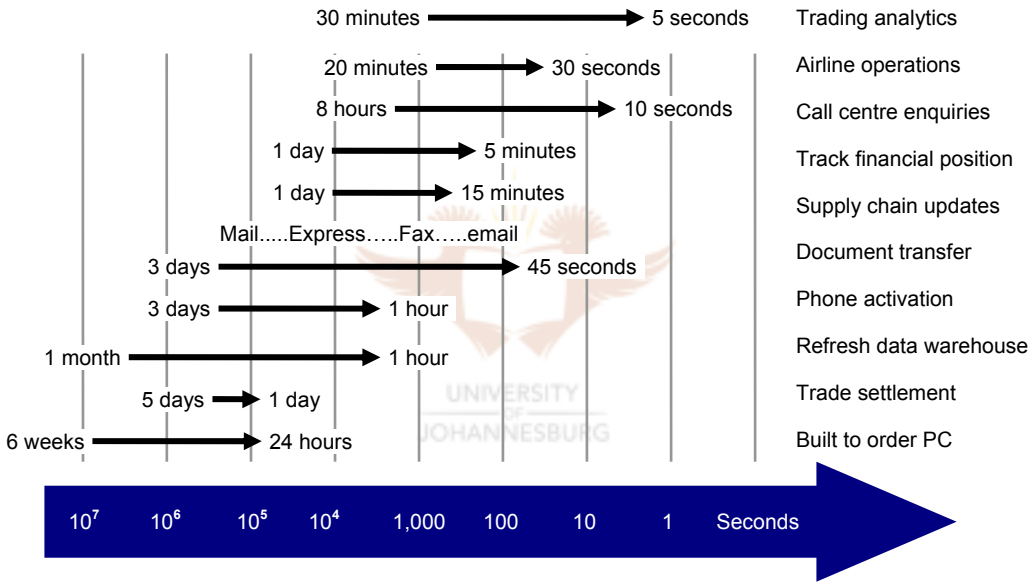


Figure 4: The increase in business velocity (adapted from Amoroso, 2003)

The Internet continues to offer ubiquitous connectivity between organisations and their business partners, suppliers and customers. This "always-on" connection offers new opportunities for organisations to re-use existing business processes in new ways. Speed ("taking the 'air' out of business processes") underlies many management strategies, including "the zero-latency enterprise", "time-based competition" and "just-in-time" inventory (Murphy, 2002:xii). When an order is placed online, there is an expectation that the goods will arrive faster. When someone applies for an insurance policy or submits a claim, he or she expects a

quicker decision and more visibility into the process. These strategies and expectations require reengineering the supply and distribution infrastructures. This can be demonstrated further by the relative increase in business velocity and the resultant impact of information proliferation (See Figure 4).

In addition to the increased velocity of business processes and thus ultimately the underlying information processes, there is the convergence of technologies that potentially leads to new ways of information delivery. New information technologies have contributed to the deluge of information by promoting communications not only within organisations between employees and management, but also with customers, suppliers and markets. From an operational point of view, the flows of goods, services and information are continuous and across organisational boundaries (Li, 1995:39). Business trends such as downsizing are intensifying the pressure by reducing the number of people available to process data and increasing the burden on the remaining individuals (Bird, 1997:1; Read et al, 2001:221). Today, with the growing emphasis on decentralised business and the rate of technological change within the global economy, technology and information have become critical components of the organisation, in line with other business drivers of success such as research and development, marketing and capital and corporate governance (King, 2002; Stan & Meyer, 1999:198). Organisations that will survive in the global marketplace will be predominantly information based. However, without immediate and accurate access to information, organisations are more at risk with every decision being made (Hartman *et al*, 2000:30).

In 1980, Bob Metcalfe promulgated his law; the value of a network equals $n \times n = n^2$ (*n squared*), where *n* is the number of people in the network. One phone or fax in a network is of no use. Two is of some value. Ten is of much more value than five are. Thus according to Metcalfe's law a ten-person network is worth 100, a 20-person network is worth 400, and so on. Networks are increasingly important, and networks can become hugely more valuable as they continue to expand as the platform or medium on which information is distributed (Koch, 2000:280).

Moore's law is another principle that has demonstrated that the proliferation and value of information is dramatically increasing. Moore's law states that the power of information and computer technology grows exponentially as its cost diminishes.

Conditions and frameworks change more dramatically over ever shorter periods of time (Means & Schneider, 2000:xv).

Even though the problem of information overload has existed for many years, recently the problem has become more widely recognised. Numerous research institutions and publications have attempted and some still are in the process of addressing this phenomenon (Edmunds & Morris, 2000:18; Hjørland, 1996:35; Wilson, 1996:21).

Whilst it is not the aim of this study to provide a solution to information overload, this aspect will be carefully studied as it is considered a business imperative and an essential "weapon" in the battle against increasing information overload to have an information policy in place (Bird, 1997:12). There are of course also important business reasons for managing the flow and visibility of information through an organisation. As many organisations are aware, information is considered a key asset and it is fundamental to the value it adds to the organisation. The efficient management of organisational information is crucial to competitive advantage and is a requirement set by all stakeholders (Bird, 1997:13; King, 2002).

This chapter will primarily focus on the concept of information and attempt to provide a good understanding of the use of information within the organisation. Ultimately, to position the concept of information as it relates to architecture.

2.2 "Information" defined

It is not the aim of this study to provide an exhaustive definition of the term "information" but it is believed appropriate to define the term "information" as it will be applied within the context of this study.

Information is not the same for everyone: information that one person would regard as useful might be of little use or no value to the next person. Architecting information helps one to find and use information that is regarded as useful and relevant. Therefore, according to Evernden and Evernden (2003:136) it is important to understand:

- The difference between data, information and knowledge.

- The features and characteristics of information.
- The distinction between information and non-information.

According to Capurro and Hjørland (2002:351) the word information has Latin roots and the *Thesaurus Linguae Latinae (TLL)* provides detailed references to the uses of "*informatio*" and "*informo*" in Latin from the works of the Roman poet Virgil (70-19 B.C.) until the eighth century. The concept of "information", was present in the English language from the 14th century, but was only used in its current spelling in the 16th century (Bawden, 2001:94; Friedman, 1996:246). Almost every scientific discipline uses the concept of information within its own context and about different scientific phenomena.

Capurro and Hjørland (2002:343) provide an extensive overview of the concept of information and discuss broadly the origins of the term and the controversial interpretations and applications of "information" within interdisciplinary sciences.

The term came to have straightforward meaning, which in many instances is defined in English dictionaries as news, intelligence and the communication of facts. However, the term has broadened in its definition and as a result in meaning.

The new Oxford thesaurus of English (2000), defines "information" as a noun describing concepts such as "...*details, particulars, facts, figures, statistics, data; knowledge, intelligence; instruction, advice, guidance, direction, counsel, enlightenment; news, notice, word; material, documentation, documents*...". This is a very broad modern day description of the term indeed.

In the more traditionalist sense of information science, Burk and Horton (1988:239) define the term "information" as:

- that which informs or has the potential to inform,
- meaning communicated or received, and
- a combination of content or meaning represented by symbols, and media or conduit, used or useable in a particular context. Use of the expression "information" itself makes the content or meaning component of information explicit.

Buckland (1991) analyses various uses of the term information in information science and suggests that it can be used in relation to things, processes and knowledge (See Table 1)

Table 1: The four aspects of information (after Buckland, 1991:6)

	INTANGIBLE	**TANGIBLE**
ENTITY	Information-as-knowledge Knowledge	Information-as-thing Data, document, recorded knowledge
PROCESS	Information-as-process Becoming informed	Information processing Data processing, document processing, and knowledge engineering ["Fluxed information": telephone calls, TV broadcast hours, etc.]

From Buckland's analysis, two aspects are highlighted. On the one side it reintroduces the concept of document ("information-as-thing"), and on the other side it points out the subjective nature of information. For example, a tree stump contains information about its age as well as the climate the tree has been exposed to during its lifetime, as manifested in its year rings. Similarly, anything might in some possible circumstances be informative. Buckland (1991:50) concludes "… *that we are unable to say confidently of anything that it could not be information*." Just as anything could or might be symbolic, anything could or might be informative or information.

Capurro and Hjørland (2002:395) continues to discuss Buckland's interpretation stating that information is a subjective concept and criteria for what counts as information are formed by socio-cultural and scientific processes. Interpretation of what is considered information depends on situations within social organisations and depends on domains of knowledge. Individuals have different educational backgrounds and fulfil different roles in society. A stone in a field could contain different information for different people, for example a geologist *versus* an archaeologist. Information can be identified, described and represented in information systems for different domains of knowledge. There are also difference in opinion as to what is considered informative within a specific domain as some

domains have a high degree of consensus and explicit relevance criteria. Other domains have conflicting paradigms with each containing its own implicit view of the 'informativeness' of different kinds of information resources (Capurro & Hjørland, 2002:395).

Goodman (1994:20) on the other hand simply defines information within the context of the information superhighway as "…*knowledge published and made available in digital format. That includes information published not only by traditional sources, but by individuals who have knowledge to share with others*…". Within this context, information is defined as news, weather, stock quotes, airline schedules and government documents to name but a few. These examples would include not only pure text but also any type of audio and visual information, such as video clips or audio recordings.

Bellinger *et al* (2004) provides further insight into the data, information and knowledge hierarchy or DIKW explanation given by Russell Ackoff (Sharma, 2003), a systems theorist and professor in organisational change, who classified the content of the human mind into five different categories, namely:

- **Data**, defined as symbols. It simply exists and has no significance beyond its own existence. It can exist in any form.
- **Information**, defined as data that are processed to be useful and that provides the common answers to "who", "what", "where" and "when" questions. Information is seen as data that has been given meaning by way of relation (Gharajedaghi & Ackoff, 1984).
- **Knowledge**, defined as the application of data and information and typically provides the answers to "how" questions. Knowledge is seen as an appropriate collection of information, with the intent of being useful to the user. In other words, knowledge is considered "instructive".
- **Understanding** is defined as an appreciation of "why", in other words "explanatory". It is cognitive and analytical as is considered the process by which one can take knowledge and synthesize new knowledge from the previously held knowledge.
- **Wisdom**, calls upon all previous levels of consciousness and specifically upon special types of human 'programming', such as moral and ethical codes. Unlike the previous four levels, wisdom asks questions to which there is no

easily achievable answer, and in some cases, to which there can be no humanly known answer period. Wisdom is therefore, the process by which we discern, or judge, between right and wrong, good and bad. Wisdom is considered a uniquely human state and requires one to have a psyche (Bellinger *et al*, 2004).

The first four categories relate to the past, what has been dealt with or what is known. It is only the fifth category, wisdom, whereby people can create the future rather than grasp the present and past. Ackoff in Sharma (2003) further states to achieve wisdom is not easy, and one has to move successively through the other categories before reaching wisdom (Figure 5).

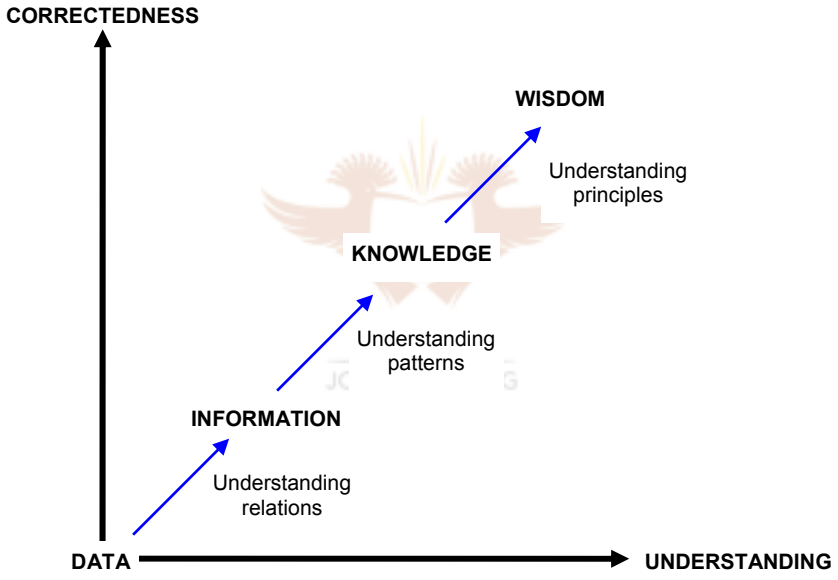


Figure 5: Progressing from data to wisdom (Bellinger *et al*, 2004).

In an online discussion debating the differences between information, knowledge and wisdom Malhotra (1998), defines a further step in the process to that of Ackoff and defines it as "action". Action may be considered in terms of individual, group and organisational processes such as strategising, decision making, learning and adapting. Each of which has implications for the strategic, tactical and operational aspects of information processing and knowledge creation. Putting "action" into the equation the following hierarchy will apply;

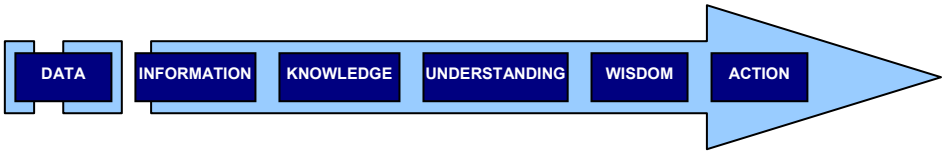


Figure 6: From data to action.

A further variation on this hierarchy is to replace the sequence after knowledge with "insight" instead of "understanding" and "foresight" instead of "wisdom".

Malhotra (1998) goes further to define knowledge as the use of information for creating potential for action and wisdom as the interpretively flexible summation or process of cognition, affect and action that is based on prior experience and serves as basis for future action.

At the simplest level, Applehans *et al* (1999:18) provides an explanation of information as it relates to data and knowledge within the context of knowledge management in a "knowledge pyramid". See Figure 7

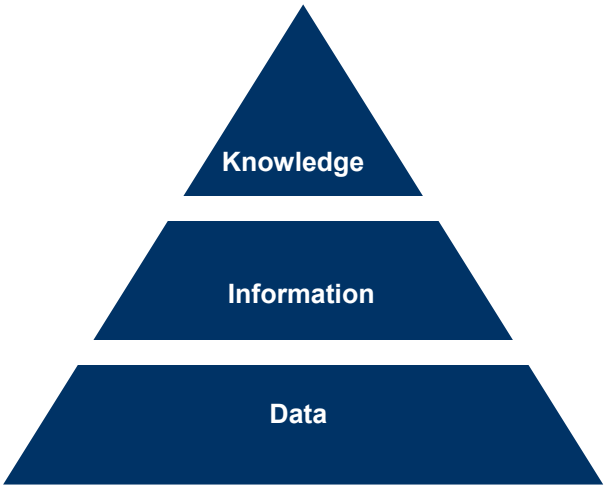


Figure 7: The knowledge pyramid (Applehans *et al*, 1999:20).

Data are represented in the form of measurements such as centimetres (cm), megabytes (MB), age and weight. Data can essentially be seen as building blocks that potentially contain information – but only after it has been processed (Du Toit, 1995:5). Data should be examined within the context a person wishes to process it so that the relevant information desired can be obtained. For one person, basic forms of data may be sufficient to be considered as information, whilst for another some processing or examination needs to take place before it can be considered as useful. One should also remember that data is the plural of "datum". Data leaves itself open to interpretation. For example, "26 April" is a datum and on its own, it is meaningless and has no apparent value. However, analysing the datum in context and thereby deriving some level of intelligence, insight and or understanding to it information can be drawn from the data. For example "Tomorrow is 26 April" is considered being information as it advises someone of the next day's date and thus puts it into context.

Information is considered as being a statement of fact about these measurements. This statement demonstrates the effects of a particular action or set of actions, but they do not indicate how to act in future in similar situations.

In order for this statement to become knowledge, it needs to be translated into frameworks, principles or general guidelines that will allow one to take effective actions in future situations.

The "knowledge pyramid" indicates that in terms of volume, data take up the most space, with information in the middle taking up less and knowledge at the apex of the pyramid taking up even less space. Knowledge ultimately allows one to be able to interpret and extract volumes of data and information in order to take effective actions in future situations.

Orna (1999:8; 2004:7) defines the term "information" as "…*what human beings transform knowledge into when they want to communicate it to other people. It is knowledge made visible or audible, in written words, or speech*."

From an end-user's point of view, information is what we look for and pay attention to when we need to add or enrich our knowledge in order to act upon a particular

action or in a situation. Orna (1999:9; 2004:7) continues to state that "*knowledge and information are separate but interacting entities; we transform one into another constantly*…" The critical aspect of this statement is that before information can be used, it has to be transferred into knowledge and thus into the human mind. Only when it is applied can it affect both the material world and the ideas of others.

The concept of information is extremely difficult to define, since over the years a wide variety of meanings has been ascribed to it (Capurro & Hjørland, 2002:343). Li (1995:28) lists a number of authors that have actively researched the concept of information and highlights the fact that some authors have identified more than 40 academic fields dealing with information, whilst others have found that in the area of international regulations alone there are more than 100 definitions of information processing and is generally referred to as or termed as "communications". Such diversity and abundance of definitions of information is not surprising given that the world is progressively entering the so-called "information-age" (Capurro & Hjørland, 2002:377).

Bawden (2001:93) continues to state that the term "information" is arguably the most over-used, and misunderstood term of present time. The advent of the information age, the information economy and information society and the ubiquity of information are undeniable. However, along with this ubiquity comes the variety in application and meaning of the term "information". Numerous definitions have been proposed for the term "information" and most of them usually serve the interests of those defining the term (Capurro & Hjørland, 2002:356).

Giving the concept of information a more precise meaning is essential to discussion, negotiation or communication in specific contexts and multiple definitions of information may lead to misunderstanding and confusion. Different definitions of information may be more appropriate for understanding different facets of transformation, and any attempt to develop a common definition of information involves oversimplification, which by nature can be unacceptable in more specific contexts (Li, 1995:29). Li goes further in outlining the different treatments of information since the 1980s within the field of geographical studies. Initially information has been treated primarily as resources represented as information capital and labour and commodities represented as information merchandise, and to

a lesser extent, as perception of patterns by means of managerial innovations. A further notion that information is a constitutive force in society, for instance through power and control, is also mentioned. Therefore, it can be assumed that information can be treated as a resource, commodity, perception of patterns and a constitutive force.

A useful hierarchy of definitions of information has been developed by Braman (as quoted in Kirk, 1999) in the area of information policy studies. This hierarchy recognises the qualitative differences among definitions of information and its application is more appropriate to organisations than definitions based only on the employee as information user. Furthermore, it provides a range of definitions that are useful in different situations.

Braman's hierarchy (Kirk, 1999) consists of four levels, each based on a category of definitions drawn from many different fields;

1. Information as a **resource**. Descriptions of information as an asset or resource are no longer unusual. Information, its initiators, processors and users are viewed as discrete and isolated entities. Information comes in pieces unrelated to bodies of knowledge or information flows into which it might be organised.
2. Information as a **commodity**. The notion of information as a commodity incorporates the exchange of information among individuals and related activities as well as its use. This relates to the concept of an information production or value chain through which information moves and gains in economic value.
3. Information as **perception of pattern**. The concept of information is broadened by adding context. Information has a past and future, is affected by motive and other environmental and casual factors and it self has an effect. This extends information management into an area of achieving objectives of an organisation.
4. Information as a **constitutive force in society**. Information has a role in shaping context. It is not just affected by its environment, but itself can affect other elements in the environment. In this context information management shifts from service provision to strategy formation.

The hierarchy of definitions presents a broad based view of information as it can be applied within the organisation.

Considering the variety of explanations above, it is clear that the term "information" should be defined within the context of what information consists of, namely "data" in its simplest form and how it then relates to what information is considered to become, namely knowledge or eventually wisdom or action as some authors suggest.

In conclusion, for the purposes of this study the term "information" will be defined as data that has been processed and arranged within a given context to provide a specific solution to a pre-defined problem that could in essence affect knowledge by adding to it or reform it. In short, information is meaning extracted from data within a given context.

Subsequently, when attempting to put together an information policy and ultimately an information strategy, one needs to take into account both the intricacies of information and knowledge and how they are interlinked.

From the above Orna (1993:196) defines information in organisational terms:
"*Whatever the organisation needs to feed its knowledge of its own business so that it can meet its objectives successfully*."

This definition implies that if the organisation wants to have a well-built knowledge base that will enable the organisation to act successfully the following questions would need to be asked and answered:

- What are we trying to do?

Then a series of parallel questions:

- What do we need to know in order to do it?
- Who needs to know about it?
- What information do we need to support the knowledge?
- What do we need to do with the information in order to achieve what we are trying to do?
- Who needs to do it, and how?
- What do we actually know?
- Who actually knows it?

- What information do we actually have?
- What are we actually doing with the information we have?
- Who is doing it and how are they doing it?

In order for the organisation to interpret the answers and make decisions on them, Orna (1993:196) goes further to state that the organisation first needs to understand:

- The organisational objectives and what their implications are related to the information required and what the organisation needs to do with it, and
- The organisational culture and the information politics that flows from it.

For an organisation to determine the answers to the above questions the organisation needs to consider doing an analysis of the information resources within the organisation, where are they located, who has access to it and how is it being utilised. This is where techniques for an information audit come into play.

2.3 Information audit

The strategic exploitation and effective management of information and enabling technologies are increasingly recognised as critical to organisational success. However, in order for organisations to understand and determine which particular information resources and technologies they have to rely on in order to exploit and manage, they need to undergo an information audit to answer these statements (Buchanan & Gibb, 1998:29; Burk & Horton, 1988:28).

The information manager requires a number of tools in order to define and implement an information strategy. A popular approach is to map dynamic information processes and information flows. This links technical and social systems as it involves and analysis of the communications (processes and information) that takes place between people in a social context (the organisation) using a variety of media and channels (technology). Information strategy is therefore concerned with managing the relationships between these entities as depicted in Figure 8.

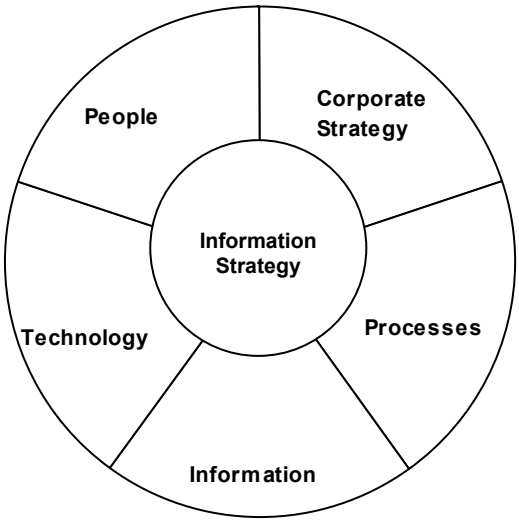


Figure 8: The co-ordinating role of information strategy (Buchanan & Gibb, 1998:34).

The information audit is a process for discovering, monitoring and evaluating an organisation's information flows and resources in order to implement, maintain or improve the organisation's management of information (Buchanan & Gibb, 1998:34). The audit should be seen as a necessary step towards determining the value, function and utility of information resources in order to enable the organisation to be in a position to fully exploit the strategic potential of the information resources it owns and have access to.

Orna (1999:69) quotes Taylor who describes "…*an audit of the formal information activities and their effect on the organisation*". It is also important to understand what the organisation does, its history, its context within the environment, its customers and to be aware of the organisational dynamics and culture and how this influences the flow of information within that organisation.

Cortez and Kazlauskas (1996:90) state that the information audit is analogous to the financial audit of an organisation and uses information audit as a generic term to designate a number of strategies for studying the effectiveness of information flow between organisations. However, as DiMattia and Blumenstein (2000) point out, the term "audit" has a negative connotation to it and is confirmed by Jones and Bonnie

(2004). Therefore, it is usually recommended to change it to something else, for example a survey, assessment, analysis or discovery process.

The information audit can be further defined as a fact-finding, analysis, interpretation and reporting activity that studies the information policies, structure, flow and practice of an organisation. The aim of the audit includes the collection of data concerning the efficiency, credibility and economy of the organisation's information handling activities and practices; the provision of adequate policies, which oversee these activities, and practices and the development of recommendations for action tailored to the organisation's specific situation.

Orna (1999:69) quotes the definition as developed by the Aslib Knowledge and Information Management Network or Aslib KIMNET (previously known as the Information Resources Management Network of Aslib):
"*A systematic examination of information use, resources and flows, with a verification by reference to both people and existing documents, in order to establish the extent to which they are contributing to an organisation's objectives*." (http://www.aslib.co.uk/info/subjectsinfoaud.htm).

The exact boundaries of the audit may be difficult to determine but can include the entire organisation, focus on one location or functional area or even the organisation's external or internal information flow, or both. The purpose of the audit will also determine the scope of the exercise (Jones & Bonnie, 2004).

Traditionally information audits have been designed specifically for an individual organisation in which it will be implemented and consequently the role has been varied depending on particular circumstances and objectives of the organisation (Buchanan & Gibb, 1998:34). Accordingly, the role of the information audit has not been clearly defined or universally accepted. Traditionally the purpose of the information audit in its simplest form is to:

- Identify the organisation's information resources, and
- Identify the organisation's information requirements.

However, the full potential of the information audit could also include aspects such as;

- Identify the costs and benefits of the identified information resources,
- Identify the opportunities to apply the information resources for strategic competitive advantage,
- Integrate IT investments with strategic business initiatives,
- Identifying information flows and processes,
- Developing and integrated information policy,
- Creating awareness of the importance of information resources management and defining the management role,
- Monitoring and evaluating compliance with information related standards, legislation and policy guidelines.

Buchanan and Gibb (1998:35) further state that ideally the information audit should include all the above aspects in order to provide a comprehensive and integrated strategic approach. However, there are very few methods proposed or discussed that go beyond basic frameworks, which require further development. To date, there are no single accepted methodology supported by statute, standard or professional body. Buchanan and Gibb (1998:36) continue to state that there are several methodologies available many of which are characterised by a very definite purpose and scope, which makes widespread implementation difficult. The overriding consideration that will determine the selected methodology is the intended purpose of the information audit (Ramjaun, 2000).

It is for this reason that some of the most popular approaches that are used in the information auditing process as described by Buchanan and Gibb (1998:36) are that of Burk and Horton and by Orna, each of which has its advantages and disadvantages. An overview of Buchanan and Gibb's integrated approach is also provided.

2.3.1 Burk and Horton's InfoMap

Developed by Burk and Horton this methodology provides a systematic process to discover, map and evaluate information resources within the organisation. A highly structured methodology is provided and a framework for carrying out a

comprehensive inventory of an organisation's information resources is presented. This method is a bottom up approach and provides a number of maps or tables to reflect the inventory of information resources. There are four main stages (Burk & Horton, 1988):

1. **Conducting the preliminary inventory (Survey)**: The existing information resource base of the organisation is defined through a preliminary inventory of all information resource entities or IREs via interviews with staff directly involved in using, handling, supplying and managing information.
2. **Measuring costs and assessing values (Cost/Value)**: A multi-disciplinary approach is used, drawing from accounting, business and economics, to measure the cost and determine the value and benefits of each IRE in order to relate cost and value in the form of ratios to provide an overview of costs and value across the organisation.
3. **Information resource mapping techniques (Analysis)**: Three information resource-mapping techniques are used to relate the identified IREs to the structure, functions and management of the organisation. Through this process, the particular functions and configurations of IREs can be identified and related to the organisational structure with the aim of identifying corporate resources.
4. **The corporate information resource (Synthesis)**: Through careful selection of a set of resource criteria, namely; nature, cost and value of each IRE, the organisation's information resources are identified along with their strengths and weaknesses relative to the objectives of the organisation.

InfoMap is considered one of the most comprehensive methods for identifying and defining an organisation's information resources. The benefits for the organisation are:

- It assists in putting together a comprehensive inventory of all information resources.
- It provides a measurement of the cost and value of the IREs.
- It draws attention to problems and opportunities relating to current information practices and policies.
- It creates and stimulates awareness of the importance of information resource management.

On the other hand, this methodology also has a number of potential problems:

- The main purpose of this methodology is discovering and making users aware of information resources, and not necessarily the management of information resources.
- This is a time consuming and expensive process.
- Attention is focused on information resources and does not include organisational analysis.
- Finally, it provides a snapshot analysis of the organisation that will require regular updating.

One limitation is that no real provision is made for organisational context. Even though Burk and Horton do point out the importance of context, they do not provide any method or technique for its analysis. Buchanan and Gibb (1998:38) provides further arguments from other authors, that because InfoMap is dependant on users identifying information resources, more emphasis is placed on the discovery process than on the use of such information. This in itself could be problematic to the analysis of the results because of the lack of detailed knowledge regarding the context of information use within part or parts of the organisation. The purpose of InfoMap is to carry out an inventory of information resources and therefore the problem lies more with the organisation than the particular method.

As Buchanan and Gibb (1998:39) quotes other author's experience and highlights the relative shortcomings in InfoMap and the need in some cases exist for a more extensive audit process that includes more of an organisational analysis. This is where Orna's flow based approach is given as an example of such a method.

2.3.2 Orna's information flow analysis

Orna's information flow analysis provides a top down approach with more emphasis placed on the importance of organisational analysis. This method focuses on dynamic information flows and the product is an information policy, as opposed to InfoMap that focus on static IREs. This methodology consists out of ten steps (see Figure 9) as per the second edition of Orna's *Practical Information Polices* (Orna, 1990; Orna, 1999 & Orna, 2004:49):

1. **Analyse the information implications of key business objectives:** A top-down analysis of the organisation's objectives, structure and culture with the knowledge gathered forming the basis of the information audit.
2. **Ensure support and resources from management:** Top management needs to buy into the process and understand what the information audit entails. Without commitment, there is little chance of success.
3. **Get support from people in the organisation:** It is essential that everyone in the organisation who will be affected be informed and have the opportunity to ask questions.
4. **Planning the audit:** It is suggested that project staff are selected to start the auditing process. This provides for quick contributions in a more or less controlled environment, with minimal risks.
5. **Finding out:** This step is the beginning of the actual audit process. Focus is placed on five key areas where essential questions need to be answered:
    - Information resources – both content and containers
    - Guardians and stakeholders
    - Information flow and interactions
    - Technology and systems to support the use of information
    - How the cost effectiveness of information is assessed.
6. **Interpreting the findings – matching what is with what should be:** The findings of the information audit are related to the organisation's objectives to identify both positive and negative relationships.
7. **Presenting the audit findings and recommend action:** Information and knowledge acquired during the course of the audit needs to be made visible and manageable for others who have not shared in the process to ensure that selling the information policy takes place.
8. **- 10. Following up the audit:** At this point, the audit is considered to be completed. However, this marks the beginning of new activities as well as another cycle of the auditing process. This process effectively culminates into the development of a corporate information policy to provide strategic direction and management guidelines for the organisation's future use of information.

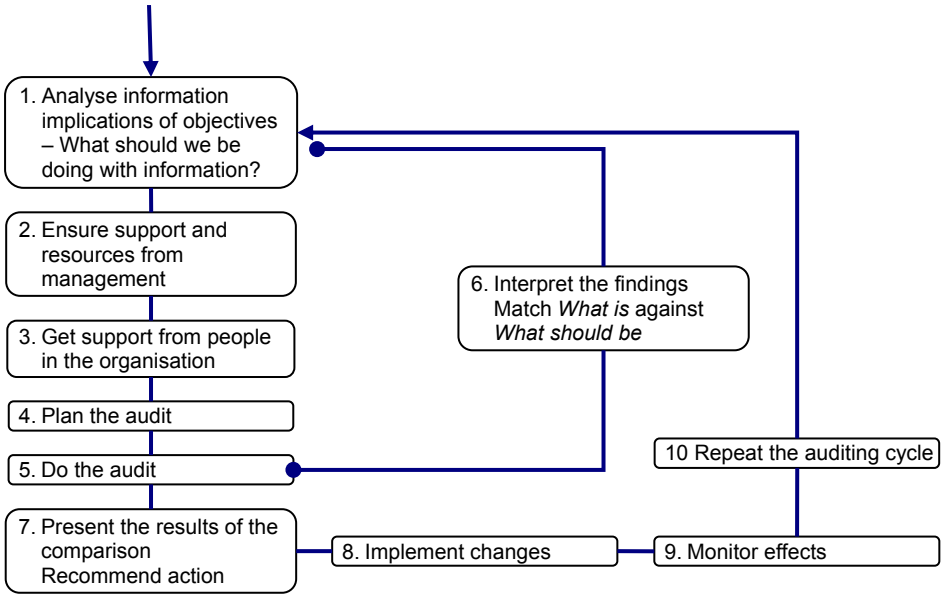


Figure 9: The information auditing process (Orna, 1999:75).

There are three main advantages over other methods of information auditing:

- A top-down organisational analysis is carried out.
- Dynamic information flows are identified.
- The product of this method is a corporate information policy.

However, the challenge with this approach is that it lacks according to some authors the suitable tools and techniques required to carry out several of the steps (Buchanan & Gibb, 1998:40). Orna does recommend that a multi-disciplinary skilled team be used during the execution of this audit and this team should be predominantly sourced internally with some assistance from an outside consultant initially (Orna, 1999:79).

It is evident that no single methodology can provide a complete information audit solution. It is essential that the purpose and scope of the information audit are clearly defined and only then, can the most applicable methodology be selected, developed and applied. This is where Buchanan and Gibb propose a universal model to be used by organisations.

2.3.3 Buchanan and Gibb's universal model – An integrated strategic approach

According to Buchanan and Gibb (1998:41), most organisations should already possess the necessary knowledge to satisfy some of the proposed steps, for instance, a mission statement with clear identified objectives.

This methodology is divided into five main stages and led by an information auditor jointly with a working group. This group should be a representative team of senior members of the organisation, with relevant experience in the area of information management.

1. **Promote:** This stage aims to promote support and co-operation for the information audit and this is achieved through three steps. The first two steps are done by the working group and the final step by the auditor.
    a. Promote the benefits of the information audit through a variety of mechanisms, such as seminars or publications that explain the role of the audit and why it is required by the organisation.
    b. Foster cooperation throughout the organisation. This is achieved by the chief executive of the organisation providing the necessary introductions to the organisation for the auditor and updates on the actual audit. This also serves as a symbol of support from the top management executive.
    c. Carry out a preliminary survey of the organisation. This is to allow the auditor to make some preliminary observations and assessments of the level of awareness and value of information within the organisation. This determines the level that the information audit should be set at.

    This step should provide the basis for greater understanding of the importance and purpose of the information audit within the organisation.

2. **Identify:** A top-down strategic analysis of the organisation is done to build up an understanding of the organisation's mission, environment, structure and culture. Towards the end of this step, the information resources and information flows within the organisation are identified. There are six underlying steps to this stage. The working group carries out the first four steps in a workshop, whilst the auditor completes the final two steps.

a. *Identify the organisation's mission*. In this step, well-known business analysis frameworks are suggested to be used.
b. *Identify the organisation's environment*, i.e. the political, economic, social and technological influences (PEST). This can be achieved through a PEST analysis and by Porter's model of competitive forces that considers the potential for new entrants (entry barriers), bargaining power of suppliers, threat of substitutes, bargaining power of buyers and the intensity of rivalry.
c. *Identify and define the organisation's structure*, which in turn defines the flow of information, and will either assist or obstruct the development of an information strategy. This step is achieved through applying well-known methodologies as presented by Hammer and Champy and Mintzberg. Preliminary information flow requirements are identified similar to that of Orna's flow based approach.
d. *Identify and describe the organisational culture*. The culture of the organisation will influence the value the organisation places on information, the way information flows, and how information is utilised.
e. *Identify information flows*. According to Orna the organisation's information flows provides insight into what information is generated within the organisation, who generates it, who uses it and how is it being used. It also shows who has the authoritative information on specific initiatives, which can be expected to know what and who should not be expected to know. It also reveals any gaps in information provision and highlights areas where there maybe shortcomings.
f. *Identify the organisation's information resources*. So far, a preliminary inventory of the organisation's information resources would have been built-up. This step aims to finalise this inventory and then to interview the information users with the intention of building up a more complete picture of each information resource and its supporting activities.

Once the identify stage is complete, the organisation will have a comprehensive database of its information resources which will be clearly

linked to the organisation's mission, goals and objectives. In addition, it will illustrate the strategic position between the organisation's mission, environment, structure and culture. Any problematic areas will be highlighted.

3. **Analyse:** The aim of this stage is to analyse and evaluate the organisation's information resources and to formulate action plans to address problematic situations and achieve the objectives documented during the previous identify stage. This stage comprises of four steps of which the auditor does the first three and the final step is done by members of a workshop.
    a. Evaluate the information resources. The information resources are evaluated according to their strategic importance, utility and associated problems in order to identify appropriate management strategies for each information resource.
    b. Produce a detailed information flow diagram that will illustrate who is using what, where and why.
    c. Produce the preliminary report that will provide a summary of the information audit process, findings, recommendations and highlight areas of concern.
    d. Formulate action plans required to improve problematic areas and realise objectives that have been identified by the information audit.

    This stage will have identified the strategic importance and utility of each information resource and the appropriate management strategies. It will also provide the organisation a set of recommendations for action to improve problematic areas.

4. **Account:** This stage's objective is to cost the information resources in order to be able to assign accurate costs to information and associated services. This is to compare costs to value and other benefits. This could be a problematic area and it is recommended that the organisation's accountants are involved in this process to ensure consistency. Due to the perceived complexity of this stage, a number of innovative approaches are suggested as opposed to a rigid methodology, such as activity based costing (ABC) and output based specification (OBS). The outcome of this stage is the identification of the cost, or cost indicators for each information resource – depending on the choice of costing methods utilised.

5. **Synthesise:** The final stage reports on the complete information audit process and synthesises the findings. This stage consists out of two steps.
    a. The information audit report that provides a detailed and complete account of the information audit process, the information auditor completes this step.
    b. The information strategy provides recommendations in order to provide an integrated strategic direction for the organisation's future and information in relation to the organisation's mission and objectives.

The perceived benefits of this particular methodology according to Buchanan and Gibb (1998:46) are that:

- It provides a complete step-by-step solution.
- It provides a management toolkit that can be adapted to individual requirements.
- The relationship between the organisation's business strategy and information strategy is identified and evaluated.
- It utilises a new approach to costing of information resources.
- It provides the organisation with an information resource database or inventory.
- It provides an integrated strategic direction and management guidelines for the future management of information.

Buchanan and Gibb (1998:46) also admit that there maybe potential barriers to the successful implementation of their methodology, namely:

- The scale of the exercise and resource requirements may be impractical for some organisations.
- The separation between the different stages may not be always that clear due to the multi-disciplinary nature of the exercise.
- There can be practical difficulties in modelling the relationships between different objectives, tasks and information resource, most notably due to complex relationships.
- Although process modelling is identified and recommended as a management tool, the tool may be criticised as being too task orientated and functional.

This methodology is intended to be generic and aimed at broad application. Organisations may have to make compromises or make use of sub-sets of the different stages and enhance them where applicable.

2.3.4 Summary

In DiMattia and Blumenstein (2000) the managing director of TFPL Ltd (http://www.tfpl.com/) is quoted as stating that there are two main drivers for information audits, namely intranets, which appear not to deliver benefit, due to the fact that they have been designed without proper thought to the information and knowledge flows and resources needed. Secondly, knowledge management initiatives where the knowledge management team is trying to obtain an understanding of the very complex assortment of information available from within and outside the organisation, and on where and when information is required. TFPL sees the information audit as a systematic process through which an organisation can understand its knowledge and information needs, what it knows, how information flows within the organisation and where information gaps may reside. The information audit reviews what information is created and needed across the organisation. As mentioned earlier in Orna's methodology (see section 2.3.2), the information audit will raise the awareness across the organisation of the value of information and the value of sharing information.

The information audit according to TFPL (2005, DiMattia & Blumenstein, 2000) will also help in:

- identifying the information needs to meet the organisational targets of the organisation itself, the various business units, and the specific needs of individuals;
- identifying the information created and assess its value to the organisation
- identifying expertise knowledge and expertise resources of the organisation, and thereby enable the start of an intellectual asset register;
- identifying quick wins that could be implemented to produce and demonstrate immediate benefits;
- reviewing the use of external information resources and how it may be used more effectively;

- reviewing the usage of internal information resources and how valuable they are, and importantly, how they can be improved;
- map information flows and current bottlenecks within these flows;
- identifying where the information resides, who utilises it, the barriers to its use and the gaps that needs to be filled;
- developing a knowledge and information map of the organisation.

The result from an information audit is an 'information map', which can be used as the basis for designing the content of intranets, the foundation of an information strategy or even a knowledge management strategy (TFPL, 2005).

The risks of not doing an information audit are the creation of duplicate, incomplete or inaccurate resources and work, inefficient use of an intranet, inefficient expenditures, innovative ideas that do not get shared and intellectual assets that are not fully utilised (DiMattia & Blumenstein, 2000).

The benefits to be gained from an information audit according to TFPL (2005; DiMattia & Blumenstein, 2000) are that the audit will help to identify how the organisation can:

- make better use of its intellectual assets;
- make better use of information;
- avoid inefficiencies and duplication of information;
- avoid information overload; and
- save time and money through efficiencies.

Ramjaun (2000) warns that despite the real advantages that can be gained through an information audit, the implications should not be ignored:

- The information audit is a time consuming process and may become costly as it necessitates proper planning and adequate resources.
- It requires a multidisciplinary working group with business and research skills led by an auditor, preferably with an information management background.
- Staff co-operation and support is a crucial element at various stages of the audit.

DiMattia and Blumenstein (2000) concludes that the information audit may not be considered by some as an essential tool for information professionals, but in terms of usefulness in marketing and establishing the value of the central information function within the organisation it can be considered as critical. Furthermore, through this type of exercise it undoubtedly brings to the attention of users the information resources available to them and the potential of new services and resources to meet their particular needs.

The information audit serves as the foundation for the organisation's information policy and ultimately its information strategy. The audit provides the map of what the organisation is actually doing with the information it owns, creates or has access to, and allows the organisation to measure how well the reality matches with what the organisation should be doing with the information (Orna, 1999:71). The importance of the information audit will also become more evident in the next chapter discussing information architecture.

2.4 Information policy

Policies are considered declarations, usually by governments, of intent to undertake certain actions within given segments of the economy. The ability of governments to develop effective policies depends on their capacity to interpret information relevant to the country's economic, social, cultural and financial situation (Valantin, 1996). The concept of information policy began to emerge in the 1960s, with government concerns being gradual, erratic and reactive in face of specific issues (Browne, 1997a:349). It was however only in the early 1990s that the emphasis increased with definitive activities in the UK and USA, amongst others (Browne, 1997b:262; Law 2000:327). Tony Blair, Prime Minister of the United Kingdom (UK), provided a definition of information policy as being "*a co-ordinated strategy, which will focus on transforming education, widening access, promoting competition and competitiveness, fostering quality and modernising government*" (Blair, 1998). This is not too dissimilar from the National Information Infrastructure (NII) as proposed by the Clinton-Gore administration in the United States of America (USA) in 1996 (Carbo, 1998:71-72). However, the definition of information policy as applied by governments will mostly differ according to the application thereof and the needs as expressed by the relevant country where it will be applied. In South Africa the needs

expressed as well as the level of access to relevant technologies is very different from that of the UK or USA based on the country's requirements, infrastructure, education, to name but a few.

Governments with polices for economic, social and cultural development requires complementary policies to ensure that the supply and use of information is carried out. Most governments have recognised this principle and have put into place a variety of measures that combined amount to a national information policy. However, they do so in different ways and some do it more effectively than others (Gray, 1988:3).

With commercial pressures on organisations to grow, the increasing application of technology and information play an important role in the success of the organisation. As highlighted earlier there are many influences; externally from the marketplace, competition and customer demand; internally from business and technological considerations, and importantly also information requirements (Cropley, 1998:210). Organisational policies form the basis for the organisation to ensure that the relevant social, cultural, financial, environmental and other internal factors are effectively absorbed in the day-to-day operation of the organisation and to ensure that the relevant information is provided for effective planning and decision-making.

In its broadest sense the information policy is considered to be the set of rules, both formal and informal, that directly restrict, encourage or otherwise shape the flow of information within a specific context (Weingarten, 1996:45). Simply put, information policies are policies about making information available to or withholding it from those who want or need it. Effective information policies require policy makers to address a broad range of legal, economic, political and management issues that apply either specifically to information itself, or in some cases the information technology used to collect, store or disseminate that information.

An organisation's information policy is based on the overall business objectives and priorities within these objectives of that specific organisation. According to Orna (1993:196; 1999:9; 2004:8), this policy may define at a general level the following;

- The objectives of information use in relation to the objectives of the organisation.
- What "information" defines within the context of the organisation's existence.
- The principles on which the organisation will manage information.
- The organisation's resources of information and its use of human resources in the management of information.
- Principles for the use of information technology in supporting the information management function.
- The criteria that will be applied by the organisation to establish the cost effectiveness of information and knowledge, and
- The criteria of monitoring and evaluating information activities.

Importantly the policy should be expressed in terms that correlates with the organisation's objectives and character and should be used throughout the organisation as a focus for thinking about how the organisation utilises and applies knowledge and information (Orna, 1999:106).

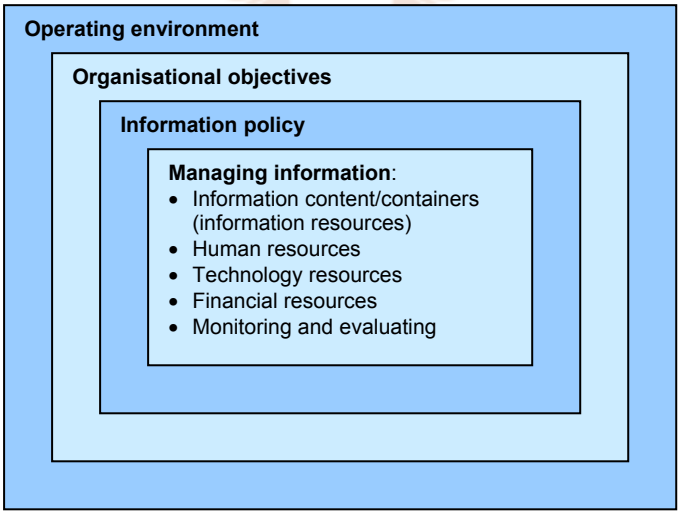


Figure 10: Information policy in context (Orna, 1993:196).

Figure 10 provides a simplified view of defining the context in relation to the concept of information policy within the context of organisational objectives and the environment in which the organisation operates.

The information policy is considered a dynamic tool than can be utilised:

- as the basis for developing an organisation's information strategy;
- to correlate everything that is done with information to the organisation's overall objectives;
- to enable effective decision making regarding resource allocation;
- to promote collaboration between all stakeholders of the organisation;
- to provide objective criteria and subsequent measurement of the results of information based activities; and
- to provide a feedback mechanism to the process of developing corporate policies.

Considering the outcome of the information policy in relation to the key organisational objectives, it will provide the relevant focal points for information strategy development.

2.5 Information strategy

The term "strategy" has become widely used and written about since it was originally used in the military context. Arguably, one of the earliest writings discussing the flair of military strategy and tactics is Sun Tzu's "*Art of War*" originating in China some 2,500 years ago (Tzu, 2003). Many of its principles are still being applied in modern times.

It was only in the early 20th century, that the subject of "strategy" within a non-military context has come about, peaking in the 1960s with works by authors such as Chandler, Sloan, Drucker, Ansoff, Porter and Mintzberg seeing the light (Koch, 2000:6). A number of varied definitions as to what exactly strategy is, is available in the literature. Suffice it to say that the term "strategy" refers to the actions to be taken by an organisation "*…identifying the desired future state for the business, the specific objectives to be obtained, and the strategic moves necessary to realise that future*." (Boar, 1994:7). Strategy is the setting of long-term goals and objectives, the determination of courses of actions, and the allocation of resources to achieve these objectives (Koch, 2000:6). In addition to this, the organisation needs to monitor and match its resources to a changing environment, markets and customers to ensure achievement of competitive advantage and to meet stakeholders' expectations.

Strategy should not be seen as an analytical process alone; it requires intuition, creativity, sensitivity to trends and an appreciation of what the organisation can or cannot deliver (Koch, 2000:x).

During the past few decades, there has been a cumulative process of important change in the economy and corresponding changes in the nature of technology. The dynamics have become richer and the impact on organisations more severe.

Organisations have underestimated the strategic importance of information and associated technologies (Buchanan & Gibb, 1998:30; Evernden & Evernden, 2003:ix). There has been a definite change over time in the approach of organisations to move towards an information systems strategy, away from technical issues and towards organisational and information concerns (Orna, 1999:20). The change in view that information can be recognised as a strategic resource has caused organisations to look at the content as opposed to the container or vehicle and move towards the managing of information. As previously mentioned in section one, information must be recognised as a resource that needs to be managed and accounted for like any other resource. Burk and Horton popularised this management philosophy as information resources management in their publication *InfoMap* (Burk & Horton, 1988:1).

The information strategy should not be confused with the information systems or information technology (IT) strategy that in itself depends on what information the organisation requires and how it needs to use it. Simply put the IT strategy deals with how applications software and infrastructure are to be utilised within the organisation to support efficient information delivery. The IT strategy considers amongst other things the current information technology landscape, new technological developments and how these aspects align with the overall organisational strategy (Boar, 1993:24). The information systems (IS) strategy can be considered as structured ways of providing information (Duffy & Assad, 1989:3). The information strategy is concerned with the creation, communication, management and availability of information within the organisation. It encompasses both management information and the management of information to adequately support the different functions within the organisation. The information strategy is closely aligned with but distinct from the IT strategy. Whereas the information

strategy focuses on the information requirements of the organisation and the methods by which those information requirement are met. Figure 11 illustrates the interlinking between the information systems (IS) strategy, information technology (IT) strategy and the information management (IM) strategy.

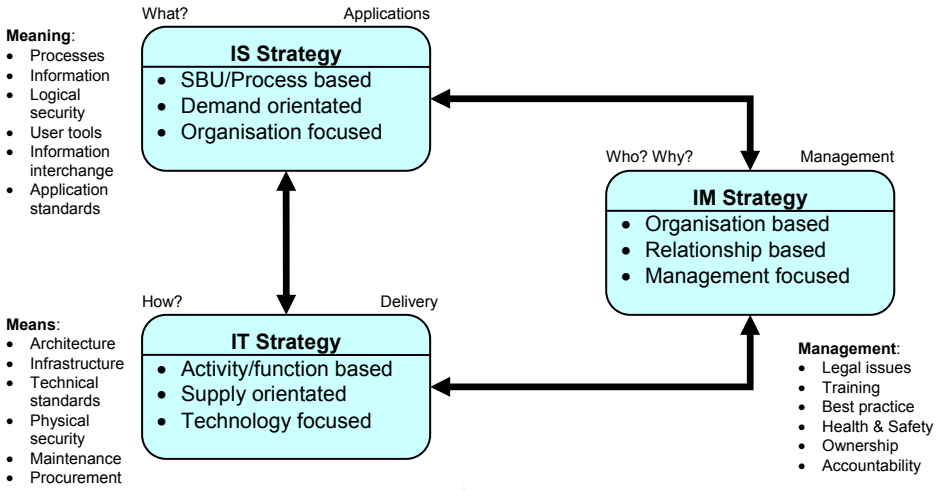


Figure 11: Interlinking information strategy components (Adapted from Buchanan & Gibb, 1998).

The alignment of the information strategy with the business strategy is a critical element for the success of the organisation (Buchanan & Gibb, 1998:31). The relationship between business and information strategies is illustrated in Figure 12.

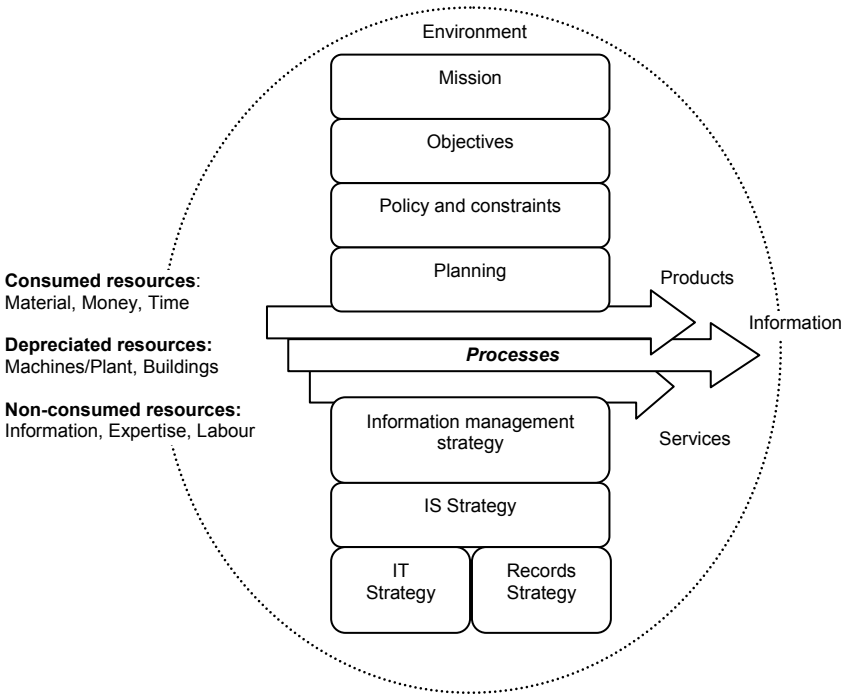


Figure 12: Business and information strategies (Buchanan & Gibb, 1998:32).

The components in Figure 12 represent an ideal and the size or attitude of the organisation towards information technologies may blur boundaries or simply ignore some of the building blocks.

The business strategy will usually involve four key components:

- **Mission** – provides a top level, generalised statement of what the organisation wishes to be. The mission statement attempts to convey the values of the organisation and should be capable of persisting through changing environmental conditions.
- **Objectives** – the mission statement is developed through a series of objectives and will not necessarily have the same degree as permanence as the overall mission statement. The objectives will be reviewed regularly to ensure that they reflect the current environmental conditions and perceptions regarding the best and/or most applicable ways in satisfying the organisation's mission.

- **Policy and constraints** – The objectives of the organisation will have to be interpreted within the context of the organisation's policy on certain aspects, i.e. human resources, procurement, acquisitions and disposals, and constraints such as the availability of resources, regulations and technologies.
- **Planning** – Having established the objectives, and identified the policy issues and constraints, the organisation will develop specific plans for the realisation of the approved objectives. The organisation will have to identify, design, implement and manage the key processes that will be used to achieve its strategy.

The above may be considered a very simplified view of business and information strategies, but overall it can be considered an alternative view of Porter's generic value chain as illustrated in Figure 13 (Duffy & Assad, 1989:111).

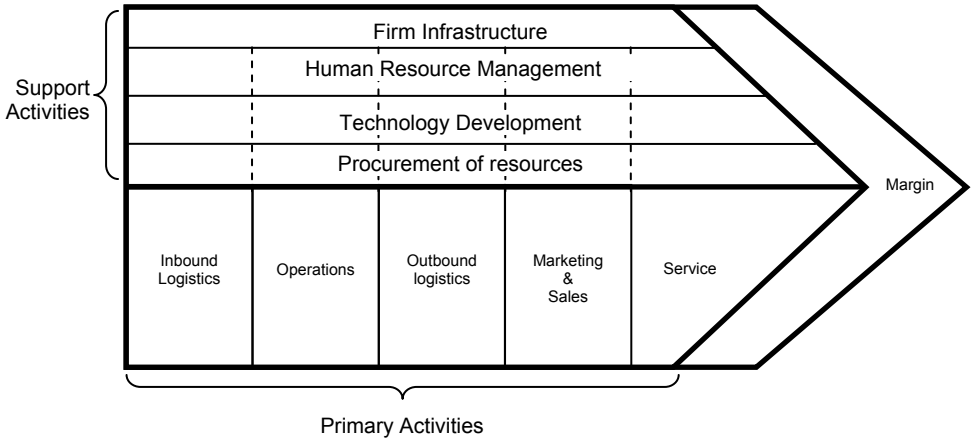


Figure 13: Porter's generic value chain (Porter, 1985:37).

Every organisation performs a number of activities in order to produce a product or render a service. The sum of these activities, together with a margin, has a value for the customer and is therefore referred to as a "value chain". Porter has identified nine generic activities that apply to all organisations that have been divided into primary and secondary or support activities.

1. Primary activities
    a. Inbound logistics – activities related to the receipt, storage and inventory control of input materials;

b. Operations – value creating activities related to the manufacturing process;
c. Outbound logistics – activities concerned with the delivery of the product and includes warehousing and order fulfilment;
d. Marketing & sales – activities associated with getting buyers to purchase the product and includes channel selection, advertising and pricing; and
e. Service – activities related to the initial installation and ongoing maintenance of the product through customer support and repair services.

2. Support activities
    a. Firm infrastructure, i.e. activities related to the overall management and financing of the organisation;
    b. Human resource management – the recruitment, development and rewarding of people;
    c. Technology development – includes research and development, process automation, and any other technology developments used to support the value chain activities; and
    d. Procurement – activities related to purchasing of raw materials and other inputs used in the value-creating activities.

Each of these activities contributes to the organisation's cost position and forms the basis of any differentiation from the value chains of other organisations, or more specifically competitors. Each activity uses technology, and utilises and creates information. Information and the relevant supporting systems and/or technology can thus be considered a competitive advantage (Duffy & Assad; 1989:112).

Buchanan and Gibb (1998:32) continue to state that the above-mentioned processes can be grouped into four main headings:

1. Core processes – servicing external customers;
2. Support processes – servicing internal customers;
3. Business network processes – crossing organisational boundaries;
4. Management processes – establishing the strategic framework for the other processes.

These processes will take inputs, transform them and create value-added outputs that will ultimately represent the products and services offered by the organisation. Therefore, the processes must be underpinned by a series of strategies that are concerned with the effective management of the required resources as per each process. For the information manager the adoption of a process rather than a functional view of the organisation have major implications. The functional view of the organisation in terms of human resources, manufacturing, finance, etc., remains important, however they can create silos and therefore barriers in the effective flow of information across the organisation. Despite their functional focus, the functions cannot operate in isolation and have a dependency on each other. Focussing on the process forces the organisation to look at how information flows and how functions must cooperate in order to leverage off information as an organisational wide resource.

The analysis of these flows of information within the organisation is part of the information audit that has been discussed in detail in section 2.3 of this chapter.

The information strategy is regarded as the detailed expression of the information policy as it relates to objectives, targets and actions to achieve the targets, for a predefined period. The information strategy provides the necessary framework for the management of information; it is contained within the framework of an organisational information policy and supported by appropriate systems and technology (Orna, 1999:10; Orna, 2004:8). The information strategy is the mechanism for maintaining, managing and executing the organisation's information resources.

The Joint Information Systems Committee (JISC) guidelines for developing an information strategy document (Hughes, 1997:60; JISC, 2000) describes information strategy as a set of attitudes and values rather than a report and is easier to describe it as the working practice of the organisation. More specifically the information strategy is a set of attitudes in which:

- Any information that should be available for sharing is well defined and appropriately accessible (allowing for necessary safeguards),
- The quality of information is fit for purpose, i.e. accuracy, currency, consistency, completeness – and only as far as necessary,

- All end-users know, and exercise their responsibilities towards information, and
- There is a mechanism by which priorities are clearly identified and then acted upon.

The information with which an information strategy is concerned should therefore cover any information contained within all media and maybe categorised according to their application or function, for example teaching and learning materials, research information and data. Such information may not be held exclusively in electronic format and may or may not be found in information repositories or libraries.

The actual strategy document should not be considered the important part but rather how end-users go about their work and attitudes towards information and the way in which it is managed. Hughes (1997:60) continues to state that information strategies place the emphasis squarely on the information and treat information as the resource that it is. This resource must be managed and exploited in the same way as other resources such as finance. The information strategy may form part of the hierarchy of strategies, headed by the organisation's strategic plan and possibly including underneath it an information systems strategy.

An information strategy framework is proposed within the JISC (2000) guidelines, that serves to illustrate the process and is graphically represented in Figure 14.

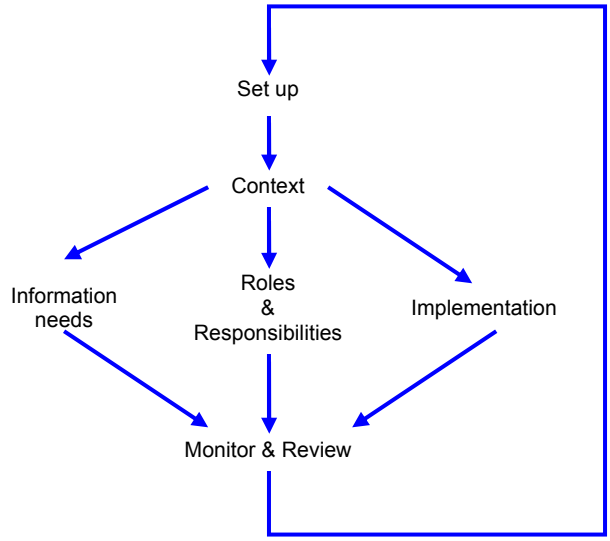


Figure 14: An information strategy framework set up (JISC, 2000).

Even though the primary context of this information strategy framework appears to be applicable only to the academic environment as per the JISC guidelines, it can be applied to most other organisation types in terms of its objectives. This information strategy framework consists out of six components, namely:

1. Set up
    - The scope, terms of reference, approach and leading individuals or committees for the development of the information strategy.
2. Context
    - A clear understanding of the intended overall direction of the organisation and of the challenges facing it;
    - The opportunities presented by emerging information technologies;
    - The environmental context within which the organisation will be functioning.
3. Information needs
    - The range of shared information within the scope of the strategy;
    - An analysis of the information items with the standards required for each;
    - Requirements for an information infrastructure;
    - Any variances and problems.

4. Roles and responsibilities
    - Identification of committees or individuals with any direct responsibilities for the creation of use of information;
    - An understanding and acceptance as to what their roles and responsibilities are.
5. Implementation
    - A priority list of projects or action items to be undertaken;
    - Project management plans against which to check for progress;
    - Programmes of change management to promulgate the strategy and gain acceptance and understanding of it.
6. Monitoring and review
    - Monitor the effectiveness of the strategy;
    - Monitor the context within which the strategy and the organisation needs to function;
    - Review and update the strategy as necessary.

Whether information is required for teaching and learning, or for research, or for management, the objective of having an information strategy is to have a clear, accepted and efficient means by which information of all kinds is created and managed in order to support and deliver the objectives of the organisation.

With the development of the information strategy, it is essential that the concept is welcomed and supported by all senior levels of management within the organisation. The executive leadership of the organisation must play a vital role in the establishment of the information strategy. This will also ensure or at least put onto the agenda the seriousness of the intended strategy and to be sure that relevant resources, be they human or financial, are committed to the deployment of the strategy (JISC, 2000; Koch, 2000:5).

2.6 Conclusion

This chapter set the scene for the concept of information and the definition of the term "information". As clearly demonstrated the term itself has lent itself to much interpretation primarily based on the context in which it is being used. From the various interpretations of the term and for purposes of this study the term

information is defined as data that has been processed and arranged within a given context to provide specific solution to a pre-defined problem that could in essence affect knowledge by adding to it or reform it. In short information is meaning extracted from data within a given context.

Obtaining sound information and using it intelligently have long been essential to the success of organisations. However, in order for organisations to understand and determine which particular information resources and technologies they have to rely on in order to use it intelligently, they need to undergo an information audit. This chapter discussed a number of approaches that can be utilised in order for the organisation to identify those information resources present within the organisation. The information audit ultimately serves as the foundation of the organisation's information policy and its information strategy. The audit provides the map of what information exists within the organisation, how the organisation creates, utilises and manages its information resources.

The information policy provides the set of rules that restrict, encourage or otherwise shape the flow of information within the organisation. The information policy is based on the overall business objectives and priorities within the organisation and has direct relevance in the execution of the information strategy.

The alignment of the organisation's business and information strategies is critical for the success of the organisation. Different processes or levels within the organisation depend on the effective flow of information between them. The information strategy is considered as the detailed expression of the information policy as it relates to objectives, targets and actions to achieve these targets for a predefined period. The information strategy provides the framework for the management of information within the organisation.

The next chapter's primary focus will be on information architecture and how this is positioned within the information strategy of the organisation. A key aspect will be to address the visualisation of information within the organisation and this will be addressed in the next chapter.

Chapter three: Information architecture

3.1 Introduction

The previous two chapters have set the scene in defining information as a resource and how various technological developments have influenced the application or delivery of information over the past few decades. This chapter will focus on aspects of information architecture and how this is applied in practise.

Organisations in today's complex world are experiencing rapid changes in ever competitive situations. There is an increased need to be able to respond quickly to changing market conditions, new business opportunities, threats and emerging alliances that were unthinkable a few years ago (Wigand *et al*, 1997:1). Pressures of global competition and a growing dependence on information technology mean that the effective use of information is more important now than ever before. Organisations have made substantial investments in information technology, but the commitment in using information as a corporate resource appears to be lacking (Evernden & Evernden, 2003:ix). The ease, in which information can be created, extracted and transmitted by email and communication links has built up expectations of the ability to exchange information faster and more frequently between organisations and end-users. Increases in computing power and the ability to offer the end-user increased benefits in accessing or assimilating information from various sources, varying degrees of complexity and an increasing number of parties that need to create, provide, contribute, review or use information (Fisher, 2004:5).

The cost in the ineffectiveness of organisations in managing information can be substantial. As an example related to information life cycle management, information is kept too long, time is wasted when looking for information, penalties are risked for non-compliance or even failing to keep mission critical information from loss or destruction. Information required is frequently not what the end-user wants or needs or the information may not be available. The key to this quick response is to be able to access the right information at the right time, delivered in the correct medium and presented in the most suitable format. Immediate access to critical information could determine the success of a business transaction, the establishment or continuance of

a business alliance or partnership or even the reaction on environmental conditions (McGee, 2004:28).

Information is now recognized as a valid and valuable resource in the day-to-day management of an organisation, the function described as information management has grown from being a pure library, filing or computing function to a mainstream management activity (Gilchrist & Mahon, 2004:xvii). From this evolutionary process the concept of "information architecture" has emerged in recent times.

3.2 Architecture defined

Architecture according to Wikipedia (2005b) is defined as the art and science of designing buildings and structures. A broader definition would include within its scope the design of the total built environment, from the macro level of town planning, urban design, and landscape architecture to the micro level of furniture. Architecture addresses the aesthetic, structural and functional considerations of a building or structure. Architecture is considered a multidisciplinary field that includes mathematics, science, art, technology, social sciences, politics, history and philosophy.

The person who practises architecture is referred to as an "architect", also known as a building designer. The architect is involved with the planning, designing and oversight of a building's construction. The architect's role is to guide decisions affecting those building aspects that are of an aesthetic, cultural or social concern (Wikipedia, 2005a).

As with architecture for a physical structure, information architects design information spaces by considering the ways they will be used and then create the detailed plans and blue prints for that use. The architect's basic grounding is design and also possesses enough knowledge about the various components of the structure, to provide high level specifications on certain components, such as plumbing, electrical circuits, the foundations and walls, and the roofing, but ultimately leaves the installation of these components up to the relevant specialist. For example, high level specifications are provided on plans on the plumbing required within the structure, but leaves it up to the plumber to actually install the

system and make minor changes needed to deliver a working system (Cohill, 1991:100; Farnum, 2002:34).

Cohill (1991:100) quotes the work of Archea who provides the analogy of a building architect as a specialist in design who works with contractors and structural engineers to build three dimensional spaces that enhances human life. The information architect would work with and coordinate the activities of the human factors and software engineers to build information structures that enhance human intellectual capabilities.

By combining the concept of "information" with that of "architecture" and applying it within a specific context, the concept of "information architecture" comes to the fore and the aim of this chapter in this study is to further explore the concept and consider its application.

3.3 Information architecture defined

In their book *Information architecture – designing information environments for purpose*, Gilchrist and Mahon (Morville, 2004:xii) provides a brief history of the concept of information architecture. The concept gained recognition in the mid-nineteen nineties, alongside the popularisation of the Internet and more specifically the world-wide web with a primary focus on the structure and design of websites.

According to a number of sources the term "information architecture" was coined, or at least brought to wide attention by Richard Saul Wurman in the mid nineteen seventies at the American Institute of Architects' (AIA) National convention in Philadelphia with the conference theme entitled "Information Architects" (Evernden & Evernden, 2003:139; Farnum, 2002:34; Knemeyer, 2004; Morville, 2004:xiii; Van Patter, 2005; Wieman, 2004; Wyllys, 2001).

Wurman's definition of an information architect according to Farnum (2002:34) and Wyllys (2001) is:

- An individual who organises the patterns inherent in data, making the complex clear,

- The person who creates the structure or map of information that allows others to find their personal paths to knowledge, and
- The emerging 21st-century professional addressing the needs of the age focused on clarity, human understanding, and the science of the organisation of information.

However, Morville (2004:xiii) and Farnum (2002:34) argue that although Wurnam's definition is helpful, its overall approach relates more to the visual design of information and emphasises Wurman's own background in designing printed media. Wurman's definition of information architecture can be construed as a way of abstracting from a complex situation or body of information and present those essentials in a clear and esthetically pleasing manner to the user (Wyllys, 2001).

The notion of information architecture is however not new, Brancheau and Wetherbe (1986:453) proposed in 1986 using a high level map of the information requirements of an organisation as an important aid to systems development. However, their model of information architecture excludes consideration of personnel and the organisational structures and challenges.

Cohill (1991:109) defines the information architect as:
"*Systems design is a multidimensional process that requires a new kind of project manager – the information architect – who has the knowledge and experience to develop information structures that account for the multiple levels and layers of interaction among humans, machines and the physical environment*".

Cohill (1991:109) further states that the traditional architect is focused on problem solving around design problems. Architects are trained as generalists and do not attempt to actually construct buildings themselves, but they rather direct the skills and energies of specialists such as engineers, plumbers and carpenters. Cohill's approach make use of the many parallels between what architects do to create built space for human beings and what should be done to create information spaces for organisational users.

Wurman has successfully popularised information architecture as primarily having to do with the graphic display of information. This was applied to web site design as it

became clear in its wider application of the job description and specification of the so-called information architect, and because of opportunities that arose during the proliferation of information on the world-wide web (Wyllys, 2001). This is unfortunate as many people came to believe that anyone who designed a web site was qualified as an information architect, even if they do lack formal training in design, computer science or organisational design.

In the influential publication written by Rosenfeld and Morville (1998:11), *Information architecture for the World Wide Web*, the role of the information architect is associated with that of web site design and is defined as someone who:

- Clarifies the mission and vision for the site, balancing the needs of its sponsoring organisation and the needs of its audiences;
- Determines what content and functionality the site will contain;
- Specifies how users will find information in the site by defining its organisation, navigation, labelling and searching systems; and
- Maps out how the site will accommodate change and growth over time.

The emphasis of this publication is on web sites and not single web pages. The authors were concerned about the presentation of information in the whole of the website, how pages within the site relate to each other, and how the user is directed to navigate around the site. Despite the fact that the primary focus of this publication was focused on web sites, the advice provided also applies to all collections of information (Wyllys, 2001).

There have been numerous definitions of information architecture been put forward in the literature and trying to obtain consensus over a single definition remains elusive. This is evident in presentations made at most information architect conferences since the ASIS summit on information architecture held in 2000 (Morville, 2000).

In his keynote address Louis Rosenfeld (2000) at the ASIS Summit 2000 on information architecture, stated that information architecture comes from many different fields: information retrieval and librarianship, visual design, human-computer interface engineering, technical communications, interface and interaction design, mark-up and data modelling, anthropology and computer science (Peek,

2000:14). Kimen (2003) continues to state that information architects blend the technical and the visual with a keen sense of organisational structures and usability.

In a collaborative knowledge base site devoted to the topic of information architecture known as *IAwiki* there is a running conversation, entitled "*DefiningTheDamnThing*" (http://www.iawiki.net/DefiningTheDamnThing) dedicated to debating the definition of information architecture. Part of this debate focuses on the duties and responsibilities of the information architect.

It is clear from the discussions posted on the IAwiki site that the field is highly multi-disciplinary and individuals involved in information architecture are likely to come from disciplines such as graphic design, technical writing, instructional design, computer science, human-computer interaction, journalism, marketing and library and information science (Evernden & Evernden, 2003:43; Farnum, 2002:34; Rosenfeld & Morville, 1998:16).

From the above discussion it is clear that there are a number of wide ranging definitions being debated as to what exactly constitutes the discipline of information architecture.

Two distinctive areas of focus come to the fore in this regard, namely in the area of computer sciences and specifically in information systems design and secondly that of web site design. However, both being a form of information system, the overall principle of designing blueprints or architectural designs for information environments is evident.

According to the debate on *IAWiki*, as mentioned earlier, there appears to be a split in definitions:

- Those who consider the information architecture role to be information organisation/content architecture/library and information science flavoured, with its attendant skill sets of thesaurus design, taxonomy creation and label design,
- Those who open it up to designing the support systems around the information structure including interaction design and information design,

- A third movement gaining more popularity is to open information architecture up to all aspects of user experience and call it experience design,
- A fourth proposal defines information architecture as the process of creating systems that mediate information to and from users. The logical conclusion of this is that information architecture creates "mediated realities".

Cohill (1991:100) defines six principles of information architecture that form the philosophical foundation:

1. Design is a process; it is circular, repetitive and unpredictable.
2. Design is intimate and idiosyncratic, it is a process that can be learned only through personal exploration and experience, it cannot be taught.
3. Design is an act of exploration, it is feedback-orientated, it requires a willingness to change and it requires sensitivity to the aesthetics of the final product.
4. Information architecture is concerned with information environments, these environments can be represented as self-contained, self-regulating structures composed of elements defined by interconnecting relationships.
5. The elements of an information structure consist of computers (hardware and software), people, and the physical and social environment in which people and computers communicate.
6. Information architects are designers. A fundamental grounding in design, combined with expertise in computer systems, organisational behaviour, and ergonomics provide them with the knowledge to design information structures.

From these foundation principles Cohill (1991:105) continues to single out design expertise as the key foundation for information architecture and upon this base three additional areas of technical skills:

1. Information systems development, including database management and design, information storage and retrieval, and software engineering.
2. Organisational behaviour, including organisational psychology, motivation and leadership theory, and workplace sociology.
3. Ergonomics, including environmental design and behaviour, anthropometry, cognitive psychology, and human performance.

Evernden and Evernden (2003:1) put forward the following definition of information architecture:

"*Information architecture is a foundation discipline describing the theory, principles, guidelines, standards, conventions and factors for managing information as a resource. It produces drawings, charts, plans, documents, designs, blueprints and templates helping everyone make efficient, effective, productive and innovative use of all types of information*."

The authors go further in highlighting the importance of architecture based on the above definition:

- Information as a resource – if information is not treated as an asset, through teaching users to use it successfully, then it will become under utilised and wasted.
- Information architecture helps everyone – information as a resource is the responsibility of everyone within the organisation and not the preserve of the technology department alone. Information architecture provides practical tools, improves efficiency, effectiveness and productivity and supports the organisational strategy, innovation, creativity and flexibility.
- It applies to all types of information – information architecture does not only apply to the design and navigation of websites, nor is it for the development of information technology or software. It is a universal discipline that applies to uses of information in general.
- Architecture is a necessary foundation – by making the architectural foundation more explicit the importance of information as a resource is further reinforced. It is especially useful in the understanding of more complex information structures found in managing large organisations.
- It is a discipline – Architecture is based on theory and ideas, and to become a skilled practitioner requires devotion, experience and formal training. It also takes time and effort to be a good information architect.

Both the definitions and proposals put forward by Cohill and Evernden and Evernden, clearly focus on the design aspect, but make it clear that information architecture is not exclusive to the domain of website design. Information architecture is the term that is applied to the structure and organisation of information and forms a key part

in managing information within the organisation. Information architecture incorporate a variety of techniques drawn from a diversity of disciplines such as information science, artificial intelligence, linguistics, management theory, knowledge management, programming and object orientated technologies.

Organisations are developing more coherent information architectures by linking IT activities with business process improvement, information value chain and portfolio management initiatives. It is expected that in future organisations will have developed mechanisms for the centralised or federated governance of information architecture efforts in order to promote standards for information modelling, educating employees about information management principles, and linking design criteria to program and project implementations. Buchanan (2002b:1) also indicates that information architecture initiatives are being hampered by confusion about their value and purpose, the context within which they are conducted and in some cases even the definition of "information" and "architecture".

The enterprise business architecture is according to Buchanan (2002a:3) the expression of the enterprise's key business strategies and their impact on business functions and processes. This typically consists of the current and future state models of business functions, processes and information value chains. The enterprise information architecture is an enterprise business architecture driven set of models describing the enterprise's information value chain that;

- Models key information flows,
- Describes the key artefacts of business events,
- Extends beyond organisational boundaries to external sources and targets, and
- Enables rapid business decision making and information sharing.

Business processes cannot be executed without the appropriate flow, timing, density, and security of enabling information. Buchanan (2002a:1) continues to state that the information architecture of an organisation can be seen as the focal point for the analysis of information flow and can be described in at least two ways:

1. It can be seen as a set of models to describe the organisation's information value chain, essentially the expression of the organisation's key business strategies and their impact on business functions and processes, or

2. A set of processes and disciplines required to utilise data for decision-making.

The first approach focuses on key business activities and describes the aspects of interest to the enterprise at different levels of abstraction, concluding in the design of physical databases.

The second approach requires information architects to develop disciplines to acquire, store, transform, present, analyse and act on these artefacts. These disciplines and activities map to the information management responsibilities of the information architect (See Figure 15).

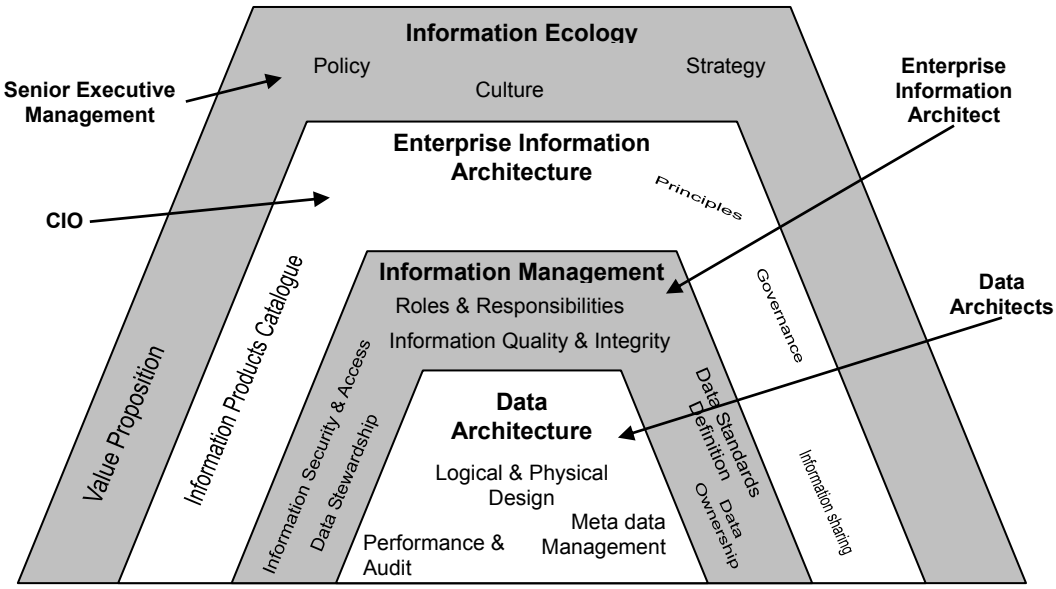


Figure 15: The information ecosystem (Buchanan, 2002a).

The framework illustrated in Figure 16 represents an expanded, enterprise view of three dimensions of information management and use:

1. data management,
2. information analysis, and
3. general management activities.

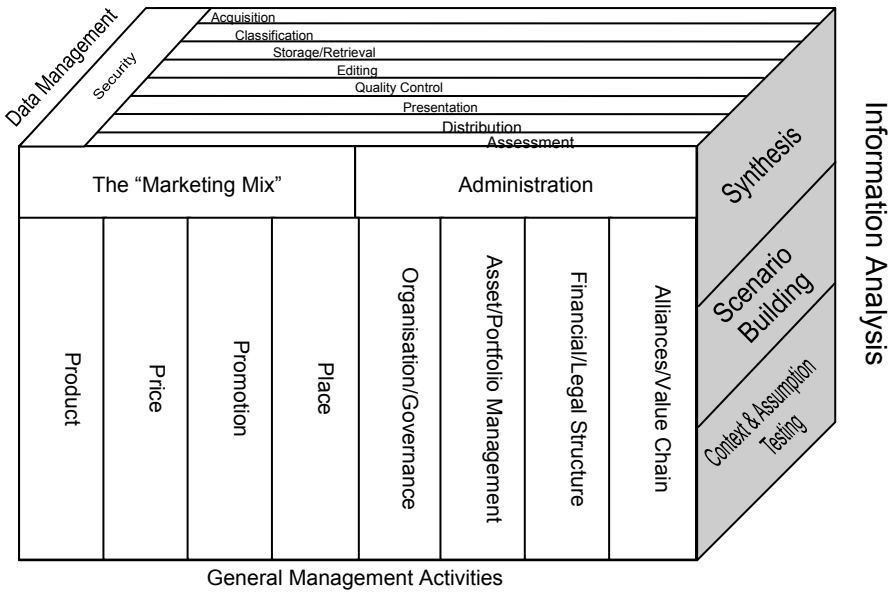


Figure 16: Dimensions of the information ecosystem (Buchanan, 2002a).

Data management consists of the following nine processes:

1. Acquisition of data from both internal and external sources;
2. Classification of this data by type;
3. Storage and retrieval;
4. Editing or the updating of data for relevance;
5. Quality control by the removal of false or misleading data;
6. Presentation (the transformation of data for appropriate audiences);
7. The distribution or dissemination to relevant audiences;
8. Assessment of the usefulness and the cost benefits of the acquired data; and
9. Ensuring that the necessary information security components are in place. For instance authentication, appropriate access levels, auditing requirements and disaster recovery mechanisms.

It is generally accepted that organisations engage in some or all of the above processes and more attention is usually paid to internally generated data, primarily due to considerations such as generally accepted accounting principles (GAAP) and corporate governance aspects, compared to data related to the external environment.

The second dimension, information analysis, transforms data into information and consists out of the following three processes;

1. *Synthesis* articulates available data into maps or models that portray areas of interest to the organisation for example competitors, markets, regulatory requirements and technology trends.
2. *Scenarios* are experiments that enable analysts to speculate about future events, for example the impact of higher inflation figures or fluctuations in the foreign exchange rate on the marketplace and subsequent impact on the organisation's revenues.
3. *Context and assumption testing* makes explicit the unarticulated assumptions about the environment that are held by management. For example, our competitors are always driven to grow market share rather than profitability.

The third dimension of information architecture, general management activity, leverages analysis to make intelligent decisions relative to the organisation's "marketing mix" (product, price, promotion and place or distribution) and administration (organisation/governance, asset and portfolio management, financial/legal structure and alliances/value chain).

A process-based framework represents a complimentary approach to information architecture that concentrates on the processes and disciplines required to make use of data for decision making, rather that the more ambitious and difficult approach to modelling the artefacts that describe the organisation's information value chain.

3.4 Information architecture and business strategy

To take advantage of the promise inherent in information architecture, it is necessary to derive the architecture from the business strategy, drivers and critical success factors. This requires that the architects articulate the architecture in business terms before defining the technology solutions (Lapkin & Rosser, 2003:1). Architecture is the bridge between business and technology. It serves as the translation mechanism by which business needs are translated into technology solutions.

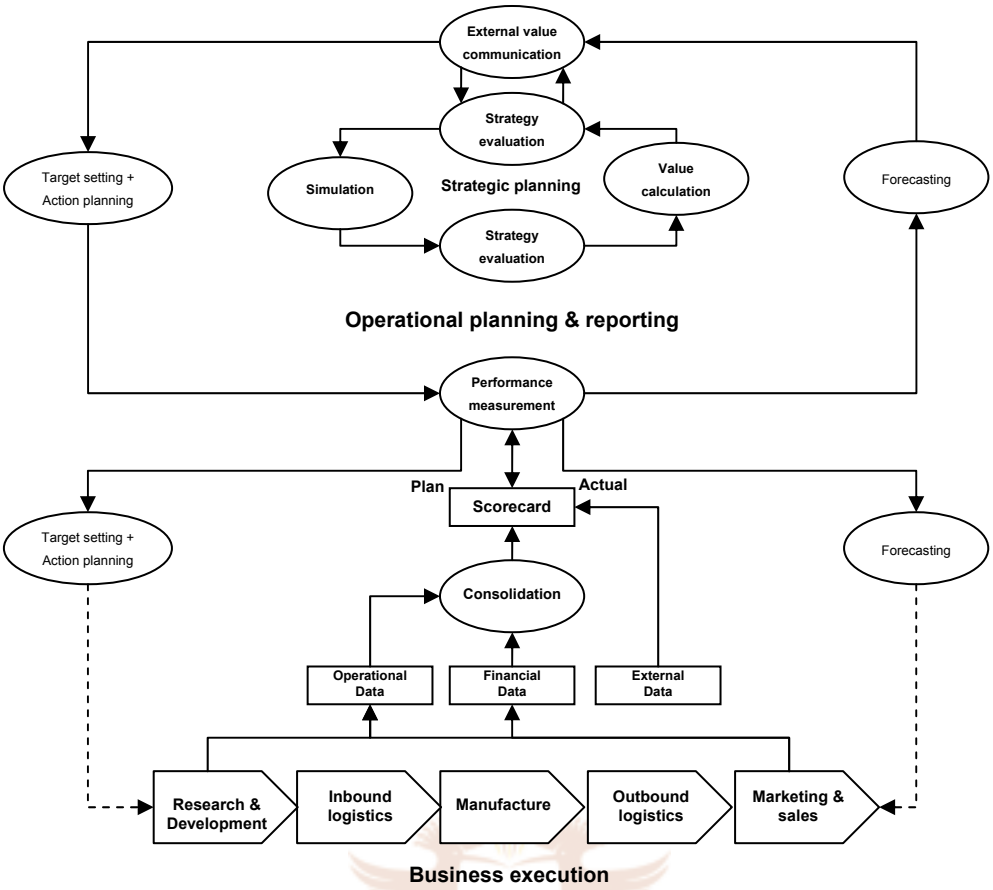


Figure 17: Decision support - a process and information view (adapted from Read *et al*. 2001).

Complex transactional systems generate substantial volumes of data and information and it is crucial for the organisation not to just gather potentially valuable data but to exploit it for competitive advantage and strategic decision support making. Due to the highly integrated nature of these systems it is crucial for organisations to understand the overlaying business and management processes based on the information generated through an integrated system. Decision support is most effective when management processes and information – strategic, financial and operational – are seamlessly integrated across business functions (Kalakota & Robinson, 1999:268, Read *et al*. 2001:212). Figure 17 demonstrates the effectiveness of an integrated environment. Data from internal (operational and financial in this example) and external sources are consolidated and compared with targets as part of the performance measurement process, creating management information. Through techniques such as simulation and scenario modelling, this

information is transformed into knowledge to form the basis of strategic planning. The complete cycle is translated into targets to drive operational performance.

Enterprise architecture is often seen as a technical undertaking. Although technical frameworks and standards do play a role, architecture must balance many competing interests that spans across the organisation. Most architecture standards will apply throughout the organisation. However, in order to reflect the variety of requirements, there may be some differences across different business units. However, the processes that are used to develop maintain and apply the architecture remains constant across the organisation.

Information architecture in an organisation must accommodate diversity in design and semantics in different protocols or business processes. Information architecture creates the logical design specifications for an application or set of systems. It may involve business models, organisational models, object models, process models or data models. Information architecture may be analogous to compiling a list of building materials and tools. The information architecture enables the development of high quality, well documented, maintainable and expandable systems (Schulte, 2002:1).

Business processes that span multiple applications or systems can be easily implemented because the applications use the same semantics and are usually implemented on the same or compatible technology bases. However, a single information model cannot be enforced across all applications in a large organisation. Formal information architecture cannot be enforced on legacy applications, ad hoc applications, applications in business partners or applications in autonomous divisions. The effect of formal information architecture on purchased applications is also quite limited because of the high cost of tailoring an application to match unique, local design decisions. Most organisations want to adopt the information model of an purchased application, because that was one of the reasons that they chose to buy rather than build the application, that is usually based on best practice principles (Schulte, 2002:2).

As business conditions change, information models must change to keep up. Attempting to enforce a single information architecture across the application

portfolio is impractical. An organisation must be able to accommodate diverse information models. The goal of information architecture is to minimise unnecessary diversity in information models, not to achieve complete homogeneity of information models within all the applications within the organisation.

Unlike information technology applications, which are typically linked to a specific business goal, the value of infrastructure is realized over a long period of time through the support of multiple business goals, many of which may not be known at the time of initial infrastructure development. The value of infrastructure is realized through the applications and initiatives it is used to support. Infrastructure in isolation is of no value, just as the foundation of a house provides no value unless, or until, a house is built on top of it.

Information architecture is required to assist in the integration of applications and draw data from disparate sources. By eliminating, streamlining and standardising redundant connections and data, information architecture can identify the ease of modification and customisation, and reduced costs over the long term. At the same time, infrastructure investment promises the ability to deliver new insights, products and services, and the ability to support new business models embracing strategic partners and alliances.

3.5 Information architecture and information auditing

As stated in the previous chapter, the information manager requires a number of tools in order to define and implement an information strategy. A popular approach is to map dynamic information processes and information flows within the organisation. This approach links technical and social systems as it involves the analyses of the communication (processes and information) that takes place between people in a social context (the organisation) using a variety of media and channels (technology).

If one considers the six different foundations and added technical areas of expertise as proposed by Cohill (1991:100) and match this up with the process of the information auditing process as discussed in section 2.3, it is apparent that the information auditing process provides the key building blocks for the information

architect. The information audit provides a baseline for the existing external and internal content and associated technologies such as search, categorisation, taxonomy, document management systems, content management systems, portals, data warehouses, business intelligence systems, financial systems, and so on. According to Scott and Pecnik (2003:7) the benefits of this process include the ability to:

- Understand how information is utilised and its value and ongoing costs of information assets including information applications;
- Identify redundancies and inefficiencies; and
- Make future deployments faster and cheaper due to easier maintenance and the re-utilisation of existing infrastructure.

In order for the information architect to have a full understanding of how information is utilised within the organisation and importantly to highlight the interrelationships with information use, the environment, the business process and applications, a detailed information audit is required. Only through this can the information architect provide the detailed high level plan or blue print of information within the organisation.

The information audit is thus a key requirement for developing the information architecture of any organisation and assists in achieving organisational wide information integration. The continued risk that organisations face is the lack of optimisation and silo approach of existing information systems within the organisation. As discussed in the previous chapter Scott and Pecnik (2003:10) also argue that large sums of money are lost due to cumbersome structures that produce standalone systems, have silo objectives and do not optimise the value of a platform that allows for flexible integration. Information and the applications that house it have increasingly become fragmented over time and this result in a limitation in the flow of information between the various stakeholders in the organisation (Delphi, 2004). If one adds to this the increasing reliance on unstructured information in the format of documents, rich media, meta describing data and multimedia, the compounding results are evident. Furthermore, aspects such as duplication in efforts, inconsistency around information classification and a lack of understanding on how information flows within the organisation further contributes to loss in revenues.

Information models help organisations deal with information overload caused by these trends and allow the increasing volumes of information to be disseminated, digested and managed effectively. The model enables the organisation to understand how information is used and by whom, it pinpoints the key stakeholder for various information types, as well as the different touch points of information as it moves through the organisation and it helps to focus on areas where the highest potential or most opportunities exist (Hibberd & Evatt, 2004:59).

The traditional approach to model information consists of designing future systems in terms of processes, stakeholders and requested software features; then selection of host technologies, such as the technical architecture or hardware platform and enabling the appropriate software (Leloup, 2004:33). At this stage of the process the information that has to be managed by the proposed system is not described in detail. Leloup (2004:33) continues to state that information models are generally limited to the description of metadata, files and media to be handled by the system. This approach however has a number of disadvantages, namely:

- A poor description of the objects to be managed – documents typically contain more than just the text or data contained within the document, but also contains metadata referring to author, title, date and subject. There is also a probability that there are cross references within the document to other files or documents. This metadata aspect adds its own level of complexity in the identification and description of the information sources identified within the organisation.
- A future and sometimes mythical system, the design of which is based on existing practices – it is difficult to convince users and organisations to review their current practices if they have been using a particular process for a number of years. Databases are no longer just used for compute figures or to manage data, they are now used for a lot more and have become in most cases a critical aspect in the information management process of any organisation. Email systems are typically used as pseudo- document management systems, whilst integration into workflow and true document management systems can provide to the organisation a much better value proposition.
- A lack of understanding of the technologies – there is a wide variety of content management technologies available in today's market that will assist

users in the creation, publication and maintenance of content. Leloup (2004:35) states that the following formula should be noted in the context of information management:

New technology + Old organisation = Vast disaster

Fisher (2004:7) proposes an approach to develop an information model in order to assist the information architect as part of the organisation's information architecture. The similarities between the information audit as discussed in the previous chapter and developing an information model is strikingly similar.

3.5.1 Developing an information model

According to Fisher (2004:7) an information model provides a layer of commonality to bridge the differences between systems and makes it easier to manage and use information in a consistent way. A level of abstraction is required in order to make the variety and complexity of information relationships available within an organisation easier to understand. The information model provides a high-level logical representation of all the key information elements that are used in the organisation as well as the different relationships between them.

The information model consists out of an 'as-is' view or an audit of the organisation's information as well as the 'to be' or blueprint in order to provide direction for the future development of information environments and systems within the organisation. The information model addresses two aspects of the organisation's information environment, namely:

1. The static view – covering the structures of information (elements and the relationships between them). The static view focuses on the following elements:
    - *A classification scheme or taxonomy* – a predetermined catalogue or hierarchy that segments elements of information into sub-groups that are mutually exclusive and unambiguous.
    - *Controlled vocabulary and thesaurus* – the vocabulary of a classification or taxonomy scheme, formally organised so that the former relationships between concepts are made explicit.

- *Metadata* – information that describes information, usually limited to formal information elements such as author, date, etc.
- *Data standards* – the rules and conventions set to ensure consistency in the way information is maintained and used.
- *A logical data model* – a model that shows the relationships between the different types of information.

2. The dynamic or behavioural view – focusing on the process or the information life cycle describing how information is created, managed and used. The dynamic views focuses on:
   - *A business process model* – to define the information needs of and the interactions between the core business processes as well as the supporting business processes.
   - *An information process or workflow model* – to define the activities in the life cycle of information sources.
   - *A data flow model* – to define the transitions and the various states of information during its life cycle.

The outcome of an information model is a set of documented information structures, information processes, standards and guidelines for implementation. It can also be presented in formats that could be used by systems engineers or system developers for the design and implementation of technology solutions.

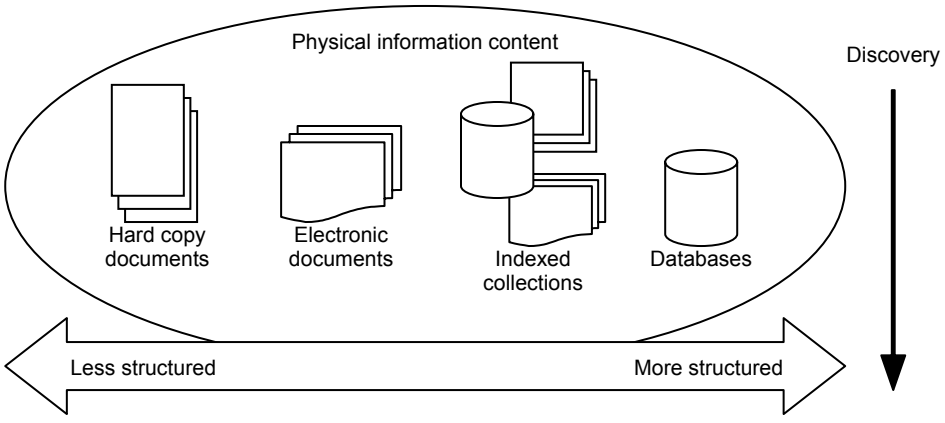
Information technology architecture links together four technology focus areas for the organisation, namely the external environment, organisational architecture, information systems and the technical infrastructure. It provides an overview of the technical and business environment and their respective interdependencies. For the organisation it enables the users to understand the information technology services provided and allows IT managers to understand their users, both internally and externally (Fisher 2004:8). The information model developed within the context of the organisational information technology architecture provides a blueprint to assist in bridging the gap between business and technology, within the context of the information technology applications.

The traditional information systems approach provides a variety of standards, frameworks and methodologies that can be utilised in order to create an information model within the organisation (Evernden & Evernden, 2003:98). Many models start off in the design of software applications and these are readily apparent in definitions put forward for a technical audience. Although there is no argument that technical definitions are required for the detailed design of software applications, they are considered unfit for the thorough understanding of information usage (Fisher, 2004:8). Examples of technical standards, methodologies and frameworks include but are not limited to the following (Descriptions and definitions as per Lankhorst, 2005):

- Architecture of Integrated Information Systems (ARIS) – a proprietary methodology that aims to describe an enterprise information system in a holistic manner using different views – data view, function view, organisation view and in order to realise the connection between these views, a control view.
- Purdue Enterprise Reference Architecture (PERA) – a publicly available methodology that comprehensively defines a generic architectural specification and integration method for enterprise wide integration or other enterprise development programmes.
- Generalised Enterprise Reference Architecture and Methodology (GERAM) – a public methodology that builds on other methodologies and aims to be the most comprehensive enterprise reference architecture and methodology. GERAM is intended to facilitate the unification of methods of several disciplines used in the change process, such as methods of industrial engineering, management science, control engineering, communication and information technology, thus to allow their combined use, as opposed to segregated application.
- The Open Group Architectural Framework (TOGAF) - The original development of TOGAF in 1995 was based on the Technical Architecture Framework for Information Management (TAFIM), developed by the US Department of Defence. Successive versions of TOGAF have become public and have proved to be successful method for developing an IT architecture that meets the business needs of an organisation.

- Architecture Based Design Method (ABD) - ABD is a method for designing the high-level software architecture for a product line or long-lived system. The ABD method fulfils functional, quality, and business requirements at a level of abstraction that allows for the necessary variation when producing specific products.
- A number of other architecture models and frameworks exist, however time does not allow for a complete listing and description of the respective methodologies or frameworks.

Evernden and Evernden (2003:98) suggest that a model that is comprehensive enough and based on explicit information architecture is used in order to establish an information model for the organisation. The involvement of individuals within the organisation is critical as a good understanding of the subject matter at hand provides a good basis for the information model. A high-level understanding of the overall organisation and specific information domains being studied as well as the information methodology being utilised is required (See Figure 18). By its nature the organisation wide information model spans different functional groups, therefore necessitating a consistent approach throughout the development of the model to ensure that a unified view of information is achieved (Fisher, 2004:10).



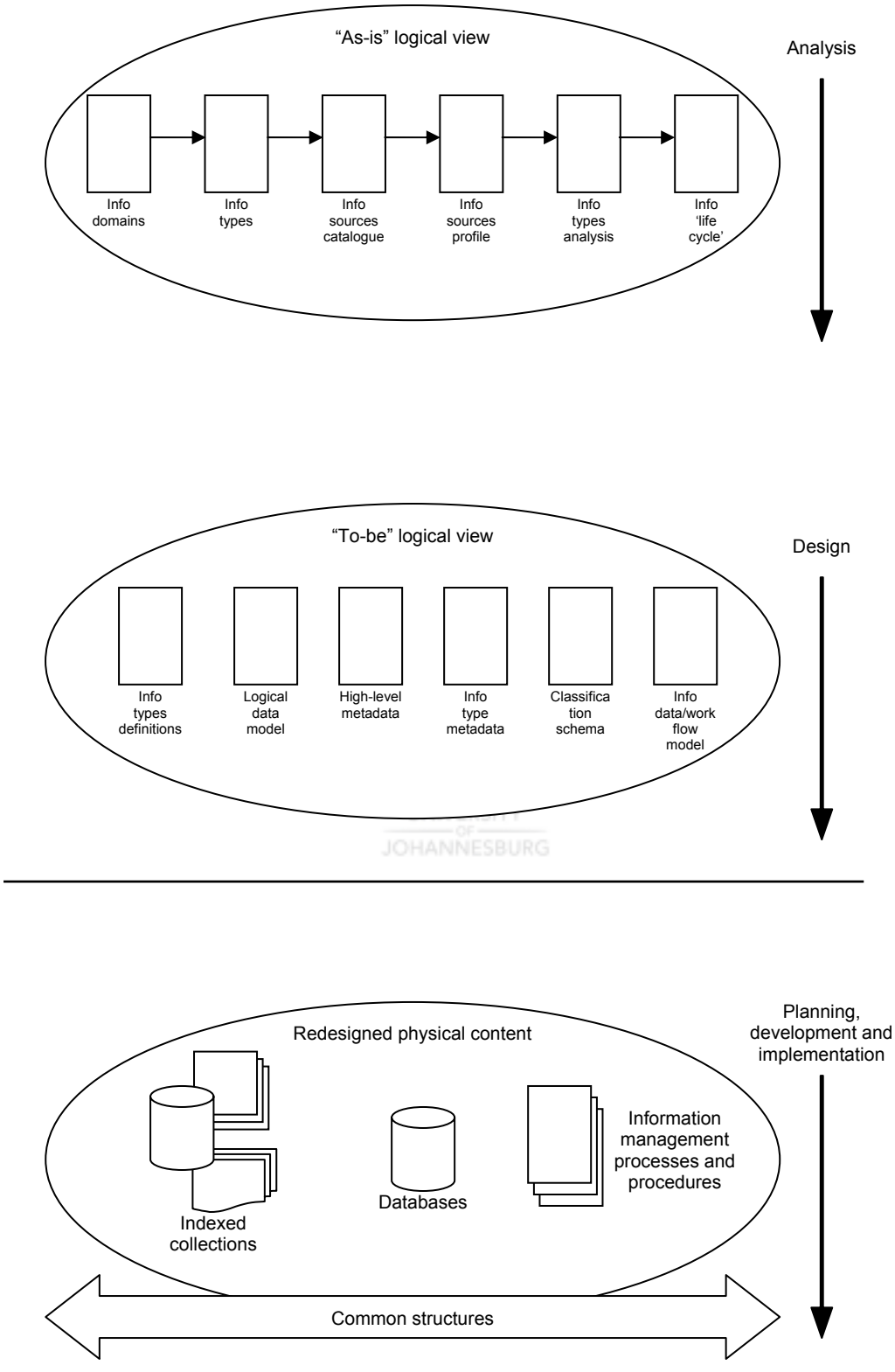


Figure 18: The information modelling process - key steps (Fisher, 2004:11).

3.5.1.1 Defining the objectives

Before any information modelling exercise can commence it is critical to define the objectives and scope of the exercise. This will prevent the project from losing focus due to the fact that the subject matter can easily expand in area as well as depth of coverage and therefore agreement on the boundaries upfront is required. However, it is very possible that the objectives and scope may change as the project progresses, but these changes should take place within a controlled manner. Organisations must develop a practical approach that recognizes the richness and ambiguity of managerial information, and also ensures senior management support by refining governance mechanisms and clarifying the value of information for the organisation (Kalakota & Robinson, 1999:293).

The objectives of the exercise will be closely linked to the objectives of the organisation and it is important to understand the business framework in which the organisation exists (Orna, 2004:20). If the organisation's existence is not understood, the decisions it makes in respect of environmental influences, can not be interpreted correctly. This could lead to assigning inappropriate values to information resources and choosing information solutions that are totally unsuitable that could potentially harm the organisation.

Further aspects that should be taken into account are the information technology infrastructure that is in place and how it supports the current information requirements of the organisation. The converse is also true in the sense that the information technology infrastructure cannot provide effective input into the organisation until the organisation has effectively defined the information needs it needs support for (Leloup, 2004:36; Orna, 2004:26).

In addition to the aspects discussed Orna (2004:26) identifies a number of soft factors need to be taken into account that will inherently have an impact on the interpretation and presentation of the information model of the organisation. Organisational history, structure and culture will all provide insight into strengths that can be built on, threats that need to be avoided, areas that should not be approached and strategic alliances that should be sought.

3.5.1.2 Identifying information domains

When a high-level organisation wide information model is undertaken it requires the identification of the information domains that exist within the organisation. The information domain does not necessarily reflect the different departments or reporting entities within the overall organisation, but rather refers to the information sources created, managed or used in specific groups and departments.

The process of identifying the information domains involves listing the main areas of business activities in the organisation and the relevant supporting functions such as human resources, finance, training, information technology and others. Compiling a high-level map of the information domains that can be used to identify areas where the organisation can gain the greatest benefit from rationalisation and integration of information resources spread across the organisation.

3.5.1.3 The discovery step

The discovery step's goal is to gather the raw information to enable the creation of the 'as-is' view of the information model and serves as a detailed record of the current state of the information environment within the organisation (See Figure 19).

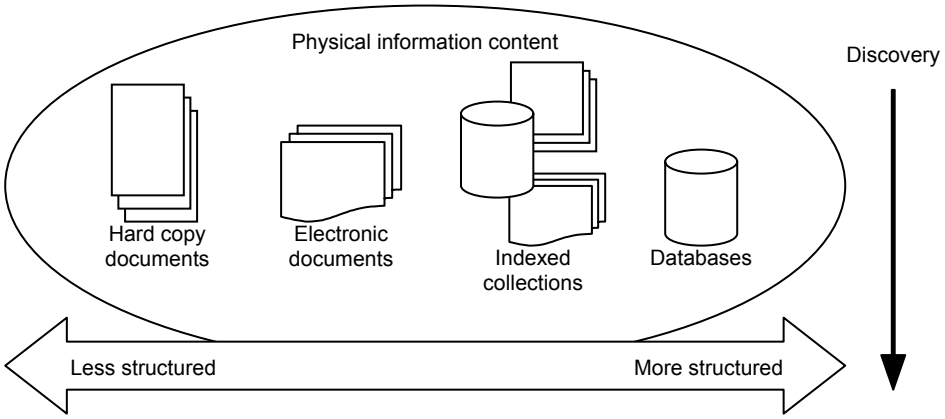


Figure 19: The discovery step

The discovery process is carried out for each of the identified information domains. Fisher (2004:14) considers it essential that a common methodology be used for all the domains being studied that will ensure consistency in analysing the data being produced.

The discovery process involves the collection and documentation of facts and details about information structures and process and results in the creation of an information sources catalogue. The catalogue should list the following:

- *Information type* – as part of the information identification.
- *Information sources names, title and description* – the identification of specific databases or information collections.
- *Information sources owner* – the individual that is responsible for the maintenance of the information source content.
- *Information sources reference number* – to ensure that each source can be identified and tracked throughout the information model development and should prevent ambiguities during the analysis and design steps when the incorporation and reorganisation of information sources are being considered.

Leloup (2004:36) adds additional factors in the determination of an information model for the organisation namely:

1. What kind of information is it?

   Five basic types of information, with different levels of structure, management process, volume throughputs and sharing capabilities can be identified;

   a. *Administrative production* – basic paperwork, ranging from contracts, manuals, orders, claims, etc.
   b. *Reference information* – considered to be the real information assets of the organisation, providing details of its knowledge and know-how. Product catalogues, methodological tools, procedures, operating manuals ad quality document are considered reference information. This is typically highly structured information, available in limited volume, utilised by everyone but managed by only a few individuals. Reference information, although regularly updated is consider a long lasting information asset.

c. *Project information* – information about a project, an activity that has a limited duration. Volume throughputs are considered to be substantial at organisational level, but may be limited at project level. Information is partially structured and access to the information within the project varies from the position of the individual within the project. The higher up in the project hierarchy the less detail is addressed versus lower level individuals within the project who will have exposure to more detail, but again limited to a specific aspect of the project. Typically a project manager will have a fairly good, but not necessarily a detailed overview of the complete project.

d. *Intelligence information* – Used widely in business information and technology surveillance. Information specialist produce value added reports based on a multitude of structured and unstructured information sources that may range from web pages, media releases, reports databases, facts and figures, and so on. Input volumes may be very high or specific intelligence reports may be very niche or limited. A organisational knowledge base can be considered intelligence information.

e. *News* – by definition news is designed for immediate consumption. Considered to be greatly unstructured but with the ability to feed other information repositories.

2. What is the information used for?

   This question identifies what the key information processes within the organisation are, namely reading and printing, re-use, sharing and publishing, distributing, relying on someone else to review, and so on.

3. Who uses it?

   Defining the actual population within the organisation who uses the information source. Here content is of importance as opposed to the actual medium of the information source.

4. Who manages it?

   Who is responsible for the upkeep or maintenance of the information source once it is disseminated into the greater organisation?

Fisher (2004:14) advises that during the discovery step a hierarchy of information sources can be identified as part of the information identification process. This can be achieved by the grouping of information sources into certain categories. Further details regarding the information source are obtained by requesting each information source owner to provide detailed information about the information source. This is achieved through questionnaires or interviews. The level of detail provided is dependant on the objectives of the project and may be divided into the following two categories:

1. The *static* or *what* view – describing the structures of information and relationships between the structure elements, and
2. The *dynamic* or *how* view – focusing on the information processes and lifecycle. In other words how information is created, managed and utilised.

It is important to note that details of any new information required by the users and how information is utilised (or not) is essential for the design of the future information model (Fisher, 2004:15). This is where needs analysis in parallel or as integral part of the discovery process could be beneficial in order to identify the requirements of the users. During the interview process with information source owners the opportunity to identify further information sources that has as of yet not been identified should be extensively utilised. During the discovery process the focus should not be limited to any particular format or medium of information sources but should include electronic documents, formal or informal hard copy collections, emails, web pages and databases. A challenge to the process may be the very ubiquitous nature of information (Kalakota & Robinson, 1999:293). Some information sources may be difficult to find because it often lays hidden and undervalued in the minds of employees.

3.5.1.4 The analysis step

The analysis step provides the 'as-is' view of the information model from the information details gathered during the discovery process. This step highlights areas of improvement and serves as input into the design of the future information model of the organisation.

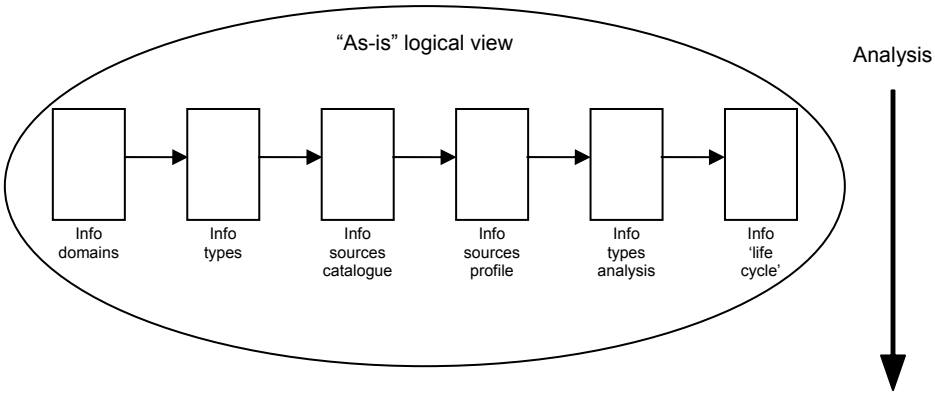


Figure 20: The analysis step.

During the analysis step commonality and variety that exist within the information environment of the organisation is highlighted. Fisher (2004:17) points out that there may already be some attributes of a well designed information model present in existing information sources, but there is also likely to be a multitude of approaches in the design and hence some inconsistency in the information model. Clearly this inconsistency may have evolved over time or as new information sources have been identified and brought to the organisation's attention. A major component of the design of the information model involves the introduction of uniformity to the model and ensuring that consistent information management takes place.

The first stage is to identify the main information types that exist within the organisation and this would have taken place during the earlier step of identifying the information domain being investigated. The second stage is to analyse each information type group in order to establish the commonality and the variations that may exist. The following aspects are addressed:

- What constitutes the information source;
- The major sub-divisions or groups within the source;
- The identifiable attributes of fields of the information items; and
- Any significant issues and features related to the identified information sources.

3.5.1.5 The design step

The result of the design step is the 'to-be' view that forms the blueprint for the future information management process within the organisation. This step sets the standards that will be followed in the rationalisation of existing information sources and for any new sources brought into the fold of the organisation.

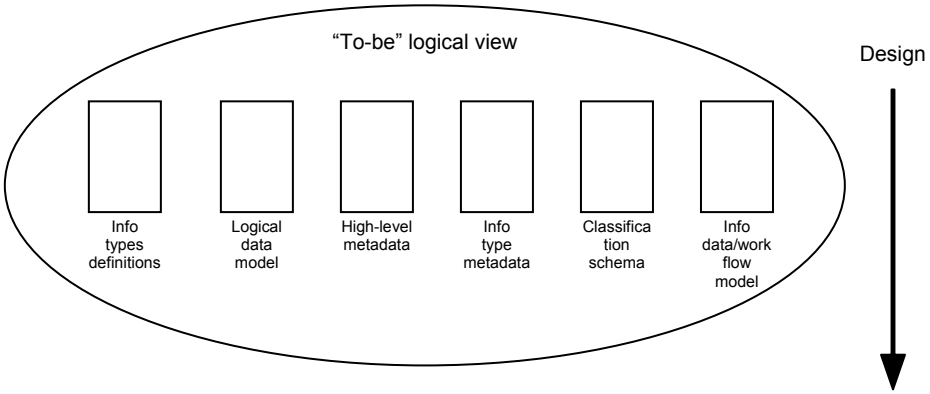


Figure 21: The design step.

This step is a culmination of the previous four steps. Through this step all the relevant parties, i.e. the information source owners and other information domain stakeholders, are brought together in a collaborative fashion to ensure consensus on the desired design of the information model. Fisher (2004:19) suggests that the designed information model should include some or all of the following points that may evolve over time:

- An agreed list of information domains;
- An agreed information types list and definitions;
- A high level logical data model in order to link information types across different domains;
- Agreed metadata for all information types across information domain;
- Agreed extended metadata for each information type within the information domain;
- A taxonomy, thesaurus or controlled vocabulary to provide consistency of concept structures and labelling across domains as well as at a more detailed level within each information domain; and

- An information process view describing the 'life-cycle' of each information type.

3.5.1.6 Planning, development and implementation

After the 'to be' information model has been defined a programme to implement of the model should be initiated.

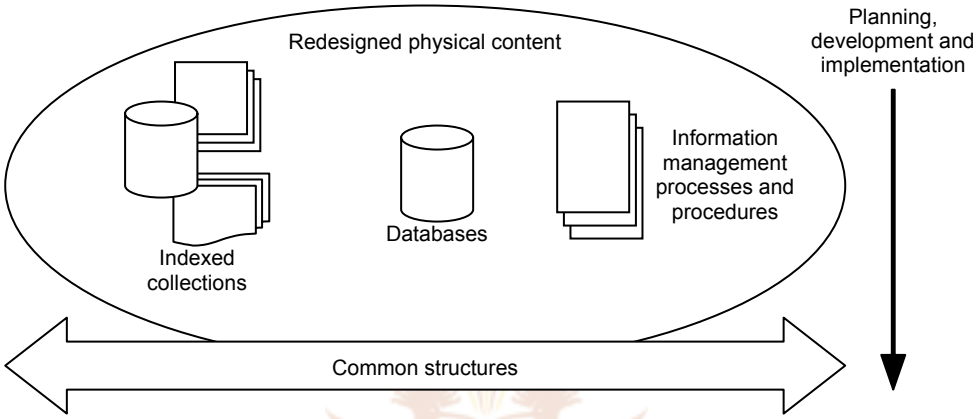


Figure 22: Planning, development and implementation.

The implementation process is likely to consist of the following aspects:

- The reorganisation and even the consolidation of existing information sources to fit into the standard information types defined during the design step;
- The creation of database indexes to record metadata for previously unstructured information sources;
- The procurement and/or development of software to enable integrated access to and the management of information sources;

Many of the techniques and notations used in the development of an information model are derived from the field of business process design and software engineering as mentioned briefly in an earlier paragraph.

Business process modelling can be defined as a simplified view of a business process and allow organisations to focus on the key aspects of the business and be able to

identify the key areas of information input into the process under review. Fisher (2004:21) further explains the difference between business process modelling and information modelling as follows:

- In business process modelling an 'outside in' view of information is taken as an input, output or a resource.
- In information modelling an 'inside out' view of information is taken by focussing on the information 'life-cycle' through determining how, when and by whom information is created, maintained and used.

From a software engineering point of view, software systems are designed around 'business objects' that represent the things that organisations creates, interacts with and uses, for example clients, projects, transactions and invoices, to name a few. These objects are closely related with real life objects and the information represented within them held in information sources such as databases. The object model comprises the static or structural and the dynamic or behavioural aspects of each business object in a form of 'attributes' and 'operations' respectively. The completed object model provides the necessary building block for systems design.

Fisher (2004:21) considers the object model as an additional deliverable from the information modelling phase into the software engineering phase. This can be created using the details from the 'to be' information model design, for example the information types, their metadata, life-cycle and the logical data model that describes the relationship between information types. This is typically manifested in XML (extensible mark-up language) schemas that allow the structure and relationships between information types to be read and understood by software applications.

Information modelling is a key success factor in an information management system and provides the building blocks for the information architecture of the organisation. Information modelling must consider content and not exclusively focus on the medium in which information is contained and distributed throughout the organisation alone. Through the implementation of prototypes information models can be improved within shorter time spans as opposed to the implementation of an extensive information model of which no one understands it value and will take up unnecessary resources. Importantly when defining the information model of the organisation existing processes and content should not be the only focus of the

exercise, in fact these are considered to be legacy systems and processes, from an outside point-of-view new ideas and technologies should be considered.

3.6 Visualising information architecture

Up to 60% of the human brain is devoted to vision and using rapid parallel processing, the human visual system is capable of handling vast amounts of complex information (Dodd, 2001). The areas of the brain involved in higher order visual perception and cognition are highly interlinked. Seeing and understanding are closely associated. The visual system is an extremely powerful form and pattern analyser with close ties to the systems in the brain responsible for recognition, understanding and recall. This means that in certain cases information can be more readily assimilated and communicated in a visual format than in any other form (Dodd, 2001).

According to Andrews (2002) the visualisation of information is the visual presentation of abstract information spaces and structures to facilitate their rapid assimilation and understanding. Visualising information architecture is the recognition of the various elements that go into an effective information environment and how these elements co-exist to create an engaging information blueprint for the organisation.

Melzer (2005) provides an example of a specialist area such as content management that forms a key part of the actual management of information resources and its link with enterprise information architecture within the US Federal Government (See Figure 23).

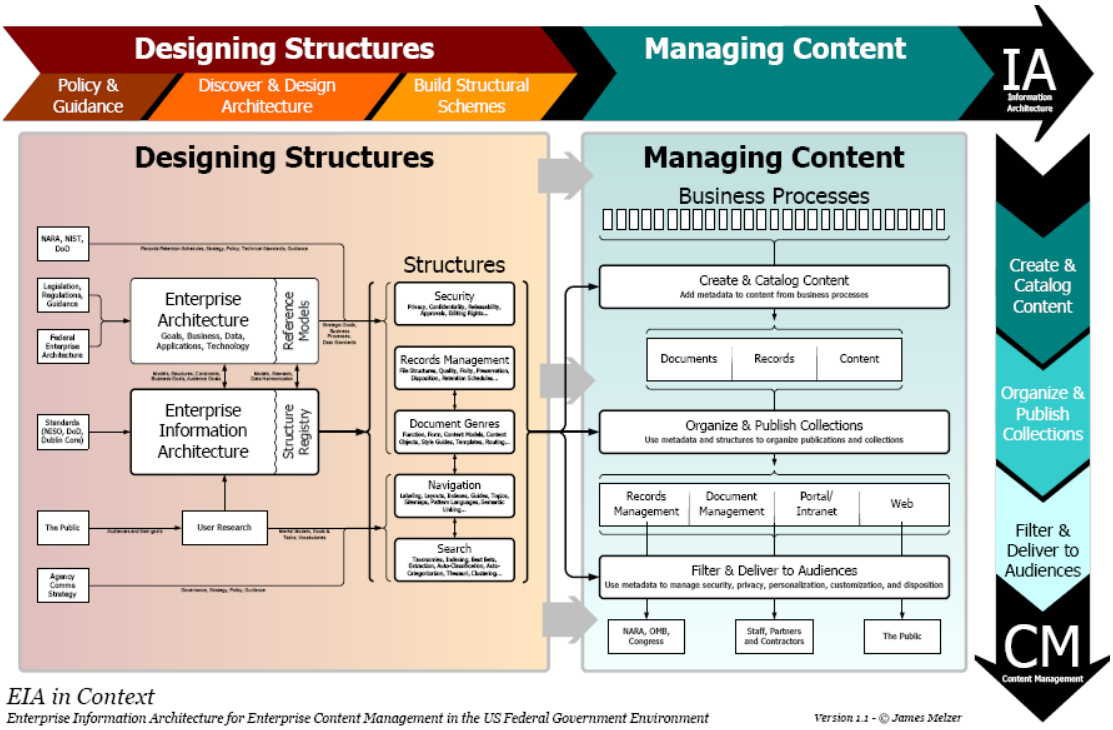


Figure 23: Enterprise information architecture in context (Melzer, 2005).

In this diagram the author depicts how enterprise information architecture (EIA) relates to enterprise content management (ECM). The two entities are distinctly depicted in order to provide for better illustration or understanding. Melzer (2005) considers ECM as a continuous process to control a never ending stream of content that must be filed, organised and delivered to the individual who require it. EIA is considered to be the intelligence behind content management. It translates the user needs, business goals, policies and standards into a coherent plan from content management. The left hand side of the diagram are the aspects that inform and drive the EIA. In the centre the author has identified five structures as the products of EIA. From the provided definitions these structures are typically web site design orientated. These structures provide input into and drive the processes depicted on the right hand side of the diagram to assist individuals to create and catalogue content, organise and publish collections and filter and deliver content to audiences. On a single page this diagram provides a high-level, but detailed enough overview of the complete interaction between the design structures and content management process to the organisation.

Although a number of visualisation tools or methodologies exist in practice to demonstrate the flow of data or information within or between systems for example flow charts, data-flow-diagrams, UML component diagrams or UML class diagrams and Business Process Modelling notations (BPM). These methodologies are predominantly focused around systems development and concentrates of the flow and interaction of information processes within specific systems. In order to understand the bigger picture of information flow and interaction, not only within systems, but also between external role players and environments a broader, more encompassing visualisation methodology is required.

From the previous chapters and discussions it is clear that within business there are different methods and models used in the design and realisation of organisational structure, business processes, information systems and infrastructure. However, these domains are usually not approached in an integrated manner, which makes it more difficult for the business to effectively determine the influence of environmental factors or changes to the organisation. Every domain speaks its own language, draws its own models, and uses its own techniques and tools to ensure the effective management thereof (Lankhorst, 2004).

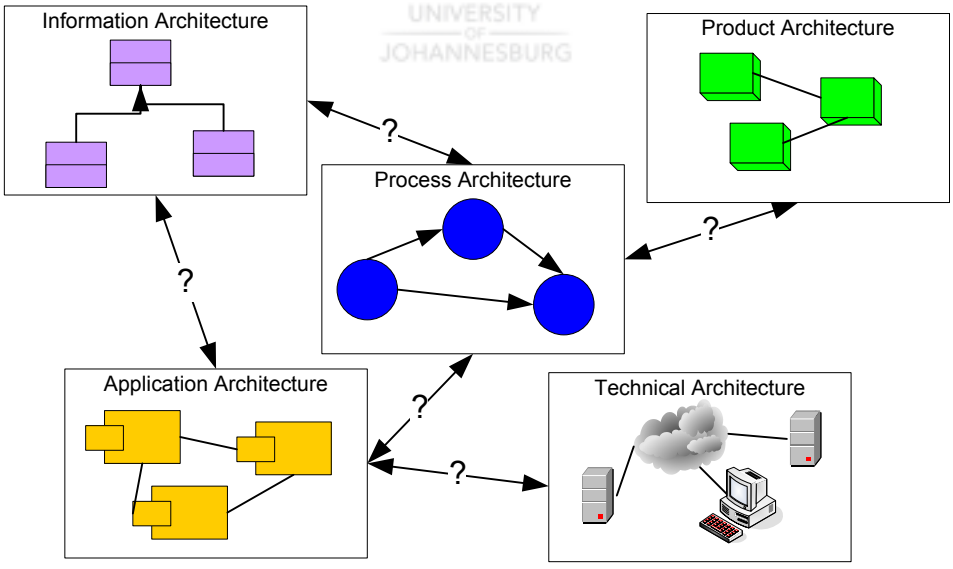


Figure 24: Heterogeneous architectural domains (Lankhorst, 2004).

Due to the heterogeneity of methods and techniques used to document the different architectures within the organisation it is sometimes difficult to determine how these domains are interrelated despite the perceived dependencies between the different domains. As Figure 24 illustrates, the goal of the business process of the organisation is to realise a product; software applications support business processes, whilst the technical infrastructure is required to run the applications; information is used within the business processes and processed by the applications.

In order to ensure that optimal communication exists between the different domains it stands to reason that as with the information modelling process as discussed in the previous paragraph, understanding of the interdependencies between the identified information domains are indispensable.

To better understand the integration between the different domains of the organisation, in terms of business processes, applications, information and the technical infrastructure, *Telematica Instituut* started the ArchiMate project in 2002 (Lankhorst *et al*, 2004). A complete model of the ArchiMate visualisation language is available from the ArchiMate web site located at http://www.archimate.com/.

Lankhorst (2004) provides a solution to overcome the difficulty posed by visualising the interrelationships between the different domains through a project and toolset known as "ArchiMate". This particular toolset provides for a visual design language with adequate concepts for specifying interrelated architectures, and specific viewpoints of stakeholders within the organisation. Furthermore, ArchiMate develops a framework and techniques that support architects in the visualisation and analysis of enterprise architectures (Ter Doest & Van der Torre, 2003).

ArchiMate proposes a service concept with a layered view where higher layers make use of services that are provided by lower levels. Three main layers are identified as per Figure 25. On top of the business layer a separate environment layer may be added whereby external environmental factors or aspects outside of the organisation maybe taken into account.

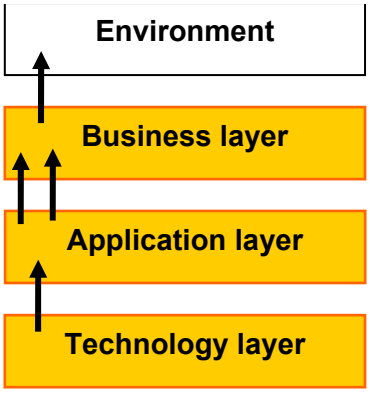


Figure 25: Layers (Lankhorst, 2004).

3.7 Conclusion

The discussion around the definition of information architecture is clearly still not over as highlighted in this chapter. Definitions vary from the practice of web site design to that of complex systems design. Even though proponents such as Wurman have provided us with a broad definition of the information architect, it is in the other definitions that involve a multi-disciplinary approach, including that of information science that the real practical purpose of information architect or architecture is presented. It is clear that information architecture is not exclusive to the practice of web site design, even though it has gained much popularity in this particular discipline.

It is evident from this chapter that the role of the information architect or the discipline of information architecture is extremely important in the design of purposeful information environments, which may include web sites. As Cohill (1991:105) clearly pointed out that even though design expertise is a key skill in information architecture other technical skills that address aspects such as information systems development, organisational behaviour and ergonomics need to be included.

The importance of information architecture is further highlighted through the value that it contributes to the organisation in ensuring that information is effectively managed as a resource and through architecture provides to the organisation the

necessary blue print or design document in highlight the information life-cycle within the organisation. Organisations need to understand the key information flows, the information artefacts and environmental impact of external resources in order to adapt and assist in rapid decision making and information sharing across the different information domains.

For the information architect to have a full understanding of how information is utilised within the organisation it important to understand the interrelationships with information use, the environment, the business processes and applications within the organisation. Defining the information model for the organisation provides a high level logical representation of all the key information elements that are used in the organisation as well as the different relationships between them.

Ultimately it is the visual representation of the organisation's information model that illustrates the processes and interaction of information. This presentation takes place through the visualisation of the organisation's information architecture and visualisation techniques such as ArchiMate that provides a common language between different architectures can be a valuable tool in the effective management of the information life cycle. It will clearly describe the interaction between different architecture domains ranging from business, organisational to the technical network infrastructure.

In the next chapter a case study will be proposed and discussed in further detail applying the different aspects of information auditing or modelling and ultimately resulting in the visualisation of this model into a blueprint for an organisation's information architecture.

Chapter four: Case study - Developing a scaleable information architecture for consolidated reporting purposes for a large conglomerate of companies.

4.1 Introduction

The case study as research method is used to investigate the information architecture design and implementation within a large investment holding company consisting out of a number of operating companies. This chapter discusses in detail the steps building up to the establishment of a scaleable information architecture and the initial stages of the project in putting into place an information architecture specifically for gathering and consolidating key information sources for reporting purposes.

4.2 The case study as a research method

The case study is one of several methodologies of doing social research (Mouton, 2001:149). According to Mouton (2001:148) other methodologies that can be utilised include observational studies, participatory research, surveys, experimental designs, field or natural experimental designs, evaluation research, statistical modelling and computer simulation studies, secondary data analysis, content analysis, textual analysis, discourse and conventional analysis and historical studies, to name a few.

The case study methodology has grown from being the specialised interest of a small group of social researchers to becoming a major feature in the mainstream educational research (Walker, 2002:109).

Case studies are preferred in examining contemporary events within a real-life context, but when the relevant behaviour cannot be manipulated. Thus, the case study method relies on many of the same aspects as a historical study. However, the case study's unique strength is its ability to deal with a full variety of evidence such as documents, artefacts, interviews and observations (Yin, 1994:13-20).

Yin (1994:23) defines a case study as an empirical inquiry that:

- Investigates a contemporary phenomenon within its real-life context; when
- The boundaries between phenomenon and context are not clearly evident; and in which
- Multiple sources of evidence are used.

A regular complaint about case studies is that it is difficult to generalise from one case to another. Yin (1994:21) and MacPherson *et al* (2000:49) have suggested that this criticism is misdirected.

Firstly, the traditional prejudices against the case study research methodology include concern over the lack of rigour of case study research. The case study investigator or researcher has been negligent and allowed equivocal evidence or biased views to influence the direction of the findings and conclusions.

Secondly, a common concern is that case studies provide little basis for scientific generalisation. Case studies, like experiments are generalisable to theoretical propositions and not to populations or universes. In this sense, the case study, like the experiment, does not represent a "sample", and the researcher's goal is to expand and generalise theories (analytical generalisation) and not to enumerate frequencies (statistical generalisation).

Finally, a frequent complaint about case studies is that they take too long and result in massive, unreadable documents. This complaint may be valid given the way in which case studies have been done in the past, but this is not necessarily the way in which case studies must be done.

The case study is of particular value when one is seeking some help on a problem in which interrelationships of a number of factors are involved, and in which it is difficult to understand the individual factors without considering their relationships with each other.

Montealegre (1999:203) states that case study research is the most common qualitative method used for information systems scenarios. He sees case study research, as defined by Yin as appropriate and consistent with the exploratory nature

of inquiry, the inability to control the interactions among the constructs of interest, and the focus on a contemporary situation in which the major actors can be interviewed. He continues to state that this particular methodology is well-suited to information technology implementation research, since the objective of the research is the study of the interplay between information technology and the social and organisational setting rather than purely the technical aspects.

4.2.1 Sources of evidence in case studies

Stake (1995), Yin (1994) and Tellis (1997) identified at least six sources of evidence in case studies and their strengths and weaknesses are highlighted in the following table:

Table 2: Sources of evidence in case studies (adapted from Stake, 1995; Yin, 1994 and Tellis, 1997).

Source of evidence	Description/Examples	Strengths	Weaknesses
Documents	Letters, memoranda, agendas, administrative documents, newspaper articles, or any document that is germane to the investigation	o Stable – repeated review o Unobtrusive – exist prior to case study o Exact – names, etc. O Broad coverage – extended time span	o Retrievability – difficult o Biased selectivity o Reporting bias – reflects author bias O Access – may be blocked
Archival records	Service records, organisational records, lists of names, survey data, and other such records.	o Same as above o Precise and quantitative	o Same as above o Privacy might inhibit access
Interviews	Open-ended, focused, and structured or survey interviews.	o Targeted – focuses on case study topic o Insightful – provides perceived casual inferences	o Bias due to poor questions o Response bias o Incomplete recollection o Reflexivity – interviewee expresses what interviewer want to hear
Direct observation	Typically a field visit conducted during the case study to collect data or record behaviours.	o Reality – covers events in real time o Contextual – covers event context	o Time consuming o Selectivity – might miss facts o Reflexivity – observer's presence might cause change o Cost – observers need time
Participant observation	The researcher becomes an active participant in the events being studied	o Same as above o Insightful into interpersonal behaviour	o Same as above o Bias due to investigator's actions

Physical artefacts	Tools, instruments, or some other physical evidence that may be collected during the study as part of a field visit.	○ Insightful into cultural features ○ Insightful into technical operations	○ Selectivity ○ Availability

No single source has a complete advantage over the others; rather they should be seen as complimentary and could be used in parallel. Tellis (1997) suggests that within a case study, as many resources as relevant to the study should be fully utilised. In this particular study data collection through the interview process will be carried out and will be complimented where possible with a combination of other mechanisms to ensure objective information gathering takes place.

4.3 Case study

The case study used for this particular study is a large investment holding company for a group of high-technology driven companies operating in the telecommunications, information technology and electronics industries. The company required an information consolidation system that would provide for a more flexible and stable information collection, consolidation and distribution solution. The existing system has become inflexible and only focused on the financial information requirements of the business. The company is a publicly listed company on the JSE Securities Exchange in Johannesburg, South Africa. The holding company also has a number of sub-holding companies, of which some are also listed on the JSE. The holding structure is depicted in Figure 26.

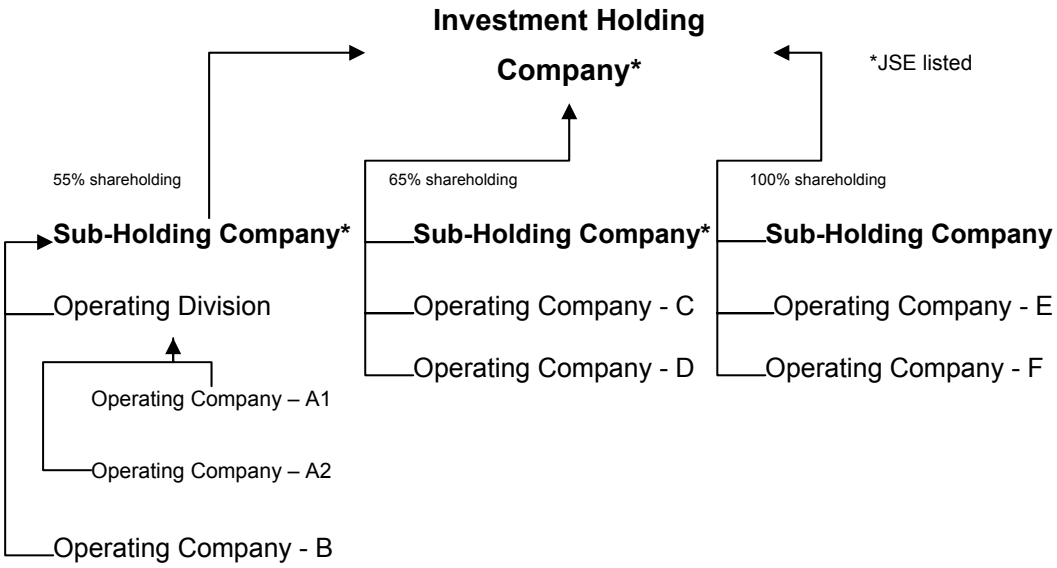


Figure 26: High level overview of the investment holding company structure.

Within each of the sub-holding companies there exist a number of operational companies that make up the greater group. In 2005 there where approximately 50 operating companies spread across the three sub-holding companies. The majority of these operating companies in turn, would have a number of divisions or branches reporting to the operating company head office. In total approximately 150 operating units make up the group. Geographically the majority of operations are located in the Republic of South Africa, with international operations in the United Kingdom, Portugal, Spain, Australia, Malaysia and a number of African countries.

As an investment holding company the continuous monitoring of the company's underlying investments is critical to ensure the maximising of the investment and to ensure value is delivered to the company's shareholders. Information is critical to ensure that management can make strategic decisions based on accurate information as it is made available from the underlying operations. This case study focuses on the top down view of information architecture within the group's structures as well as the bottom-up flow of information to the higher levels in the group's structures.

4.3.1 Case description

This group has over the past 40 years of its existence developed into a complex conglomerate of companies primarily through the acquisition and disposal of companies. For the executive management it remains a challenge to obtain key information from the underlying investments upon which strategic decisions can be based due to a number of reasons – both historical and inherent in the infrastructure that has developed over time.

Although mechanisms exists in feeding information from the lower levels in the organisation to the higher levels, these mechanisms have become largely inflexible and no longer suitable for an organisation requiring information on a more readily basis.

The group essentially required a more effective and efficient collecting, consolidating and reporting strategy for its key information sources. The primary drivers for this strategy have been driven by the following aspects:

- Increasing growth and expansion of the group;
- Increase in complexity of reporting requirements as stipulated by the Johannesburg Stock Exchange (JSE Limited), General Accepted Accounting Practices (GAAP), International Financial Reporting Standards (IFRS) and other financial parameters;
- Difficulty in collecting regulatory and statutory information across the group;
- Reporting on non-financial information, especially regarding Black Economic Empowerment as required by legislation and the South African Department of Trade and Industry (DTI);
- General concerns on the continued integrity, completeness and usefulness of information available in the group and required for reporting purposes; and
- A process of ad hoc reporting and obtaining additional information across the group that is generally time consuming, inefficient and frustrating to all.

Further issues impacting on the above is the fact that each operating unit within the group has its own accounting or transactional system in place. Subsequently consistent formats and definitions for information are often lacking to achieve meaningful consolidation of certain types of information across the group.

In order to address these issues a formal project has been embarked upon to establish a group corporate information system that will cater for the information requirements for senior management. The aim is not to replace any of the existing transactional or information processing systems at operation level, but to replace the current financial reporting system with a more flexible mechanism of collecting, consolidating and reporting.

The existing financial reporting system has become very inflexible due to its antiquated and distributed architecture. For example, currently users at operating level need to extract the general ledger file from their accounting systems, upload the extracted file into the current reporting application and map the accounts to the group chart of accounts. Once this has been completed and any other detail contained within the financial reports is amended a financial reporting pack is emailed to the respective holding entity. At the holding level, the various financial reporting packs are received and the consolidation process is done at this level. Again a financial reporting pack is created and emailed to the final level within the reporting hierarchy of the group. Once it reaches the top-level most of the supporting data is no longer available and no real opportunity exists for data mining and flexible reporting. Thus the process is very decentralised and extremely inflexible as illustrated in Figure 27

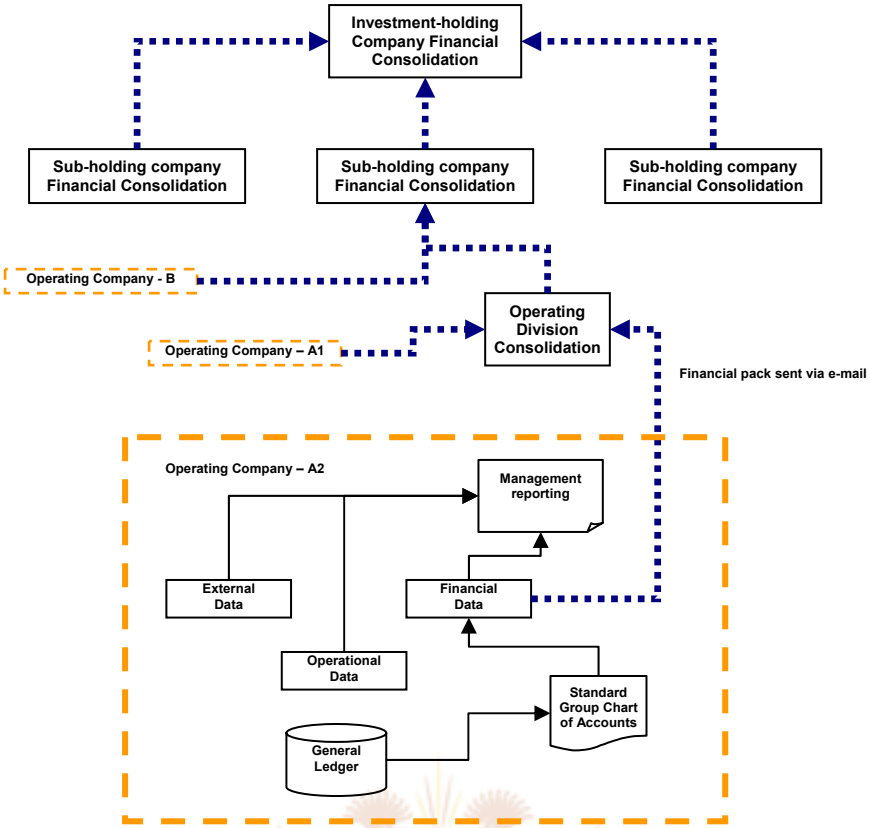


Figure 27: The current monthly financial reporting methodology.

In addition to the above issues experienced with the existing reporting system, is the inability or lack of capability to report on other non-financial information that is regularly required by the group. Effectively there is no standardisation around information and reporting definitions within the group and sometimes some uncertainty exists as to what exactly is being requested to report on.

This research has been divided into a number of phases with each phase building on the previous phase within the project. The two initial phases form the primary focus of this case study as this is considered to be the foundation of the overall group information architecture and the aspects leading up to the future development and refinement of the group's information strategy.

- Phase 1 - Investigation and audit of existing information sources and user requirements
- Phase 2 - Information architecture mapping related to phase 1.

- Phase 3 - Implementation of information architecture, applications and roll out into the greater organisation.

The following headings provide a more detailed background on the case study.

4.3.2 Regulatory and environmental requirements

As mentioned earlier this group of companies has evolved into a diverse conglomerate of companies spread over three sub-holding companies operating in the telecommunications, information technology and power electronics. Direct environmental factors such as regulatory requirements, market pressures, consumer demand, competitors and supply chain aspects are primarily managed at operating level. However, the impact of these environmental factors reflected in the monthly financial statements of the operating company are reported on a consolidated basis up to the operating companies' respective sub-holding company, and in some cases into a operating division and finally up into the investment holding company as illustrated in Figure 28.

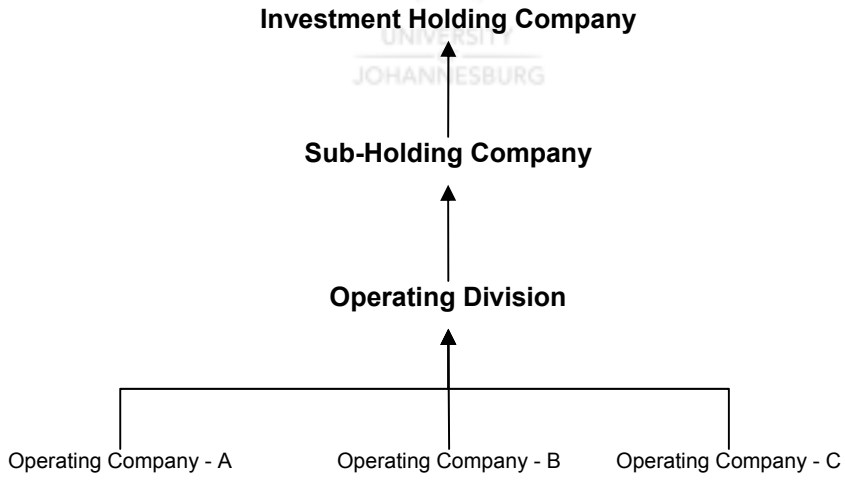


Figure 28: Simplified upward flow of information.

4.4 Approach followed

Due to the intricacies and diverse nature of the group in terms of the various environmental influences, regarding technology, market pressures, other legislative factors and strong autonomy of operating companies a process of interviewing various role-players was followed. Time constraints and the complexity of the group only allowed for a high level investigation in order to highlight to the executive management team the challenges of information management within the group. No specific operational issues were addressed as these are typically taken care of at company operational level. However, where applicable, these areas have been taken note of and if of any value for the rest of the group in terms of strategic reporting purposes have been captured as part of the interview process.

No structured interview process was followed except for highlighting some major points as per the objective of the audit and the questionnaire was structured in such a way to allow the interviewee to freely provide his/her information requirements. Orna (2004:56) also confirms that she doubts the true value of working on a fixed script for an interview and that an informal structure covering the main points of the audit allows for interviewees to make their own decisions, thereby producing better results.

An external party was contracted in assisting the internal project team with the information needs analysis exercise of this project. This was done due to the lack of sufficient internal resources, time constraints and to ensure that there will be objectiveness to the project. As Orna (2004:53) highlights an external party or consultants can offer experience of other audits, provide specialist support in areas of questionnaire design or analysis, but the biggest component is the contribution of the internal employees who has the knowledge and experience of their own organisation. A combination of both an external party and internal resources made up the core project and audit team.

The basis of the information audit as detailed in chapter two as well as aspects of information architecture and the information model as discussed in chapter three was used for the interview process. Not one single author's specific methodology was used as an exclusive approach.

4.4.1 Audience

In total the group employs approximately 12,000 people of which approximately 10% is considered to be senior management. Due to the enormity of the potential pool of people that could be interviewed it was decided in the interest of time and costs for the project to limit the number of interviews to only a number of influential individuals. These individuals was put forward by the executive management of the investment holding company and the internal project team and highlighted as major contributors to the project. A representative sample of head office and operational management staff consisting from the following was interviewed:

The positions of staff members identified to be interviewed varied from the following levels;

- Holding Company
    - Top executives ranging from Chief Executive, Chief Financial Officer, Financial Directors, Senior Directors – top management.
    - First line management ranging from Information Technology, Human Resources, Accounting, Financial, Tax, Secretarial and Auditing – senior management.
- Sub-holding company
    - Top Executives – Chief Executives, Financial Directors, Divisional Executives/Directors, Commercial Directors – top management.
- Operational company
    - Managing Directors, Financial Management, Procurement, Sales, Operational management – top management, senior management and some middle management.

The interviews primarily focused on high level information needs with specific reference to information required by the participant to be able to manage his/her operations or decision process on a day-to-day basis. An example of existing reports used within the organisation was used to encourage requests for improvements or to establish if a need was met satisfactory in terms of the information contained within the reports. Each individual or group was requested to prepare for the interview ahead of time.

The following table provides the questionnaire that each interviewee was requested to complete during the interview or workshop:

Table 3: Corporate information system needs analysis questionnaire.

Corporate Information Architecture
Needs Analysis
Interview questions

The group is in the process of evaluating its existing information architecture with a view of upgrading and enhancing the existing system. You have been identified by the project team as a contributor to the project and your input is highly valued. You are requested to provide relevant input regarding your critical information requirements. Especially *vis-à-vis* management information and information required by your respective reporting entity. Please complete the questionnaire as detailed as possible.

1. **Stakeholder information** - This questionnaire has been completed by:

Title (Dr/Mr/Mrs/Ms):	Name:	Surname:

Designation:	Company:	What is the reporting level of your company: • Investment Holding • Sub-holding • Operational

Please indicate your position within the company: • Top Management (Executive/MD/FD) • Senior Management (GM/FM) • Middle Management (Other Manager)	What is your functional position with the company: • Strategic (General Management) • Financial • Human Resources • Sales • Procurement • Other (e.g. IT, Legal, Audit, etc)

2. **Information Requirements** - List the key information requirements within your specific operation (Multiple listings are allowed). Typical information sources being utilised by you and by your sub-holding company management may include, but are not limited to the following examples:
   - Strategic management information
   - Main business drivers and performance measures or indicators
   - Main suppliers, customers and products
   - Financial Information (Actual, Budget, Forecast/Modelling/What-If, Costing, History, Shared services/Transfer pricing)
   - Customer information
   - Operational information
   - Human Resources information
   - Regulatory statistics including Black Economic Empowerment statistics, etc.
   - Frequent add-hoc requests - prioritized into order of importance to the management team and the reporting units.

3. **Rating information requirements** - For each of the above listed information requirements rate it by the following criteria using the key assigned to each criterion:
   - Importance – how important is the request or requirement perceived to be to the organisation.
     - A – Strategically critical/Can make a difference
     - B – Valuable contribution/Must have/Essential to do work
     - C – Nice to have
     - R – Statutory, Legal requirement
   - Current status – what is the current status of the requirement – is it already in place, or it a requirement or enhancement?
     - IP – in place and used
     - RQ – Requirement
     - EN – Enhancement identified
   - Frequency of need – how often is the information required?
     - D – Daily
     - W – Weekly

- M – Monthly
- Q – Quarterly
- A – Annually

- Horizon key – what is the period of information required?
  - D – Daily
  - W – Weekly
  - M – Monthly
  - Q – Quarterly
  - A - Annually
- Type – what type of information is required or requested?
  - MI – Management information including comments
  - BF – Basic financial information (Balance Sheet, Income statement, Cash Flow)
  - FA – Financial analysis
  - FB – Financial budgets
  - FC – Financial costing and trial balance
  - BI – Strategic and value driver information, business intelligence
  - RS – Regulatory and statutory
  - OI – Operational information, i.e. manufacturing statistics
- Comparison – what is the historical period the information will be compared to?
  - YTD – Year-to-date
  - BD – Budget
  - PY – Prior year
  - FC - Forecast
- Source – what is the most likely source where this information will be obtained from?
  - MAN – Manual input or manually produced
  - MSP – Microsoft Office package (e.g. Excel, Access)
  - JAV – Existing toolset/application used for information consolidation
  - LEG – Legacy system with difficult extracting process
  - SQL – Application on SQL platform
  - PAY – Payroll system
  - TX – Accounting/transactional system
  - HR – Human resources management system
  - ALX – Group intranet
  - EXT – External sources, i.e. third party
- Distribution – to what level within the organisation will this information be distributed to?
  - GRP – Investment holding company
  - SUB – Sub-holding company
  - DIV – Division
  - OCO – Operating company, internal use only
  - REP – Reporting unit
  - LCO – Legally required
- Who – who will be the typical end user of the resulting information?
  - EXCO – Executive, top management
  - MAN – Senior management
  - FIN – Financial management
  - SALES – Sales
  - PROC – Procurement
  - IT – Information technology
  - OPS – Operational management
  - HR – Human resources
  - LEGAL - Legal
- Main information use – what is the main purpose and use of the information?
  - CNS – Consolidation up the reporting hierarchy
  - MIS – Management information for decision making
  - MPF – Monitor performance
  - DRV – Drivers of value
  - SFC – Factory floor and manufacturing control and efficiency measures
  - REG – Regulatory requirement

#	Information requirements	Importance	Current Status	Information type	Frequency of need	Horizon	Comparisons	Source	Distribution	Who	Main use
1.											
2.											
3.											
…..											
n											

4. **Information technology** - if you are unsure about the detail regarding the information technology infrastructures of your company please refer this part of the questionnaire to your Information Technology department for completion.

Accounting & Transactional system:		Example:
What is the company's accounting or transactional system?		Accpacc, SAP R/3, Oracle, etc.
What is the operating system used?		Windows Server, Unix, other.
What is the primary database used for the application?		MS SQL, IBM DB2, Oracle
Does the system allow for integration by an external package?		Open standards, ODBC, etc.
What tools are utilised for reporting purposes?		Oracle Discoverer, MS Excel, Crystal Reports, etc.
How is data extracted from the accounting system?		File extract into CSV, ASCII, etc.
Is all the information utilised for strategic decision making contained within the accounting system or are there external applications utilised to compliment this information?		MS Word, Excel, Access or other external systems are also utilised.
Are you using specific data definitions/standards to describe certain datasets within the system?		Own definitions, COA, DTI, etc.
User access:		
What is the primary operating system of the user's desktop/laptop		Windows 2000, Windows XP, other.
What type of access do the users have to the network/Internet?		LAN, Dialup, 3G, other.
Connectivity:		
Who is your Internet Service Provider?		Telkom, DataPro, UUNET, etc.
What is your bandwidth to the ISP?		64Kb, 128Kb, 256Kb, etc.
What firewall do you have in place?		Cisco Pix, Symantec, etc.
General:		
Do you have any additional comments or remarks regarding the availability and usage of data/information within the systems that you have in place?		

5. **General** - Please give high level additional general comments regarding:
   - What currently works for you and the reporting units?
   - What does not work for you and the reporting areas and are problem areas?
   - What improvements can be made or suggestions do you have?
   - What concerns do you have regarding potential developments in the information and systems areas and or the project?

4.5 Collection of data

In total 82 individuals was interviewed on a one-to-one basis. Where the opportunity existed a workshop was held with multiple participants, simply to ensure the time utilised was maximised. In total four workshops were held in which the 19 individuals were interviewed. (4, 5, 6 and 4 respectively). The interview or workshop process lasted between one to three hours, depending on the amount of interaction and discussion taking place between the various participants and the facilitator/interviewer.

Of the 82 individuals interviewed 51 was from top management (including 7 Executives, i.e. CEO, CFO and other senior directors), 24 from senior management

and the remaining 7 from middle management positions. The spread across the group consisted out of 17 individuals from the investment holding company, 18 from the sub-holding companies and 47 from operational companies. As for the functional role of the individuals a fairly broad range of roles have been covered including strategic management (33), financial (21), information technology (6), procurement (5), internal audit (4), human resources (4), sales (3), investor relations (2), treasury (1), tax (1), secretarial (1) and corporate affairs (1).

During the interview process a matrix of feedback was compiled in order to provide a structured feedback mechanism to the business. Individuals have been asked to indicate the importance of the information needs, typically focusing on strategic, day-to-day essential, regulatory and nice to have requirements. Individuals were also asked to indicate the current status of the information requirement to indicate if a particular requirement is in place or if it is a requested enhancement that has been requested in order to determine if the requirement is adequate. Additional parameters regarding the information type, how often it will be used, and what period of information is required to make meaningful comparisons and the source of information were added into the matrix. A final set of parameters provided further detail on the distribution and consumption of the resulting information or reports.

At the same time of the interview process key areas of information requirements have been grouped together as identified information domains and separated as per the relevant headings below. The needs identified are listed in no particular order of importance.

4.5.1 Interview summary

Table 4: Interview summary grouped by information domains.

#	High level input provided on Information used and needs identified.	Importance	Current Status	Information Type	Frequency of need	Horizon	Comparisons	Source	Distribution	Who	Main use
1.	**FINANCIAL CONSOLIDATION & REPORTING**										
1.1	Group financial reporting pack per sub-holding – consolidated for the group.	B	IP	BF	M	M, YTD	YTD, BD, FC, PY	JAV	GRP	EXCO MAN FIN	MPF, CNS
1.2	Flash report per sub-holding company – consolidated for the group	B	IP	FA	M	M, YTD	YTD, BD, FC, PY	MSP	GRP	EXCO MAN FIN	MPF, CNS
1.3	Drill down to underlying data – root cause analysis	B	RQ	FA	M	YTD, Q	YTD, BD, FC, PY	JAV	GRP	All	MPF
1.4	Debtors > 90 days	B	IP	FA, MI	M	M	FC, PY, YTD, BD	MSP, TX	OCO, SUB, GRP	MAN FIN	MPF
1.5	Stock > 6 months	B	IP	FA, MI	M	M	FC, PY, YTD, BD	MSP, TX	OCO, SUB, GRP	MAN FIN	MPF

#	High level input provided on Information used and needs identified.	Importance	Current Status	Information Type	Frequency of need	Horizon	Comparisons	Source	Distribution	Who	Main use
1.6	Debtors > credit limits	B	IP	FA, MI	M	M	FC, PY, YTD, BD	MSP, TX	OCO, SUB, GRP	MAN FIN	MPF
1.7	Credit notes, write offs, losses	B	IP	FA, MI	M	M	FC, PY, YTD, BD	MSP, TX	OCO, SUB, GRP	MAN FIN	MPF
1.8	Budgets - Same process as current system	B	IP	BF, FA	M, Q, A	M, Q, A	PY	JAV	SUB, GRP	EXCO MAN FIN	MIS, MPF, CNS
1.9	Budget parameters from the top	B	IP	BF, FA	M,Q, A	M, Q, A	PY	JAV	SUB, GRP	EXCO MAN FIN	MIS, MPF
1.10	Macro view at the top – more detail at sub-holding	B	IP	BF, FA	M, Q, A	M, Q, A	PY	JAV	SUB, GRP	EXCO MAN FIN	MIS, MPF
1.11	Modelling and forecasting - done at Sub-Holding level on rolling basis	B	IP, RQ	BF, FA	M, Q, A	M, Q, A	PY, BD, FC	JAV	SUB, GRP	EXCO MAN FIN	MIS, CNS
1.12	HQ consolidated to end of Quarter, Half year & Full year	B	IP, RQ	BF, FA	M, Q, A	M, Q, A	PY, BD, FC	JAV	SUB, GRP	EXCO MAN FIN	MIS, CNS
1.13	HQ might look at major indicators changes only – top part of income statement, sales, gross margin, interest rate, PBIT	B	IP, RQ	BF, FA	M, Q, A	M, Q, A	PY, BD, FC	JAV	SUB, GRP	EXCO MAN FIN	MIS, CNS
1.14	Various levels of sophistication and flexibility	B	IP, RQ	BF, FA	M, Q, A	M, Q, A	PY, BD, FC	JAV	SUB, GRP	EXCO MAN FIN	MIS, CNS
1.15	Exception reports explaining changes	B	IP, RQ	BF, FA	M, Q, A	M, Q, A	PY, BD, FC	JAV	SUB, GRP	EXCO MAN FIN	MIS, CNS

#	High level input provided on Information used and needs identified.	Importance	Current Status	Information Type	Frequency of need	Horizon	Comparisons	Source	Distribution	Who	Main use
1.16	Flash updates – trading, trends.	B	IP, RQ	BF, FA	M, Q, A	M, Q, A	YTD, BD	JAV, MSP	OCO, SUB, GRP	MAN FIN	MIS, DRV, MPF
1.17	Cash flow - Monthly reports from Group Treasury	B	IP, RQ	FC, BF	M,Q, A	M, Q, A	PY, BD, FC	MSP	SUB, GRP	EXCO MAN FIN	MIS, CNS
1.18	Informal process of forecasting at SHC	A	RQ	FC, BF	M, Q, A	M, Q, A	PY, BD, FC	SQL	SUB, GRP	EXCO MAN FIN	MIS, CNS
1.19	Business risk reviews	B	IP	AD	M, Q, A	A	PY	MSP	OCO, SUB, GRP	EXCO MAN FIN	MIS, MPF
1.20	Financial systems review	B	IP	AD	M, Q, A	A	PY	MSP	OCO, SUB, GRP	EXCO MAN FIN	MIS, MPF
1.21	Computer Systems review	B	IP	AD	M, Q, A	A	PY	MSP	OCO, SUB, GRP	EXCO MAN FIN IT	MIS, MPF
1.22	Thefts, fraud, etc.	B	IP	FA, MI	M	M	FC, PY, YTD, BD	MSP, MAN	OCO, SUB, GRP	ALL	MPF, MIS
1.23	Forecast information	B	RQ, IP	MI	M	M, Q, A	YTD	MSP, TX	OCO, SUB, GRP	EXCO MAN FIN	MPF, MIS
1.24	Modelling at various levels	B	RQ	MI	M	M, Q, A	YTD	MSP, TX	OCO, SUB, GRP	EXCO MAN FIN	MPF, MIS
1.25	Dashboard/KPI monitoring	B, A	RQ	BF, FA, MI	W, M, Q, A	W, M, Q, A	YTD, BD, FC, PY	TX	OCO, SUB	EXCO MAN FIN	MPF, MIS

#	High level input provided on Information used and needs identified.	Importance	Current Status	Information Type	Frequency of need	Horizon	Comparisons	Source	Distribution	Who	Main use
1.26	Exception Reporting on fixed against budget, forecast	B	RQ	BF, FA, MI	M, Q, A	M, Q, A	YTD, BD, FC, PY	JAV, MSP, TX	OCO, SUB	EXCO MAN FIN	MPF
1.27	Monthly review of trends, patterns, highlights, concerns	B	RQ	BF, FA, MI	M, Q, A	M, Q, A	YTD, BD, FC, PY	JAV, MSP, TX	OCO, SUB	EXCO MAN FIN	MPF
1.28	Inventory levels, ratio's and development of trends	B	IP	FA, MI	M	M	FC, YTD, BD	MSP, TX	OCO, SUB, GRP	MAN FIN SALES	MPF, MIS
1.29	Total value, sales days, stock turn, days per product	B	IP	FA, MI	M	M	FC,PY , YTD, BD	MSP, TX	OCO, SUB, GRP	MAN FIN SALES	MPF, MIS
1.30	Debtors values per company, major customer, ratio's, exceptions	B	IP	FA, MI	M	M	FC, PY, YTD, BD	MSP, TX	OCO, SUB, GRP	MAN FIN SALES	MPF, MIS
1.31	Days per company, industry benchmark, over 90 days	B	IP	FA, MI	M	M	FC, PY, YTD, BD	MSP, TX	OCO, SUB, GRP	MAN FIN SALES	MPF, MIS
1.32	Risks current and potential, problems, litigation	B	IP	FA, MI	M	M	FC, PY, YTD, BD	MSP, TX	OCO, SUB, GRP	EXCO MAN FIN LEGAL	MPF, MIS
1.33	Credit information, values, ratio's, exceptions	B	IP	FA, MI	M	M	FC, PY, YTD, BD	MSP, TX	OCO, SUB, GRP	MAN FIN SALES	MPF, MIS

#	High level input provided on Information used and needs identified.	Importance	Current Status	Information Type	Frequency of need	Horizon	Comparisons	Source	Distribution	Who	Main use
1.34	Days o/s per customer, company, ratio to debtors, 30 vs. 50 days	B	IP	FA, MI	M	M	FC, PY, YTD, BD	MSP, TX	OCO, SUB, GRP	MAN FIN SALES	MPF, MIS
1.35	Rolling 12 month forecast on sales, earnings, working capital, profitability	B	IP, RQ	BF, FA, MI	M, Q, A	M, Q, A	YTD, FC, BD	MSP, TX	OCO, SUB, GRP	MAN FIN SALES	MPF, MIS, DRV
1.36	Multiple formats of reporting causing frustration	B	IP, RQ	BF, FA	M, Q, A	M, Q, A	YTD, BD, FC, PY	MSP	OCO, SUB, GRP	ALL	MPF
1.37	Common chart of accounts	A	IP, RQ	FA, MI	M, Q, A	M, Q, A	FC, PY, YTD, BD	TX	OCO, SUB, GRP	FIN	MPF, CNS
1.38	Monthly Management Letter	A	IP, RQ	MI	M	M, YTD	YTD, PY, BD, FC	JAV, MSP, MAN	OCO, SUB, GRP	ALL	MPF, DRV

41% % contribution

2.	BLACK ECONOMIC EMPOWERMENT & HUMAN RESOURCE INFORMATION										
2.1	BEE holding and percentage status	R	RQ	RS	M	M, YTD	BD, FC	MSP	GRP, OCO	EXCO MAN HR	MPF, CNS
2.2	Corporate Social Investment (CSI) spend	R	RQ	RS	M	M, YTD	BD, FC	MSP	OCO, SUB, GRP	EXCO MAN FIN HR	MPF, REG, CNS
2.3	HR numbers and statistics	A	RQ	HR, RS	M	M, YTD	BD, FC	MSP	SUB, GRP	MAN HR	MPF, CNS

#	High level input provided on Information used and needs identified.	Importance	Current Status	Information Type	Frequency of need	Horizon	Comparisons	Source	Distribution	Who	Main use
2.4	Equity shareholding per operating company and consolidated	R	RQ, IP	RS	M, Q, A	M, Q, A	PY, BD	MSP	SUB, GRP	MAN HR SECT	MPF, REG, CNS
2.5	Representation of Employment Equity	R	RQ, IP	RS	M, Q, A	M, Q, A	PY, BD	MSP, HR	OCO, SUB, GRP	MAN HR	MPF, MIS, REG, CNS
2.6	Skills development progress	R	RQ, IP	RS	M, Q, A	M, Q, A	YTD, PY, BD	MSP, HR	OCO, SUB, GRP	MAN HR	MPF, MIS, REG, CNS
2.7	Employment Equity statistics	R	RQ, IP	RS	M, Q, A	M, Q, A	YTD, PY, BD	MSP, HR	OCO, SUB, GRP	EXCO MAN	MPF, MIS, REG, CNS
2.8	HR actual cost, salaried, wages, per head, per company, management	B	IP, RQ	BF, FA, MI	M, Q, A	M, Q, A	YTD, FC, BD	MSP, PAY, HR	OCO, SUB, GRP	MAN FIN HR	MIS, DRV
2.9	Spending on SMME	R	IP, RQ	RS	M, Q, A	M, Q, A	FC, YTD, PY, BD	MSP, TX	OCO, SUB, GRP	MAN FIN PROC	MIS, CNS
2.10	Training and development spend, vs. budget, % claimed back	R	IP, RQ	RS	M, Q, A	M, Q, A	FC, PY, YTD, BD	MSP, TX	OCO, SUB, GRP	FIN HR	MIS, CNS
2.11	Benchmark remuneration rates to group internal & market	B	IP, RQ	HR	M, Q, A	M, Q, A	PY, FC, BD, YTD	MSP, HR, PAY, EXT	OCO, SUB	HR	DRV, MIS

#	High level input provided on Information used and needs identified.	Importance	Current Status	Information Type	Frequency of need	Horizon	Comparisons	Source	Distribution	Who	Main use
2.12	Equity – compare rates for EE report per government balanced scorecard targets	R	IP, RQ	RS	M, Q, A	M, Q, A	PY, FC, BD, YTD	MSP, HR	OCO, SUB, GRP	HR	REG, DRV
2.13	Equity – weighted EE analysis	R	IP, RQ	RS	M, Q, A	M, Q, A	PY, FC, BD, YTD	MSP, HR	OCO, SUB, GRP	HR	REG, DRV
2.14	Training – skills development expenditure as a portion of total payroll	R	IP, RQ	RS	M, Q, A	M, Q, A	PY, FC, BD, YTD	MSP, HR, PAY	OCO, SUB, GRP	HR	REG, DRV
2.15	Training – workplace skills plan with learnership break-up by race, gender, etc.	R	IP, RQ	RS	M, Q, A	M, Q, A	PY, FC, BD, YTD	MSP, HR	OCO, SUB, GRP	HR	REG, DRV
2.16	Equity ownership - % share of economic benefits	R	IP, RQ	RS	M, Q, A	M, Q, A	PY, FC, BD, YTD	MSP	OCO, SUB, GRP	MAN FIN HR	REG, DRV
2.17	Equity - % black persons in executive management and/or board	R	IP, RQ	RS	M, Q, A	M, Q, A	PY, FC, BD, YTD	MSP	OCO, SUB, GRP	EXCO MAN HR	REG, DRV
2.18	EE/preferential procurement – from black and empowered enterprises as a proportion of total	R	IP, RQ	RS	M, Q, A	M, Q, A	PY, FC, BD, YTD	MSP, TX	OCO, SUB, GRP	FIN PROC SALES	REG, DRV
2.19	CSI residual spend for operating entities	R	IP, RQ	RS	M, Q, A	M, Q, A	PY, FC, BD, YTD	MSP, TX	OCO, SUB, GRP	FIN HR	REG, DRV, CNS

#	High level input provided on Information used and needs identified.	Importance	Current Status	Information Type	Frequency of need	Horizon	Comparisons	Source	Distribution	Who	Main use
2.20	Skills database	B	RQ	HR	M, Q, A	M, Q, A	N/A	MSP, HR, MAN	OCO, SUB, GRP	HR	DRV
2.21	Payroll analysis per cost centre, HR analysis, Statutory returns	R, B	IP, RQ	HR, RS	M, Q, A	M, Q, A	YTD, BD, FC, PY	PAY, MSP	OCO, SUB	HR	MPF, DRV
2.22	Standardised definitions for EE	R, B	IP, RQ	HR, RS	M, Q, A	M, Q, A	YTD, BD, FC, PY	PAY	OCO, SUB	HR	MPF, DRV
2.23	Consolidated, policies, procedures and profiles	B	RQ	HR	M	M, Q, A	YTD, PY, BD, FC	MAN, MSP, ALX	SUB, GRP	HR	MPF, DRV
25%	% contribution										
3.	**SUPPLIER & CUSTOMER INFORMATION**										
3.1	Purchases from the Group	B	IP, RQ	AH	M	M, Q, A	YTD, PY	MSP, TX	SUB, GRP	FIN SALES PROC	MIS, CNS
3.2	Accredited suppliers (BEE, SMME)	R	RQ	RS	M	M, Q, A	YTD, PY, BD, FC	MSP	SUB, GRP	FIN PROC	MIS, CNS
3.3	Top suppliers & customers per Group, Sub-holding	B	IP, RQ	MI, BI, AH	M	M, Q, A	YTD, PY	MSP, TX	SUB, GRP	EXCO MAN FIN SALES PROC	MIS, MPF, CNS

#	High level input provided on Information used and needs identified.	Importance	Current Status	Information Type	Frequency of need	Horizon	Comparisons	Source	Distribution	Who	Main use
3.4	Volumes/Commodity spend	B	IP, RQ	MI, BI, AH	M	M, Q, A	PY, YTD	MSP, TX	SUB, GRP	FIN SALES PROC	MIS, MPF, CNS
3.5	Exports (Hard Currency)	A, B	IP, RQ	SC, AH, FA, BI	W, M	M, Q, A	YTD, PY, BD, FC	MSP	OCO, SUB, GRP	EXCO MAN FIN SALES	MPF, MIS
3.6	Sales and profitability per customer (Top 20)	A, B	IP	SC, MI	W, M	W, M	YTD, PY, BD, FC	MSP, TX	OCO, SUB, GRP	EXCO MAN FIN SALES	MPF, DRV
3.7	Sales and profitability per customer (Bottom 20)	A, B	IP	SC, MI	W, M	W,M	YTD, PY, BD, FC	MSP, TX	OCO, SUB, GRP	EXCO MAN FIN SALES	MPF, DRV
3.8	Sales and profitability per customers type /industry segment	A, B	IP	SC, MI	W, M	W, M	YTD, PY, BD, FC	MSP, TX	OCO, SUB, GRP	MAN FIN SALES	MPF, DRV
3.9	Sales and profitability per customer type/geographic segment	A, B	IP	SC, MI	W, M	W, M	YTD, PY, BD, FC	MSP, TX	OCO, SUB, GRP	MAN FIN SALES	MPF, DRV
3.10	Sales and profitability per product type/geographic segment	A, B	IP	SC, MI	W, M	W, M	YTD, PY, BD, FC	MSP, TX	OCO, SUB, GRP	MAN FIN SALES	MPF, DRV
3.11	Top 20 customers by sales/relative positions	A, B	IP, RQ	FA, BI	W, M	W, M	YTD, PY, BD, FC	MSP, TX	OCO, SUB, GRP	EXCO MAN FIN SALES	MPF, DRV

#	High level input provided on Information used and needs identified.	Importance	Current Status	Information Type	Frequency of need	Horizon	Comparisons	Source	Distribution	Who	Main use
3.12	Major Tenders open	A, B	IP, RQ	FA, BI	W, M	W, M	FC, BD	MSP, EXT	OCO, SUB, GRP	MAN SALES	MP F, DR V
3.13	Major Tenders won	A, B	IP, RQ	FA, BI	W, M	W, M	FC, BD	MSP	OCO, SUB, GRP	MAN SALES	MP F, DR V
3.14	Group's customers, ranked by value of sales, type of product or services, market share	B	RQ	SC	M	M	PY, BD, FC	MSP, TX, MAN	OCO, SUB, GRP	EXCO MAN FIN SALES	MP F, DR V, CN S
3.15	Key decision makers, relevant strategy, opportunities	B	IP, RQ	SC	M	M	BD, FC	MAN, MSP	OCO, SUB, GRP	EXCO MAN SALES	DR V
3.16	Cross selling opportunities	B	RQ	SC	M	M	N/A	MAN, MSP	OCO, SUB, GRP	SALES	DR V
3.17	Key account management	B	RQ	SC	M, Q, A	M, Q, A	FC, PY, YTD, BD	MAN, MSP	OCO, SUB, GRP	SALES	MP F, DR V
3.18	What products and services the group sells, the proportionate contribution of each and the relative profitability of each at the gross margin level.	B	RQ	FA, MI, BI	M, Q, A	M, Q, A	FC, PY, YTD, BD	TX, MAN, MSP	OCO, SUB, GRP	EXCO MAN SALES	MP F, CO NS

19% % contribution

#	High level input provided on Information used and needs identified.	Importance	Current Status	Information Type	Frequency of need	Horizon	Comparisons	Source	Distribution	Who	Main use
4.	**OPERATIONAL STATISTICS**										
4.1	Capacity planning status	B	IP	OI	W, M	W, M	FC, PY, YTD, BD	MSP, TX	OCO, SUB	MAN OPS	MPF, SFC
4.2	Manufacturing efficiency	B	IP	OI	W, M	W, M	FC, PY, YTD, BD	MSP, TX	OCO, SUB	MAN OPS	MPF, SFC
4.3	Stock levels and stock ratio's vs. order bank	B	IP	OI	W, M	W, M	FC, PY, YTD, BD	MSP, TX	OCO, SUB	MAN FIN OPS SALES	MPF, SFC
4.4	Volume throughputs per product and factory recoveries	B	IP, RQ	OI	W, M	W, M	FC, PY, YTD, BD	MSP, TX	OCO, SUB	MAN OPS	MPF, SFC

4% % contribution

5.	**GENERAL GROUP INFORMATION/NICE TO HAVE**										
5.1	Group activities – newsletters, press, policies	B, C	IP, RQ	MI, AH	D, W, M	N/A	N/A	MSP, MAN	OCO, SUB, GRP	ALL	MIS, DRV
5.2	Group Calendar	B	IP, RQ	MI, AH	D, W, M, A	D, W, M, A	N/A	MSP, ALX	GRP	ALL	MIS
5.3	Availability of Group Tenders, Projects, Corporate Services, etc	B, C	IP, RQ	MI, AH	D, W, M	D, W, M, A	N/A	ALX	OCO, SUB, GRP	ALL	MIS, DRV
5.4	Market share information – product, segment, customers	C	RQ	SC	M, Q, A	M, Q, A	BD, FC	EXT	OCO, SUB	EXCO MAN SALES	DRV

#	High level input provided on Information used and needs identified.	Importance	Current Status	Information Type	Frequency of need	Horizon	Comparisons	Source	Distribution	Who	Main use
5.5	Macro economic indicators, GDFI month by month	C	RQ	SC	M, Q, A	M, Q, A	BD, FC	EXT	OCO, SUB	ALL	DRV
5.6	Major projects	C	RQ	SC	M, Q, A	M, Q, A	BD, FC	EXT, MAN	OCO, SUB	ALL	DRV
5.7	Intellectual capital, knowledge sharing	C	RQ	MI				MSP, MAN, EXT, ALX	OCO, SUB, GRP	ALL	DRV
5.8	Company registration numbers. Organogram, legal structure, Income tax, VAT, PAYE, SDL, UIF and WCA reference numbers	R	IP, RQ	MI, BI, AH, RS	M, Q, A	M, Q, A	N/A	MSP, EXT	OCO, SUB, GRP	ALL	MPF
5.9	Process of capturing, consolidating and reporting of non-financial information	B	IP, RQ	BF, FA, MI, BI	M, Q, A	M, Q, A	YTD, BD, FC, PY	MAN, MSP, ALX, EXT	OCO, SUB, GRP	ALL	CNS, MIS
5.10	Common address list sharing across the group	B	RQ	HR, OI	M, Q, A	M, Q, A	PY	HR, ALX	OCO, SUB, GRP	ALL	DRV

11% % contribution

100% Total % contribution

4.6 Interpretation of results

The requirements as expressed during the interview process as well as observations made during meetings and general discussions with the various role-players within the organisation have continued to provide the project team the necessary confirmation of the information requirements of the organisation.

With the overall objective of this project to establish a group information architecture that will form the basis of a group wide information system that will cater for the information requirements of senior management in mind the general observations from the interview process pointed out that there are definitively shortcomings in information delivery within the group and at various levels;

- Currently the overall information delivery within the group relies on a very inflexible financial reporting system. The replacement of this financial reporting system has then been identified as a key objective of this project.
- Companies generally accepted that they are the "owners" of regulatory and statutory information as required by legislation; however this is difficult to collect due to inconsistency in data definitions or the inability of the underlying systems in providing the required information. A further factor is that historically some of the information to be reported on was never a requirement and subsequently new information or data fields need to be catered for.
- General concerns regarding the integrity, completeness and usefulness of information provided have been expressed by the interviewees.
- The process of ad hoc reporting and providing additional information for which there is no standard reporting format is time consuming, inefficient and frustrating to all. Typically a request would be made by the investment holding company that requires the operational companies to provide certain information that is not contained in the monthly management reports. A long and protracted process would then be embarked on to define the information required, extract this from transactional or accounting systems and aggregate the results to the investment holding company. Such a process

could last a long time after which the usefulness of the information comes into question once an answer is provided.

It is thus clear from the above that the group requires a more effective and efficient collecting, consolidating and reporting information architecture that will allow it to:

- Collect data and information from diverse and dispersed information resources.
- Consistent formats and definitions of data and information sets needs to be defined and used across the group in order to achieve meaningful consolidation of information.
- A more flexible and easier to use reporting mechanism needs to be put into place.
- Companies need to be able to leverage off information that is gathered across the group for their own benefit as well.
- Make better use of modern technology facilities that will allow it to collect, collate, view and distribute information.
- Not interfere with existing legacy systems. Existing systems are considered to be stable and needs to remain in place where possible, but should be more effectively utilised by making provision for additional information requirements as dictated by the information requirements of the group.

The specific requirements as expressed by the individuals interviewed during this process are discussed in detail below.

4.6.1 Information domains

Referring to the information domains as proposed by Fisher (2004:12) the following main trends and important requirements have been identified in the interview process and these needs to be consolidated across all the companies:

1. Financial consolidation and reporting;
2. Black Economic Empowerment (BEE) & Human resources (HR) information;
3. Supplier and customer information;
4. Operational statistics; and
5. General group information (Nice to have)

Due to the fact that relative freedom was given in allowing each interviewee to supply as many requirements as they could a number of duplicate requirements have been captured in the questionnaire. Through a process of standardising the listed requirements and eliminating duplicates the requirements as listed in Table 4 provides a summary of the requirements as listed by the interviewees.

The proportionate contributions of the requirements as expressed by the number of listed requirements are illustrated in Figure 29.

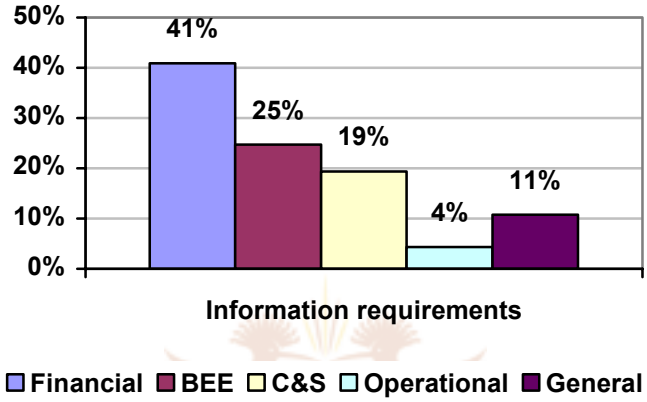


Figure 29: Proportional contribution of information requirements per information domain.

Due to the number of interviewees with a financial function and the purpose of this research looking at the replacement of the existing financial reporting system, it was no surprise that the contribution around the financial requirements was as high as 41%. However, taking into consideration that the second highest requirement was for BEE reporting at 25%, it was clear that the BEE transformation process has received high priority within this organisation and reporting on BEE as per the government is a high priority. This is also evident through internal BEE charters and initiatives.

With customer and supplier reporting and management requirements at 19% it is evident that great emphasis is placed on the relationship this organisation has with both its customers and suppliers. This will be discussed in further detail later in this chapter in section 4.6.1.3.

Operational reporting requirements scored a low 4% and can thus be considered as a low contributor to the overall strategic decision process at the higher reporting levels within the organisation.

Under general the information requirements were spread over a relative wider area that does not warrant any priority focus at this stage.

4.6.1.1 Financial consolidation and reporting

As with any organisation consisting out of a number of underlying entities in which it has investments or shareholding the financial position of the overall investment needs to be monitored and management continuously. Furthermore as was the case in this instance one of the key drivers of the project has been the replacement of the current application used for financial consolidation purposes. This application has been in use for approximately twelve years. The technology platform on which the application is run has become very outdated and thus a risk for the organisation. This application has simply become inadequate in providing a dynamic and robust platform for financial consolidation within a large organisation. It was therefore no surprise that the financial information requirements received the most requests for improvements during the interview process.

Although most of the features requested are already in place and indicated by the key "IP" in Table 4, there are a number of items that have been listed jointly as requirements (RQ) indicating a request for enhancement on existing features. These enhancements can be typically grouped into the following three areas:

1. Drill down capability – Due to the disconnected nature and lack of a centralised database within the existing consolidation application there is no drill down capability. Drill-down is the ability to investigate information in increasing detail. For example not only to be able to see the total sales, but also by product, region or even by sales person. This is an analytical process which accesses and evaluates detail data which has been aggregated into interrelated data.

2. Trend analysis – Trend analysis allows for the analysis of changes in a given item of information over a period of time. Again due to the lack of a centralised database that would keep historical data and information the ability to carry out trend analysis cannot be done for the whole group. The impact of certain parameters on the group can also not be done in order to determine certain outcomes. For instance the impact of the rand-dollar exchange rates on the group's foreign income. This could also be of use within the strategic decision making process in order to determine possible futures for the group.
3. Dashboards – A dashboard in information representation terms is a user interface that organises and presents information in such a way that it is easy to read and understand. The analogy is of course the dashboard of a motor vehicle with various dial and indicators, indicating the speed of the vehicle and other aspects required by the driver to steer the vehicle. Their purpose is to help decision-makers make better and faster decisions by consolidating key business information and making it available at-a-glance through a standard web browser (Cate, 2003). An example of a dashboard is depicted in Figure 30.

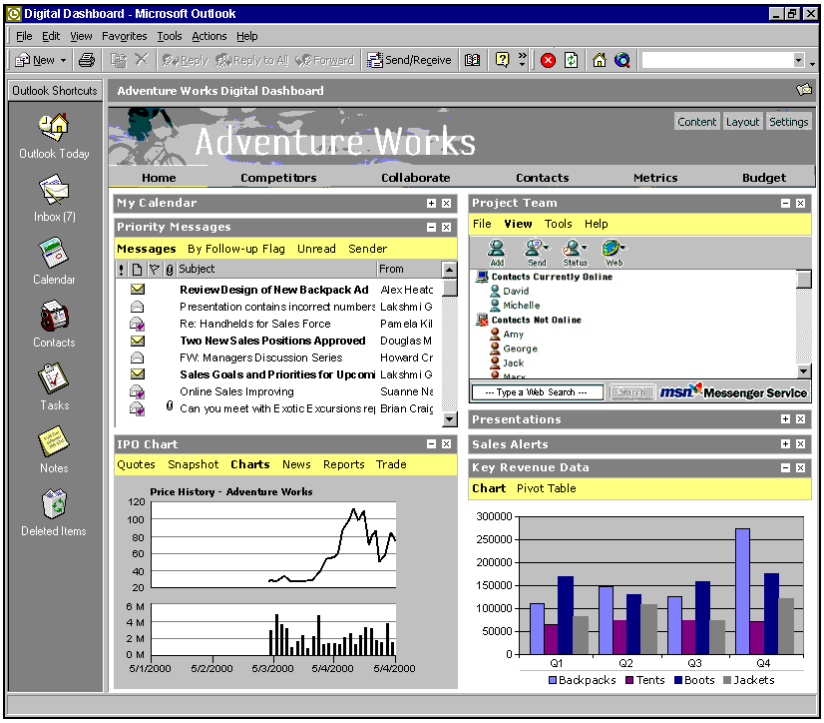


Figure 30: An example of a dashboard.

Although these enhancements can be considered an improvement of the current application, the ability to do drill-down, trend analysis and delivery of information are clearly aspects that will assists with the usage of data and information and ultimately the presentation of the information.

4.6.1.2 BEE and HR information

Over and above the pure financial reporting requirements on a monthly basis the second largest need within the group that has been identified is the reporting of regulatory information, specifically issues relating to Black Economic Empowerment (BEE). During the build up to the project it become quite evident that organisations within South Africa needed to put into place transformation processes with the proclamation of the Employment Equity Act 55 of 1998 and the Broad-based Black Economic Empowerment Act 53 of 2003 that made provision for a legislative framework for the promotion of black economic empowerment, issuing of codes of good practice and the publication of transformation charters (RSA, 2003).

The intended purpose of this act is clearly to guide companies to transform and promote economic transformation. This requires companies to put into place necessary mechanisms to report on their progress in meeting the targets as defined and set out by the industry charters. A number of industry charters have been established and is recognised by the South African Department of Trade and Industry (DTI) namely the maritime transport and service industry, forwarding and clearing industry, mining, tourism industry, petroleum and liquid fuels industry and financial sector. The information communication and telecommunications (ICT) charter is still in draft format with many companies in the ICT industry already gearing themselves up to align themselves with this particular charter (DTI, 2005).

The investment holding company established out of its own accord an internal charter thereby creating its own internal monitoring mechanism, but more importantly the roadmap for the group in developing its overall BEE outlook. As part of this roadmap critical areas have been identified on which group companies needs to report on, namely:

- Ownership;
- Board and management representation;

- Human resources development (Employment Equity and skills development);
- Affirmative procurement and enterprise development; and
- Corporate social investment (CSI).

Each of the above areas has been allocated predefined targets that need to be achieved annually with a final target date for the year 2010. As with the financial reporting scenario information gathered for the BEE scorecard needs to flow up into the group structures in order for top management to monitor the overall progress of the group.

A major constraint is the lack of human resource systems from where the relevant information can be sourced. Currently all reports are done using a spreadsheet and mailed to the next level where some aggregation of information takes place.

From the results of the interview the following key areas for reporting have been identified:

- Internal charter scorecard components namely
    - Ownership;
    - Board and management representation;
    - Human resources development (Employment Equity and skills development);
    - Affirmative procurement and enterprise development; and
    - Corporate social investment (CSI).

  Clear guidelines are provided in the internal charter on the parameters for each of the components including the relevant definitions, indicators, weightings, conversion factors and targets. Definitions are based on definitions contained in existing legislation thereby ensuring consistency across not only the organisation but also the different industry sectors. The policy statements guide all group companies as to the specific targets to be achieved, as well as the method by which performance will be measured. The so-called red, amber, green (RAG) analysis is adopted as an internal early warning system for those whose performance will be judged, among other things, against the achievement of group targets. A standard reporting system has been developed and will be prescribed in order to facilitate uniform

reporting and evaluation at the different levels of companies including the Board of Directors.

- Government requirements specifically relating to the
    - Employment Equity Act, 55 of 1998;
    - Skills Development Act, 97 of 1998;
    - Preferential Procurement Framework Act, 5 of 2000;
    - Broad-based Black Economic Empowerment Act, 53 of 2003; and
    - Industry or transformation charters where applicable.

  A key theme across all the above listed acts is the ability to measure BEE initiatives and to be able to determine the progress made against objectives as determined by these acts or charters. The challenge therefore for any organisation is to be able to report on the requirements as outlined by the various acts. However, due to the uncertainty and lack of clear guidelines, especially the different requirements as outlined by the industry charters, the Department of Trade and Industry (DTI) recently published the Broad-based Black Economic Empowerment Act. This Act is largely designed to bring about consistency and equal measurement of BEE activities in South Africa and to integrate various elements of BEE in South Africa, while the BBBEE codes are meant to translate and implement the Act. The codes as outlined by the BBBEE Act ranges from the measurement of ownership, management control, employment equity, skills development, preferential/affirmative procurement, enterprise development and a residual component or corporate social investment.
- Human resources skills. Currently there is no overall human resources management system that spans the whole group. Some companies do have an internal system in place that combines many human resources functions, including benefits administration, payroll, recruiting and training, and performance analysis and review into one package. It would appear that a requirement exists for the group wide management of employees in terms of accessing skills and experience across the group. In discussions during interviews and project meeting the idea of being able to determine the skills level available within the group would be of benefit, especially when specialised skills are required for a specific project or initiative. A further benefit would be to utilise such a skills database to share information or knowledge and could be seen as a precursor of a knowledge base.

4.6.1.3 Supplier and customer information

As discussed in chapter two every organisation performs a number of activities in order to produce a product or render a service. The sum of these activities, together with a margin, has a value for the customer and is therefore referred to as a "value chain". As part of this value chain as proposed by Porter (See Figure 13 in section 2.5) and the relevant primary and secondary activities the beginning and end through procurement and sales respectively contributes to the functioning of the organisation. Without the procurement or purchasing of raw materials and other inputs used in value creating-activities the organisation is unlikely to exist. Similarly if there are no marketing and sales activities to get buyers to purchase the product or service the purpose of the organisation is questionable. It is therefore of key importance to be able to understand and manage the costs incurred during the procurement process and certainly the sales process as well. Primarily in order to identify the major contributors to the organisation through input or procurement and the customer who is ultimately the financial contributor to the existence of the organisation.

The key areas as identified by the interview are:

- Top supplier and top customers. Currently each company's top suppliers and customers are manually extracted from their underlying systems and published in a hardcopy report on a monthly basis. No standardisation of company names exist and details are overall inconsistent. Aggregation of figures is done manually at the higher reporting level. This manual process immediately creates a level of doubt and uncertainty as to the accuracy of figures and are usually a month old once it reaches the investment holding company. This makes it extremely difficult in obtaining a single view of the interaction the group has with a particular supplier or customer. Another key factor is that multiple companies with the group interact with the same supplier and or customer albeit at different levels. By supplying information on key contacts for account management would streamline the interaction with both supplier and customer.
- Products and services available. Being such a large conglomerate of companies the product and service range varies tremendously. Very often

companies would be unaware of what products and services are available within the group, needless to say the same would apply for customers. However, putting such a catalogue of products and services together is a daunting task as much of the products sold by the group are of a high technology type and subject to numerous changes and updates. The answer may lie in providing a high level overview of available product and service categories. A number of opportunities for cross-selling to customers exist provided sufficient knowledge exists about the group's product ranges.

4.6.1.4 Operational statistics

The requirements expressed for operational statistics was minimal, however from certain individuals point of view required to be reported on within their particular sub-holding company. Most of the areas identified are already in place and for the purposes of this research will not be addressed in further detail.

4.6.1.5 General requirements

As expected a number of additional items have been listed that does not necessarily fall into any of the above categories. Information required is of a general nature and revolves around communication and general knowledge sharing. For example a listing for group activities, projects, and address lists.

4.6.2 Information technology and infrastructure auditing

In addition to the above results obtained from the interview process that focused predominantly on the information requirements across the organisation, high level technical audits regarding the information technology infrastructure have also been completed. These audits focused on the following two aspects namely:

1. Accounting/Transactional systems, and
2. Connectivity.

4.6.2.1 Accounting and transactional systems

The accounting and transactional systems or a combination of both are considered to be one of the primary sources of information within each company. However, there is no single accounting or transactional system in place catering for the whole group. Instead each company within the group has its own accounting or transactional system in place. This is mainly due to the autonomous nature of the group and a long history of acquisitions. Some of the many challenges created through this variety of systems are the availability of information in specific formats, standardisation of definitions of information and legacy systems that do not allow for the easy extraction of information.

Summary of findings:

1. There is a variety of accounting systems in place, ranging from purely financially focused to more complex enterprise resource planning systems. Systems listed include Accpacc, Brilliant Accounting, Fourgen, Great Plains, Mapics, MFG Pro, Oracle, Pastel, Profitability, Sage, SAP/R3, Scala and Syspro.
2. The system operating system varies from Microsoft Windows 2000 to some Unix varieties including Linux.
3. Databases on which the primary application is run varies from Microsoft SQL, Oracle, DB and some proprietary databases. However, all have the ability to extract data in a usable format such as comma separated values (CSV), or ASCII.
4. There is a lack of consistency across systems in information definitions and descriptions. Most companies have made up their own definitions of data, but where possible have based these on definitions as publish by the Department of Trade and Industry, specifically for BEE definitions.
5. Under general comments regarding the company's IT system the following remarks have been made:
    - Companies with complex systems, such as SAP R/3 or Oracle 11i would typically have an overabundance of information available that could be utilised at operational level. However, the opposite also holds true for smaller companies where the business processes may not be as complex and therefore would not have information sets available.

- A lack of integration between certain modules within some systems also creates a duplication of information sets.
- The general availability of information is problematic in that some companies may have difficulty in making information available due to the fact that it is not currently available or not being catered for.
- The diversity of information sources within companies creates islands of information. Some information is kept within the primary transactional system of the company, whilst portions of the information are kept separately in other applications such as Microsoft Excel or proprietary reporting applications.

It is clear that although information applications or resources can be easily identified within a company, the actual data contained within the systems are not consistently defined and managed across the whole group. This can be primarily ascribed to the autonomous nature of the group and the lack of a common system across companies.

The only commonality that is available across the group is a standardised set of chart of accounts (COA) utilised by the investment holding company. Although a COA has been in place for some time this exercise presented an opportunity to identify potential shortcomings and enhancements to the existing COA.

It was clear that from the financial information requests that there are definite shortcomings, especially within areas where subsets of information is required, for example the cost of travelling broken up into local and overseas, flights, accommodation, car rental and so forth. Currently only a single line item for travel exists. These items are typically reported outside of the current financial consolidated reporting and take a considerable amount of time to extract and normalise before any level of consolidation can be done.

The COA allows for companies to map their internal set of accounts or general ledger extracts to the common COA through a mapping exercise. This allows for the standardisation of internal, diverse sets of information to conform to a standard set of definitions across the group.

Please note that the purpose of this study is not to detail the process of financial consolidation, but to point out in this particular case the use of the financial consolidation process as a key source of information within this specific organisation. The primary driver for information flow within this group has been financially focused, however as evident from the interview process other key areas of information that is required within the group also needs to be addressed.

4.6.2.2 Connectivity

Each company within the group has access to the group's intranet. Access gained to the intranet web site is via the Internet using secure protocols to ensure that information accessed remains within the group and does not become available to the general public. This common access structure provided the ideal opportunity for this project to leverage off the existing connectivity infrastructure available.

- All companies have access to the Internet.
- All companies have secure access to the group's intranet.
- Connectivity ranges between 64Kb to 256Kb from the company to the Internet service provider (ISP)
- A variety of ISPs are used to procure Internet related services from.
- The majority of companies make use of the same ISP.
- Relevant security protocols and measures are in place to protect companies from unauthorised access from the public Internet.
- A variety of access mechanisms exist that will allow for users to access the Internet and intranet for example, fixed line, dial-up, 3G, etc.
- There are common facilities available at the ISP being used by the majority of companies for hosting of web sites and applications.

In summary the IT and infrastructure audits highlighted a number of challenges to ensure that there is an appropriate technology backbone across the organisation that will support the delivery of information across to the relevant audience in the group. However, it also pointed out some areas that could be further exploited to the advantage of this project. For example the fact that there is already a common point of entry into the group's information technology infrastructure, i.e. the intranet, has

presented itself as the logical area where the information technology infrastructure will be hosted.

4.7 Recommendations

The above exercise of interviewing key decision makers within the group and allowing to express their requirements has confirmed for the project team the requirements of a group wide information architecture. Although it has been generally accepted that the primary driver of this exercise has been to replace the existing financial consolidation system, a number of additional key information reporting aspects have also been raised.

In order to address these particular requirements the following areas as basis for a group wide information architecture has been put forward, based on the requirements reported on during this project as well as taking into consideration the existing infrastructures and organisational environment into consideration.

4.7.1 Technical issues

Information sources in the group are generally diverse and dispersed. The wide range of legacy, non-integrated systems at operational level, presents a significant challenge to any potential technical solution.

4.7.1.1 Distributed versus centralised

It is clear from the existing distributed and disconnected architecture that a tremendous amount of value is lost in terms of providing the ability to do group-wide scenario planning and trend analysis. It is impossible to do drill-down and investigation of existing consolidated reports down to areas of greater detail in order to identify potential problem areas.

Making use of a centralised area where companies can upload data to which is based on a standardised and defined set of data definitions can add considerable value to the group.

4.7.1.2 Local organisations' information systems

The investigation on the existing systems with the group revealed a diversity of systems both accounting and transactional that are in place, each with its own configuration and ability to manage data and information. Considerable investment has already gone into the establishment and maintenance of these systems. It would therefore be unreasonable and unwise to change the system for the sake of having particular data or information for the investment holding company. It was therefore agreed that the underlying systems should remain as they are except in the case where critical information needed by the investment company could not be produced. In this case the company should investigate the possibility of integrating the required information into the existing system before any further considerations should be taken in terms of replacing the overall system.

4.7.1.3 Data definitions

Although the effect of data definitions and the standardisation of data sources from the financial information domain have been largely taken care of by using a single chart of accounts for the whole group, some new areas within the BEE information domain need to be catered for.

Before the proclamation of the Employment Equity Act in 1998, there was no particular need for companies to report on BEE transformation. However, with the proclamation of this act and the publication of various transformation charters it has become a key requirement. Initially some definitions have been provided by the Department of Trade and Industry, Department of Labour and the industry charters, but there was still confusion on the majority of definitions, especially in the area of affirmative procurement.

Overall the group has adopted its own internal charter and uses the definitions as outlined within this charter to clear any confusion that may exist on definitions related to BEE or transformation reporting. It is anticipated that the BBBEE Codes will further clarify the relevant requirements.

4.7.2 Information architecture

A relatively easy option to address some of the concerns in terms of data consistency and data visibility would have been to replace the existing transactional and accounting system with one single instance across all companies within the group. However, the investment holding company's strategy of mergers and acquisitions and local operating autonomy would render this approach of "one size fits all" uneconomic. The cost of implementing a global ERP system would be astronomical and take many years to complete and in all likelihood fail in keeping pace with new acquisitions or mergers. In addition, local companies would find a global application unsuited to their scale or business model.

The project team has decided that the most practical and less intrusive approach would be to have a single centralised application that would not interfere with the day to day transactional and accounting processes of each company within the group.

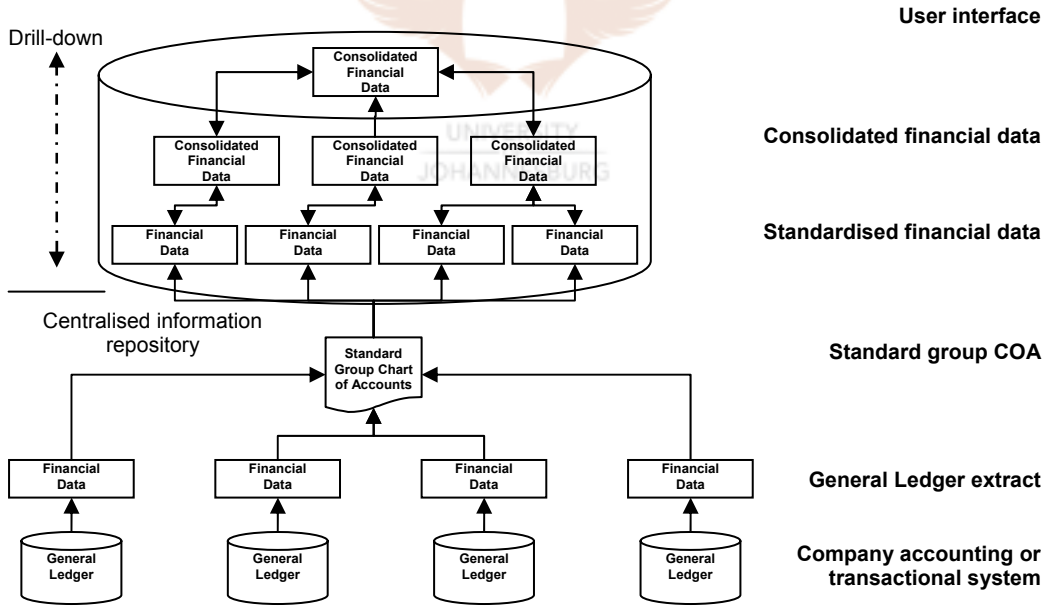


Figure 31: Centralised financial information repository.

Figure 31 illustrates the proposed information architecture in order to address the requirements as set out in the interview process for financial consolidation, the technical infrastructure audits as well as addressing issues relating to data definitions

and the availability of information. This particular diagram focuses specifically on the financial consolidation process and illustrates the extraction of month end data from the general ledger located within the accounting or transactional system of the company. Mapping of the extracted data is done through a single standardised COA managed and maintained centrally by the investment holding company's requirements. All data would then be uploaded into a single database in which the detailed process of financial consolidation will take place as per the reporting structure of the group.

Having all the data in one central repository will allow for additional features such as the ability to do drill down from the top into more detailed information or data sets. For the purposes of this exercise a decision was made not to allow for drill down beyond the central information repository. In other words, the ability to drill down into more detailed sets of information will be limited to what is available within the central information repository. This is sufficient for the requirements of the investment holding company as it does not require and is against the nature of the group to micro-manage the day-to-day operations of the individual group companies. This is the task of operational management.

4.7.3 Data requirements and standardisation

With the above viewpoint in mind and with the restriction of not allowing for drill-down into the operational company's systems the detail of data and information required from group companies have also been limited to only what is required at the higher reporting levels, in other words the sub-holding and holding company levels. Investigations into the detailed data available within companies have revealed a plethora of definitions and descriptions of entries. Although a level of standardisation exists within the operating company, the same level of definitions or descriptions are not necessarily applicable across the whole group. As with the notion of implementing a single instance of an accounting system attempting to embark on a group wide data standardisation exercise would be impractical and uneconomic.

With the relative standard of financial information already established and managed through the COA, the "newly" required information sets, especially BEE related does present an opportunity for standardisation across the group.

4.8 A scaleable information architecture

Utilising the same information architecture approach as proposed for the financial information consolidation process, other information requirements can be addressed and provide the investment holding company a more effective way of exposing the group's underlying information assets.

The proposed architecture as illustrated in Figure 31 will provide for a framework that addresses the information requirements as expressed within the interviews and other requirements related to the infrastructure and data aspects.

Taking a bottom up view of the information architecture the following key decisions have been made that will form the basis of the project's deliverables (See Figure 32):

- Existing information systems remain as is - the various information systems within each operating company of the group, continues to be the primary information source. No replacement of existing systems will be required upfront. Should any systems not be able to deliver the required information as required by the investment holding company the possible replacement or upgrade of the legacy system will be evaluated on its merits.
- Additional information sources other than pure financial needs to be provided – as clearly highlighted within the overall requirements for the group, information regarding BEE would need to be reported on. However, the uncertainty if there is existing information sources specifically geared to deliver the required information comes into question. Some companies already have human resources management system in place in which most of the information is captured, but conversely some smaller organisations may not have the information readily available. Typically this information would reside in a spreadsheet or even in a rudimentary document. Furthermore, no direct integration will take place between the centralised information repository and the underlying source systems for the time being. This could become an option but due to the fact that the information will only be uploaded once a month this is not yet required.
- Standard definitions for data will be defined by the investment holding company – using standard definitions to which companies can map their

extracts to provide a more cost effective way for companies to standardise their own internal data to that of the group. The COA already provides a complex structure of data definitions for the financial data and with some enhancement and changes will be continued to be utilised. With the other information requirements a separate definition list will be used specifically for the information required based on already publicly published standards. No company should be allowed to create their own definitions of certain data sets.

- A single information repository will be created for the entire group's information requirements – this statement implies a single database where all the information required by the investment holding company will be uploaded to. This in itself will be a major change in the current information consolidation process in the group. The risk of losing information within the consolidation context as it is currently done is by far greater than having it centrally available. The source data will be available from the beginning within the database. This has far reaching implications for the management and interrogation of the available data. The ability to do drill-down, trend analysis based on historical data and other analytical exercises are now a reality.

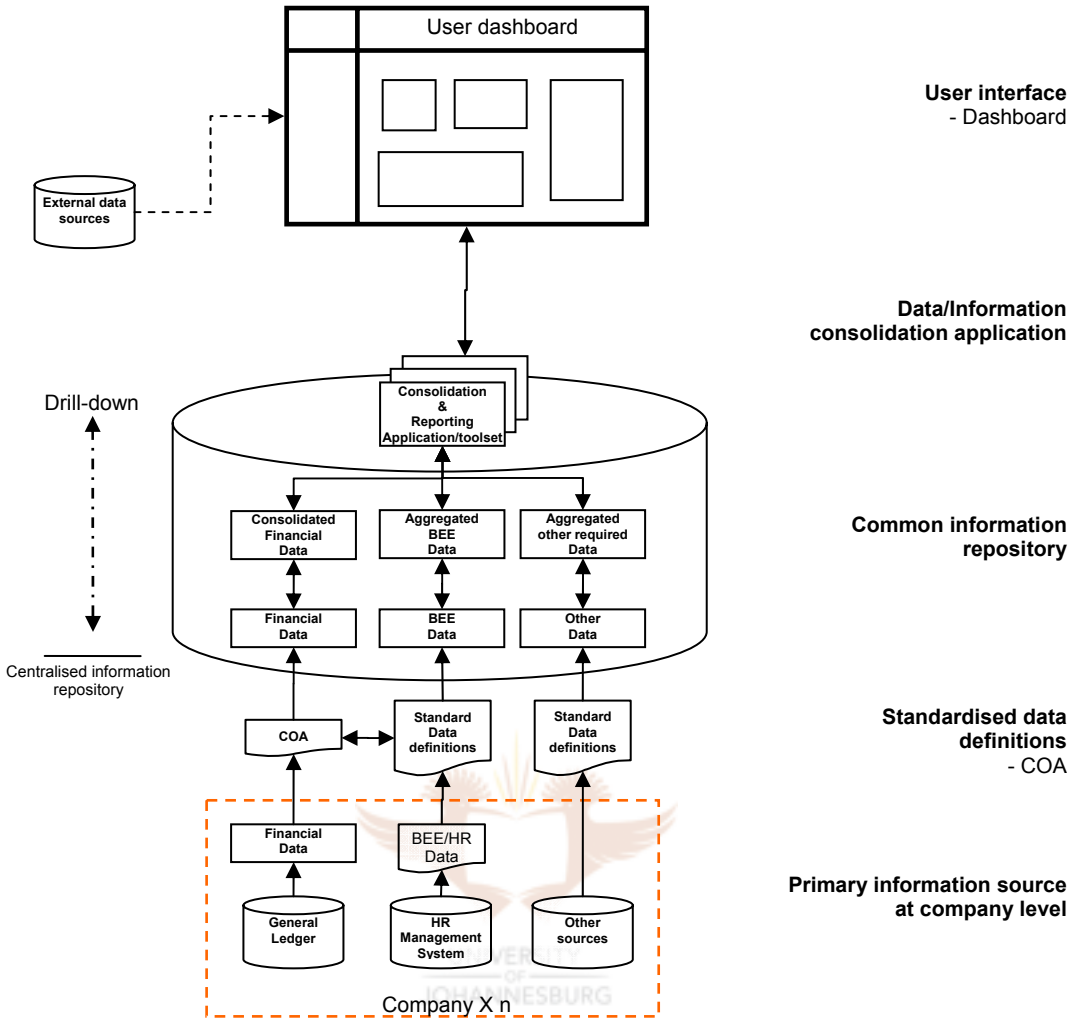


Figure 32: A scaleable information architecture.

- A single user interface or dashboard will present the relevant information to the end user – as discussed in paragraph 4.6.1.1 the dashboard provides a single view of key business information components to the user. Drawing from a number of information sources on various platforms the dashboard provides the user an intuitive graphical interface where critical information can be monitored.

4.9 Conclusion

The existing information reporting process and information flow within the organisational architecture provided management most of the relevant information required for strategic decision making. From the interview process it was clear that the requirements are driven by what is currently in place and what enhancements should be added to the existing information architecture of the group. By taking these requirements into account a scalable information architecture has been proposed that takes into consideration not only the requirements, but also key aspects such as the status quo of the underlying information systems, data and infrastructure.

In order to implement this information architecture it is necessary to adhere to a number of enabling and empowering principles. These principles must spell out the parameters and requirements in order to ensure that the architecture does not become too fragmented. The principles listed below have been applied to this particular project and is a culmination of the aspects addressed during the research process.

1. Information is a strategic and valuable resource – it is vital that the organisation consciously decides at the highest level how important information is and the value it contributes to the strategic decision process.
2. The investment holding company and sub-holding companies have the right to request certain information – recognition must be given the fact that information within the organisation are not only used by the owner of such information but is also required by other stakeholders. It is therefore a fair expectation that such stakeholders have the right to request information from its investments. However this should be done within an agreed framework;
    - Information requested must consist of the specified minimum information content as required by legislation and identified and agreed as valid business requirements.
    - Information must be supplied with audit trails to the lowest level to enable the requestor to verify the source and integrity of the information.

3. Cost benefit of information requirement at investment holding company to be established before allowing right of request – the right of request for information must be properly balanced by the input from the owners regarding the cost of producing or extracting the information requested from source systems. If there is little or no future value in the information requested it should not be done for the sake of reporting.
4. Information collection will follow a push and not a pull approach – as a result of a number of factors including the decentralised and autonomous nature of the group and the principle agreed on information ownership, an approach of the information owners uploading the information into a centralised repository will be followed. Thus placing the onus on the information owners and underlying companies to ensure the integrity of information supplied.
5. All information requested must have an electronic source – the impact on the integrity, accuracy, completeness and the ability to further manipulate through drill downs are of critical importance.
6. A pragmatic process will only be possible through the establishment of a centralised unit to manage the process – a centralised unit will provide the necessary guidance in terms of providing access to established definitions as they should be applied across the group. Furthermore, to ensure that companies can transact with the centralised infrastructure using the necessary information technology infrastructures.

Chapter five: Conclusion

5.1 Introduction

Organisations are exposed to a vast array of information in a huge variety of delivery mechanisms. Information managers have a major role in making information available to users within organisations. They need to take control of the management, organisation, filtering and preservation of this great amorphous mass of information. To paraphrase S.R. Ranganathan librarians or more specifically information managers need to build structures which will deliver the right information to the right user at the right time (Law, 2000:329; Steckel, 2002).

Information architecture is a term that is applied to the structure and organisation of information and is therefore a key part of the information management process. Evernden and Evernden (2003:17) states that information architecture is necessary when organisations are large and complex, change if constant and far-reaching, there are huge opportunities for economies of scale and a high degree of coordination and collaboration necessary. Information architecture handles a diverse range of information management problems that organisations are faced with today. This research study addresses the definition of information in its most basic form and the leading up to information architecture as a way of designing information environments for organisations.

Technologies brought on by the Internet and specifically the world-wide web has revolutionised the way in which organisations manage and access information. Standardised and open protocols that evolved out of the evolution of the Internet provide for both hardware and software interoperability. The Internet and ultimately the Web has been responsible for a number of enabling technologies that have allowed for the integration of what has been previously considered separate applications. The ability of these integrated applications to instantaneously deliver information directly to the end-user by means of a graphical user interface, poses a number of challenges to the information manager. As access to information becomes a critical catalyst in organisation's way of conducting business the information manager needs to take into consideration the potential effect that information

architecture has on his/her role as information manager and ultimately how this affects the implementation of the organisation's information strategy.

It has not only been the Internet that has developed and had a major influence on how organisations deliver and access information, but a number of events in recent history have added to this evolution of information access and regulation.

The demise of some large corporations in the US, point events such as September 11 and new legislation related to information compliance and access in various parts of the world have all had an impact on how organisations build structures for information management.

The application of technology in order to assist organisations to manage the information lifecycle from its inception, usage and ultimately archiving or destruction needs to take place in an integrated fashion in order to ensure that the maximum usage is obtained from the information assets. However, this can only take place if an organisation has an information policy in place, stipulating how information is gathered, accumulated and ultimately managed.

The underlying information architecture plays an important supporting role in how this information policy and strategy is sustained. The information architecture involves the logical design for a specific application system or set of systems. This involves business models, organisational models, process models or data models. Through this process the organisation can ensure that the relevant systems are put into place to support the information strategy that is maintainable and sufficiently responsive to support the organisation's information requirements.

In order to determine how an organisation's information requirements can be supported by the underlying information architecture this research addressed the following aspects by means of an extensive literature study and a case study example:

1. Defining the concept of "information" and how this relates to information policy and strategy.
2. The positioning of the concept of "information architecture" and how this interacts with the organisation's information and business strategies.

3. Finally, a case study is put forward where all relevant concepts as discussed within the literature study is applied to a real-life scenario and delivered through an information architecture.

Therefore, the aim of this study was to develop a scaleable information architecture for an enterprise wide consolidated information management platform. In order to develop this information architecture it was necessary to look at some of the basic concepts in information management to fully understand the basic concepts that needed to be addressed.

5.2 Information policy and strategy

By defining and putting into perspective the concept of "information" and the need for a relevant information strategy the basic foundation for information management for the organisation is defined. A detailed overview of the concept of "information" reveals a long history and various definitions of the terms "information" as found in literature.

However what is important is the fact that information according to Burk and Horton (1988:239) is defined as:

- that which informs or has the potential to inform;
- meaning communicated or received; and
- a combination of content or meaning represented by symbols, and media or conduit, used or useable in a particular context. Use of the expression "information" itself makes the content or meaning component of information explicit.

The concept of information is extremely difficult to define, since over the years a wide variety of meanings have been ascribed to it and arguably the most over-used, and misunderstood term of present time. For the purposes of this study the term "information" has been defined as data that has been processed and arranged within a given context to provide a specific solution to a pre-defined problem that could in essence affect knowledge by adding to it or reform it. In short, information is meaning extracted from data within a given context.

Orna (1993:196) defines information in organisational terms:
"*Whatever the organisation needs to feed its knowledge of its own business so that it can meet its objectives successfully*."

This definition implies that if the organisation wants to have a well-built knowledge base that will enable the organisation to act successfully the following questions would need to be asked and answered:

- What are we trying to do?

Then a series of parallel questions:

- What do we need to know in order to do it?
- Who needs to know about it?
- What information do we need to support the knowledge?
- What do we need to do with the information in order to achieve what we are trying to do?
- Who needs to do it, and how?
- What do we actually know?
- Who actually knows it?
- What information do we actually have?
- What are we actually doing with the information we have?
- Who is doing it and how are they doing it?

In order for the organisation to interpret the answers and make decisions on them, Orna (1993:196) goes further to state that the organisation first needs to understand:

- The organisational objectives and what their implications are related to the information required and what the organisation needs to do with it, and
- The organisational culture and the information politics that flows from it.

For an organisation to determine the answers to the above questions the organisation needs to consider doing an analysis of the information resources within the organisation, where are they located, who has access to it and how is it being utilised. This is where techniques for an information audit come into play.

The information audit is a process for discovering, monitoring and evaluating an organisation's information flows and resources in order to implement, maintain or

improve the organisation's management of information. The information audit can be further defined as a fact-finding, analysis, interpretation and reporting activity that studies the information policies, structure, flow and practice of an organisation. The aim of the audit includes the collection of data concerning the efficiency, credibility and economy of the organisation's information handling activities and practices; the provision of adequate policies, which oversee these activities, and practices and the development of recommendations for action tailored to the organisation's specific situation.

There are no single accepted information auditing methodology supported by statute, standard or professional body. Several methodologies are available many of which are characterised by a very definite purpose and scope, which makes widespread implementation difficult. The overriding consideration that will determine the selected methodology is the intended purpose of the information audit.

For purposes of this research the methodologies of Burk and Horton (InfoMap), Orna (Information flow analysis) and Buchanan and Gibb's integrated approach are discussed. It is evident that no single methodology can provide a complete information audit solution. The purpose and scope of the information audit must be clearly defined and only then, can the most applicable methodology be selected, developed and applied. The information audit is seen as a systematic process through which an organisation can understand its knowledge and information needs, what it knows, how information flows within the organisation and where information gaps may reside. The information audit reviews what information is created and needed across the organisation. It will raise the awareness across the organisation of the value of information and the value of sharing information. The result from an information audit is an 'information map', which can be used as the basis for designing the content of intranets, the foundation of an information strategy or even a knowledge management strategy.

The information strategy focuses on the information requirements of the organisation and the methods by which those information requirements are met. The information strategy is regarded as the detailed expression of the information policy as it relates to objectives, targets and actions to achieve the targets, for a predefined period. The information strategy provides the necessary framework for the management of

information; it is contained within the framework of an organisational information policy and supported by appropriate systems and technology.

The alignment of the organisation's business and information strategies is critical for the success of the organisation. Different processes or levels within the organisation depend on the effective flow of information between them. The information strategy is considered as the detailed expression of the information policy as it relates to objectives, targets and actions to achieve these targets for a predefined period. The information strategy provides the framework for the management of information within the organisation.

5.3 Information architecture

When constructing a building the builder does not simply start building at the building site without having a building plan that shows how the building will be constructed and out of what material. The architectural blue print defines the dimensions, number of rooms, the building material, standards to be adhered to and so on.

As discussed in detail in chapter three, architecture also applies to information. Information architecture is the term that is applied to the structure and organisation of information and forms a key part in managing information within the organisation. Information architecture incorporates a variety of techniques drawn from a diversity of disciplines such as information science, artificial intelligence, linguistics, management theory, knowledge management, programming and object orientated technologies. Information architecture is the term that is applied to the structure and organisation of information and forms a key part in managing information within the organisation.

Information architecture in an organisation must accommodate diversity in design and semantics in different protocols or business processes. Information architecture creates the logical design specifications for an application or set of systems. It may involve business models, organisational models, object models, process models or data models.

The information manager requires a number of tools in order to define and implement and information strategy. A popular approach is to map dynamic information processes and information flows within the organisation. The information auditing process is the key building block for the information architect. The information audit provides a baseline for the existing external and internal content and associated technologies such as search, categorisation, taxonomy, document management systems, content management systems, portals, data warehouses, business intelligence systems, financial systems, and so on.

In order for the information architect to have a full understanding of how information is utilised within the organisation and importantly to highlight the interrelationships with information use, the environment, the business process and applications, a detailed information audit is required. Only through this can the information architect provide the detailed high level plan or blue print of information within the organisation. The information audit is thus a key requirement for developing the information architecture of any organisation and assists in understanding and achieving organisational wide information integration.

Information audits or models help organisations deal with aspects such as information overload and allow the increasing volumes of information to be disseminated, digested and managed effectively. The model enables the organisation to understand how information is used and by whom, it pinpoints the key stakeholder for various information types, as well as the different touch points of information as it moves through the organisation and it helps to focus on areas where the highest potential or most opportunities exist.

The approach proposed by Fisher (2004:7) to develop an information model in order to assist the information architect as part of the organisation's information architecture is discussed in further detail and the similarities to some of the information auditing methodologies discussed in chapter two are very noticeable. The development of an information model as part of the information architecture process consists of:

1. Defining the objectives of the exercise to ensure a practical approach that recognizes the richness and ambiguity of managerial information, and also

ensures senior management support by refining governance mechanisms and clarifying the value of information for the organisation.

2. Identifying the information domains that exist within the organisation and refers to the information sources created, managed or used in specific groups and departments. Compiling a high-level map of the information domains that can be used to identify areas where the organisation can gain the greatest benefit from rationalisation and integration of information resources spread across the organisation.
3. The goal of the discovery step is to gather information regarding the *status quo* or 'as-is' view of the current information model. The discovery process involves the collection and documentation of facts and details about information structures and process and results in the creation of an information sources catalogue.
4. The analysis step provides the 'as-is' view of the information model from the information details gathered during the discovery process. This step highlights areas of improvement and serves as input into the design of the future information model of the organisation.
5. The result of the design step is the 'to-be' view that forms the blueprint for the future information management process within the organisation. This step sets the standards that will be followed in the rationalisation of existing information sources and for any new sources brought into the fold of the organisation. This step is a culmination of the previous four steps.
6. After the 'to be' information model has been defined a programme to implement of the model should be initiated.

Information modelling is a key success factor in an information management system and provides the building blocks for the information architecture of the organisation. Information modelling must consider content and not exclusively focus on the medium in which information is contained and distributed throughout the organisation alone.

It is evident from this chapter that the role of the information architect or the discipline of information architecture is extremely important in the design of purposeful information environments. The importance of information architecture is further highlighted through the value that it contributes to the organisation in

ensuring that information is effectively managed as a resource and through architecture provides to the organisation the necessary blue print or design document in the information life-cycle within the organisation. Organisations need to understand the key information flows, the information artefacts and environmental impact of external resources in order to adapt and assist in rapid decision making and information sharing across the different information domains.

For the information architect to have a full understanding of how information is utilised within the organisation it is important to understand the interrelationships with information use, the environment, the business processes and applications within the organisation. Defining the information model for the organisation provides a high level logical representation of all the key information elements that are used in the organisation as well as the different relationships between them.

Ultimately it is the visual representation of the organisation's information model that illustrates the processes and interaction of information. This presentation takes place through the visualisation of the organisation's information architecture and visualisation techniques can be a valuable tool in the effective management of the information life cycle. It will clearly describe the interaction between different architecture domains ranging from business, organisational to the technical network infrastructure.

5.4 Information architecture application – case study

The case study as research method is used to investigate the information architecture design and implementation within a large investment holding company consisting out of a number of operating companies. The company required an information consolidation system that would provide for a more flexible and stable information collection, consolidation and distribution solution. The existing system has become inflexible and only focused on the financial information requirements of the company. The holding company also has a number of sub-holding companies and in turn there exist a number of operational companies that make up the greater group.

As an investment holding company the continuous monitoring of the company's underlying investments is critical to ensure the maximising of the investment and to ensure value is delivered to the company's shareholders. Information is critical to ensure that management can make strategic decisions based on accurate information as it is made available from the underlying operations. This case study focuses on the top down view of information architecture within the group's structures as well as the bottom-up flow of information to the higher levels in the group's structures.

Driven by a number of objectives a formal project was embarked on to put into place the necessary information architecture that will cater for:

- Increasing information requirements tied to the growth and expansion of the group,
- Increase in complexity of reporting requirements as stipulated by the Johannesburg Stock Exchange (JSE Limited), General Accepted Accounting Practices (GAAP), International Financial Reporting Standards (IFRS) and other financial parameters,
- Assist in collecting regulatory and statutory information across the group,
- Reporting on non-financial information, especially regarding Black Economic Empowerment as required by legislation, and
- Ad hoc reporting and obtaining additional information across the group that is generally time consuming, inefficient and frustrating to all.

Due to the intricacies and diverse nature of the group in terms of the various environmental influences, regarding technology, market pressures, other legislative factors and strong autonomy of operating companies a process of interviewing various role-players was followed. The basis of the information audit as detailed in chapter two as well as aspects of information architecture and the information model as discussed in chapter three was used for the interview process. Not one single author's specific methodology was used as an exclusive approach.

Key executives who are considered influential in the overall management and strategy of the group were interviewed. The interviews primarily focused on high level information needs with specific reference to information required by the participant to be able to manage his/her operations or decision process on a day-to-

day basis. Each interviewee was given the freedom to list the items he/she was most concerned with and requested to rank their requirements based on a specific set of criteria.

A number of shortcomings have been pointed out by the interviewees and directly related to the existing mechanisms of information delivery within the group. These pointed to:

- The existing system's inflexibility,
- Inconsistency of data definitions and availability of data required,
- General concerns regarding the integrity, completeness and usefulness of information, and
- The unstructured nature of *ad hoc* reporting.

The results of the interview have been grouped into three key areas namely (two other areas have also been identified but considered as a low priority);

1. Financial consolidation and reporting – three key enhancement requirements were highlighted that will improve the usage of information presented by the system. These included the ability to drill down into underlying data, to be able to do trend analysis and the presentation of information in a graphical user interface or dashboard.
2. Black Economic Empowerment (BEE) and Human resources (HR) information – identified as the second largest need, predominantly due to regulatory requirements. Currently no formal application or system exist whereby underlying companies report into a single report the status of BEE within that particular company. An internal charter has guided companies on what to report on and how the data definitions should be applied. However, the challenge remains for companies to report on the various requirements as outlined by a broad spectrum of acts and industry charters.
3. Supplier and customer information is seen as a key reporting area to ensure that the relationships with both suppliers and customers are managed. Again as with BEE reporting no formal application exists that will assist management in building an accurate picture of how the relationship with both supplier and customer is managed from a group point of view.

In terms of the information technology landscape the questionnaire focussed on the underlying accounting and transaction systems and the interconnectivity of the companies. As there is no direct integration between underlying systems and networks this had to be taken into consideration for the design of the information architecture.

The only commonality that is available across the group is a standardised set of chart of accounts (COA) utilised by the investment holding company. The COA allows for companies to map their internal set of accounts or general ledger extracts to the common COA through a mapping exercise. This allows for the standardisation of internal, diverse sets of information to conform to a standard set of definitions across the group.

From the results a centralised information architecture has been put forward that can exist within a decentralised information technology environment. The implementation and management of this information architecture is however subject to a number of principles to ensure the successful utilisation thereof and addressing the current and future needs of the investment holding company.

5.5 Future research

This research only highlighted one aspect of information architecture within the organisation. As with a typical architectural plan the opportunities exist to expand on the existing plans and the following items are just some potential subjects for future research:

- Leveraging the organisation's investment in legacy systems through service orientated architecture (SOA) can improve maintainability, costs and increase productivity. The key behind any modernisation strategy is to extend the mainframe data and applications, however in order to understand the impact on the organisation the field of information architecture can assist in order to ensure that the business process knowledge embedded in the legacy systems work with the new or requirements of the organisation.

- Upcoming technological innovations will change how people and organisations interact with and share information. The main drivers are standards for improved interoperability, improved understanding of the information supply chain and increased mobility and wider connectivity. Developing an agile information architecture to allow for the interoperability for these types of technologies will be key.
- Topical technologies or trends such as BI (business intelligence) and CPM (Corporate performance management) are prime candidates for further research into information architectures as information architecture forms the basis of these technologies. Various areas of research exist within the field of information science, from the design of these systems to the delivery of information, collaboration, intranets, content management, knowledge management platforms, workflow and information rights management.
- The use of visualisation techniques and toolsets in conjunction with information science principles as opposed to traditional information systems methodologies. Toolsets such as Archimate, discussed in some detail in chapter three, is a good beginning in standardising the visualisation of the interaction of data, information and systems, but lacks some aspects of information science that can be brought into the toolset.
- With regulation and compliance becoming major parts of governance around the globe, the use of information architecture can be of great benefit to organisations to map out and understand the information interaction within the organisation and assist in adhering and fulfilling compliance requirements.

Information architecture provides a blueprint for any organisation and describes in visual terms the interaction between the various information resources it has within its boundaries as well as with external sources. It helps everyone within the organisation to make efficient, effective, productive and innovative use of information resources available within the organisation.

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