CHAPTER 1 - INTRODUCTION

1.1 INTRODUCTION

> *Man is not threatened by cold and wild animals; he is threatened by exploding complexity* (Beer, 1975:26).

Enterprise architecture (EA) is *the continuous practice of describing the essential elements of a socio-technical organisation, their relationships to each other and to the environment, in order to understand complexity and manage change* (EARF, 2009). This thesis presents a work-level acceptance framework for enterprise architecture (WoLAF for EA) for management of enterprise architecture acceptance. WoLAF for EA is the result of research where the focus was on human factors impacting on acceptance of EA as an enterprise-wide strategy. According to Zachman (2008b), EA is the foundation and key strategy to manage complexity and change in an enterprise in the information age. Enterprise architecture frameworks are used to describe the existence and complex interaction of all the building blocks, components and processes of an enterprise.

Information systems (IS) is the field concerned with information, human involvement and technology in enterprises. In this thesis EA is considered from the perspective of the IS practitioner. EA is used to describe an enterprise in its totality. The process of adopting, accepting, creating and implementing EA is far from trivial, as has been indicated by many case studies in different types of organisations (Ross *et al.*, 2006).

Giachetty (2010:4) defines an enterprise as *a complex, socio-technical system that comprises interdependent resources of people, information, and technology that must interact with each other and their environment in support of a common mission.* A socio-technical system is described by authors from an organisation-as-a-social-system viewpoint where the use and usefulness of technology impact on people in the social environment of the system (Emery & Trist, 1960; Ropohl, 1999). An enterprise consists of numerous interrelated building blocks and processes. The building blocks of an enterprise are described in context and include the definition of the enterprise, its environment, scope, goals, systems, culture, humans, processes and technology (Nadler & Tushman, 1989:194; Nadler & Tushman, 1997). An enterprise is dynamic and needs a strong foundation in a modern, competitive era where change happens frequently (Ross *et al.*, 2006).

For many years, the focus of how to run organisations as enterprises successfully was on business principles, business management and execution of processes (DeLone & McLean, 1992:60; Nadler & Tushman, 1997; Sabherwal *et al.*, 2006:1849; Venkatesh *et al.*, 2003:425). Organisations as enterprises often invest significantly in human capital to successfully manage their business processes. Although none of this has changed and the role of humans in organisations is acknowledged in EA frameworks, human factors affecting the acceptance of EA have not been described explicitly (Perks & Beveridge, 2003).

Traditionally, information technology (IT) system development and maintenance were conceptualised as separate from business issues. IT specialists were consulted when business and information problems called for a technology solution. Vendors provided technology solutions or IT systems were designed and built by local technical teams. For example, as illustrated in Figure 1.1 a department or a section would have a

problem and would request an IT solution from the IT department. The IT department that was a separate entity would then provide a single solution for the problem.

Figure 1.1: Traditional relationship between 'business' and IT

Today technology is regarded as an infiltrated core and basis for the business of any organisations. The broad, complex enterprise cannot function successfully without good integration and alignment of business vision, information management (IM) and technology support – all of it human driven. As illustrated in Figure 1.2 the IT functionality becomes a core part of the organisation and is not separate from the business of the organisation as previously was the case. Introducing something new in such an integrated environment creates different challenges, especially related to acceptance by users of a new artefact, system or strategy.

Blanckenberg (2009:11) argues that people accept that knowledge of technology products (*what*) makes its use obvious but states that the argument should be extended to asking: *who* is using the technology, for what purpose (*why*) and to the benefit of *whom*. It is against this background that my research intents to identify, analyse and describe human factors affecting EA acceptance in organisations.

1.2 BACKGROUND

Although EA has been used by organisations for many years, there is still debate on a general definition of EA and no mutual agreement about and understanding of concepts used in the field of EA (Kappelman, 2010). The following are the key concepts related to EA, as used in this thesis:

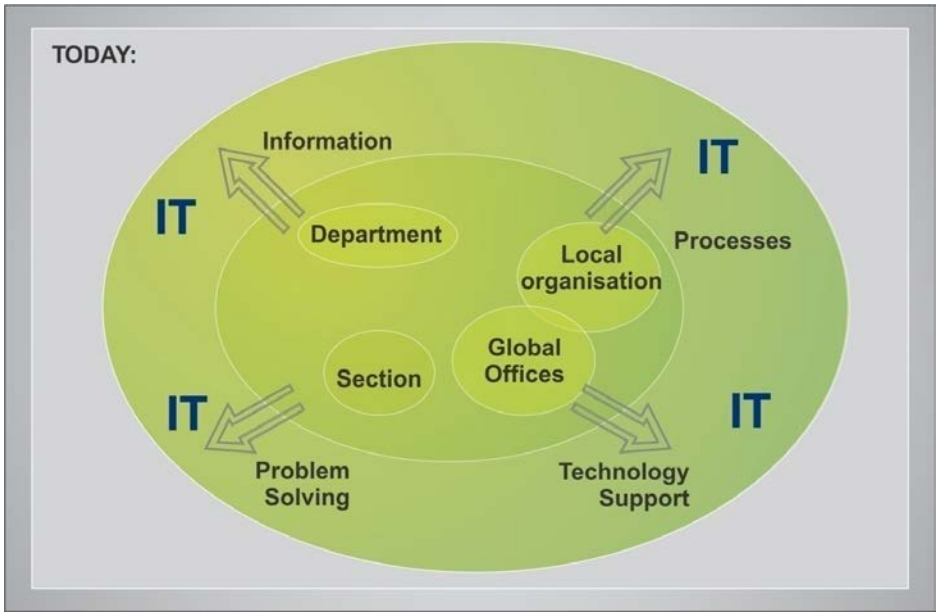


Figure 1.2: The integrated 'business' and IT environment of today

- *Organisations* in the twenty-first century are described as complex networks of joined entities, making use of available resources, having objectives of success and competitive advantage in context of their business (Nadler & Tushman, 1989:194). An *enterprise* is any collection of organisations that has a common set of goals and is described as a socio-technical organisation (Checkland & Holwell, 1998:81; TOGAF, 2009:5). Enterprises and organisations will be discussed in more detail in Section 3.2.
- *Enterprise architecture* addresses and describes this complex network of joined entities and continuously strives to manage change through descriptive representation of resources in a structured way. The EARF definition of EA first states that EA is the description of all the essential elements of a socio-technical organisational environment and their relationships to each other and then emphasises the importance of EA in the understanding and management of complexity and change in organisations (EARF, 2009). EA assists in the description of organisational elements to address the needs of stakeholders and users and manage change through modelling of business processes and activities and their relation to each other (Figure 1.3). According to The Open Group Architecture Framework (TOGAF) (2008), EA is essential for an organisation's ability to achieve its mission in context and EA enhances an organisation's ability to effectively act with its assets and react to challenges. Furthermore, Zachman (2008a) states that EA is a purely structural set of primitive, descriptive artefacts or models that constitute the knowledge infrastructure of the enterprise.
- *Information management* (IM) deals with all facets of organisational information and comprises processes, resources and people (Ferreira & Erasmus, 2010:1). Business processes and people generate information that is collected, stored, processed, protected, maintained and used to assist with organisational decision-making, operations, products and services (Chaffey & Wood, 2005:7; Laudon & Laudon, 2007:13). Martin (1995:6) states that *organisational knowledge resides in software of ever-growing complexity* and modern enterprises rely on its *knowledge infrastructure.*

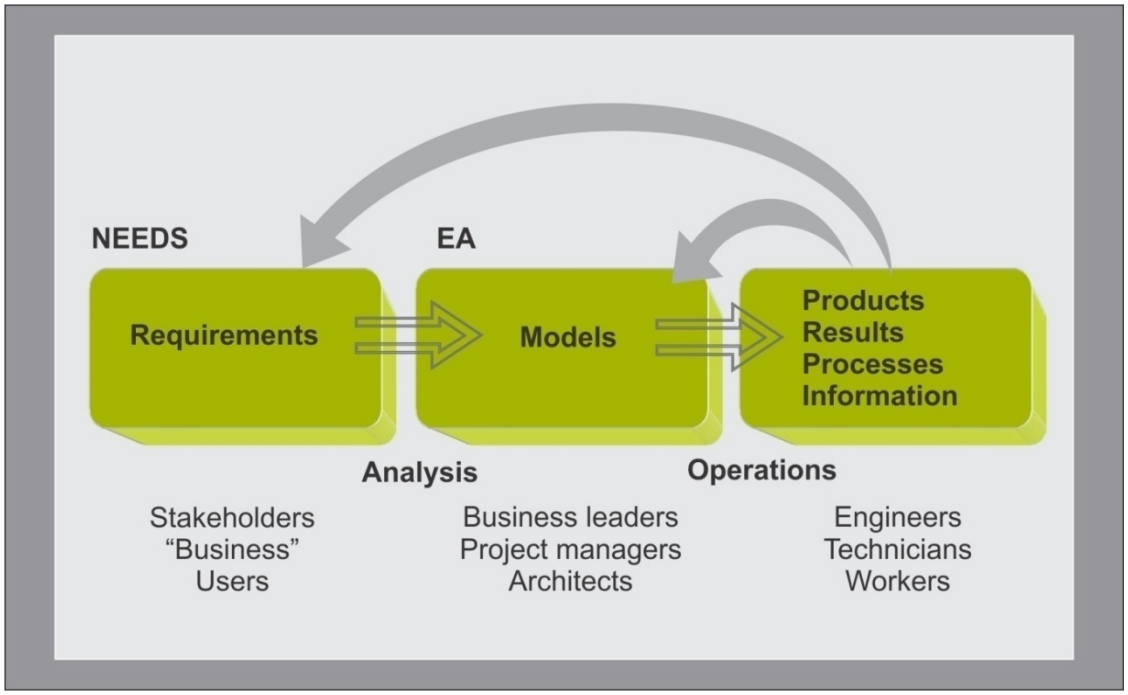


Figure 1.3: EA and human involvement

Complex enterprises need to align business services and IM according to set standards and design principles, to be successful and competitive. In a constantly dynamic and changing business environment they need to be able to manage change fast and effectively. Adoption and acceptance of new strategies in organisations result in change. According to Green (2007:5) and Lewin (1951), change in organisations happens in interactive systems within an environment; there are forces impacting on human-driven systems that need to be addressed during change; and active observation and involvement are necessary during a change process. Human understanding of change, organisational culture and leadership are forces and entities central to the success of organisational change. The more complex form of organisational change is described by Green (2007:22) as an emergent type of change which is:

- either focused on the whole organisation or parts of the organisation and is a dynamic process;
- either a planned or an emergent approach; or
- a social process where stakeholders should be identified and involved.

As also described in Chapter 2, for EA the change management process includes a need for change, an 'as-is' to 'to-be' roadmap and a change strategy.

Drivers for change are creativity and innovation. Humans in organisations are the knowledge owners and knowledge is a basis for creativity and innovation. Where knowledge exists in organisations, it is necessary for management to prioritise knowledge sources in order to reach the goals and organisational objectives. According to Drucker (Stein, 2010:30), organisations exist because of human workers and therefore goals of an organisation and human needs should be balanced by organisational principles. Also, decisions and judgement are important in an organisation and Drucker distinguishes between governance and operations by saying that management make decisions and should leave responsibility for action and operational work to

workers. *Knowledge is the core resource of the economy, the crucial factor of capital and costs and knowledge work is inherently productive* (Stein, 2010:31). According to Stein (2010:131), the technology era led to information being an asset of experience of an organisation. Information of experience has to be analysed, stored and utilised. Strengths and knowledge of every worker in an organisation contribute to the success of the organisation. Stein (2010:134) explains that managers need to be entrepreneurs for change when he quotes Drucker as writing that as a manager *it is necessary to design the company for change* and as an entrepreneur *it is better to create change rather than to react to it.*

Complexity, change and information/knowledge retention are organisational entities addressed by EA. EA can assist in capturing of tacit knowledge in organisations. As opposed to historical organisational management of human capital, the focus of organisations today is to acknowledge human efforts in organisational operations. It was the aim of the research to show that it is just as important for organisations to ensure that humans accept and relate to strategies such as EA, which would enable organisations to retain tacit knowledge.

EA is a way to describe the integration of business and IM of an enterprise. EA as a strategy is increasingly used to integrate business and IM in complex enterprises (Ballangee, 2010a:46; Dietz & Hoogervorst, 2010:1; Zachman, 2010a:37).

One aspect of introducing EA as an organisational strategy that should not be ignored or underestimated is the role of *human involvement in an organisation's systems and processes* (Du Plooy, 1998:1; Sellen *et al.*, 2009:58). People have different views and perspectives and come from different disciplinary backgrounds and career orientations. In an address by Zachman (2009) he emphasised the importance of people in an organisation and stated that *any enterprise is a human endeavour* that should be engineered and should not be implementation dominated. Many authors argue that although the main focus of using EA is to align business strategies with IM and IT within organisations and to manage change, it is just as important to manage human involvement in the business, data and knowledge representation processes (Deng, 2006:161; Goethals *et al.*, 2007:269; Langenberg & Wegmann, 2004:1; Magda, 2009:210; Sage, 2006:1; Schekkerman, 2010).

Humans in organisations are defined by their *work roles*. Work roles differ from one organisation to another and human behaviour is dependent on the context of the organisation. Enterprise strategists, managers and leaders often have a holistic, bigger picture of the enterprise and often find it difficult to communicate this view to stakeholders that are involved in more specific ways and work roles. Strategists and managers are the decision makers responsible for adoption of new strategies such as EA. Stakeholder involvement in the acceptance process of EA in an organisation can be one of the critical success factors of change in an organisation. McGovern *et al*. (2004:5) list several stakeholders and issues that need to be addressed in a synergetic way for the successful implementation of EA: stakeholders include architecture team members, organisational users, business partners and customers; needs and concerns of stakeholders have to be addressed; and organisational context, global diversity and data needed for different architectures may affect the success or failure of EA. Implementation can only happen successfully after acceptance by relevant stakeholders. The focus should be on the people involved in the development, improvement, and maintenance of the architecture and not only on the technology, techniques or methodology. What

complicates explanations of human behaviour in organisations is that humans are individuals and group actors and human behaviour is not predictable or fixed. Behaviour of people in organisations corresponds to the definition of organisational culture given by Hofstede *et al*. (2005:282) as *the collective programming of the mind that distinguishes the members of one organisation from another*. Human involvement in the establishment of organisational culture has been discussed in studies over many years and human behaviour and human factors such as values, beliefs and perceptions contribute to organisational cultural setting (Giddens, 1984; Gortner *et al.*, 1989; Robbins, 2004:647; Schein, 2004:437; Stein, 2010).

Humans play a vital role in organisations and organisations often invest a fair amount of capital in human development and training only to find out later that so called 'soft issues' or human factors are responsible for more serious problems than training and employer ability (Magda, 2009). For many years research on human involvement in IS and IT focused on the impact of technology on humans or acceptance of technology by humans (Burton-Jones & Hubona, 2005; Davis, 1989b:982; DeLone & McLean, 1992:60; Nadler & Tushman, 1997; Sabherwal *et al.*, 2006:1849; Venkatesh *et al.*, 2003:425).

The focus of my research is on human or stakeholder factors affecting acceptance of new strategies in enterprises, more specifically EA acceptance. When organisations adopt EA to describe the complex composition of their business and IM strategy, human involvement is woven into all models and processes. Work-role-related human factors impacting on EA acceptance have not explicitly been described in EA literature and in many instances, management of human factors related to EA in enterprises remains problematic. The thesis of this research is that a framework can be compiled that can support organisations with the management of human factors after the adoption of EA as a strategy.

1.3 PURPOSE OF THE STUDY

The Enterprise Architecture Research Forum (EARF) was formed in 2009 as a result of people involved in EA realising the need for more research and growth in the relatively new field of EA in South Africa. Although the focus of the forum is on research, one of the aims is to share knowledge on EA between people from industry, researchers and academics. It was during several EARF knowledge-sharing meetings that the role of humans and human factors were mentioned as impacting on EA acceptance in organisations. Also, little attention was given to this topic in EA literature and practice.

It was mentioned by speakers that EA is a dynamic process and because of organisational knowledge not being contained in one person, people in organisations do not only need to be aware of EA's benefits but should also accept ownership of the process (EARF, 2009). Zachman (2012b) described an enterprise as complicated and EA as the non-negotiable *total knowledge base* of an enterprise. Complexity in enterprises arises from composite processes and interactions. Zachman (2012b) stated that an enterprise is human oriented and that people are the problem when it comes to acceptance of EA. EA promotes integration of business and IT processes, cooperation of people from business and technology sections of enterprises, and management and preservation of enterprise knowledge (EARF, 2009). EA is described by a CIO from the banking industry as a long-term investment where human stakeholders have to understand the benefits, buy into the idea of EA and remain committed throughout the EA process (EARF, 2009).

Organisations involved in adopting EA as a strategy has no guidelines to assist them with human-acceptance-related obstacles. Furthermore, it is evident from the literature reviewed that no framework of human factors for EA acceptance is described from an organisational perspective. Therefore, the purpose of the research this thesis documents is to address this gap to *identify human factors impacting on the acceptance of enterprise architecture in an organisation and compose a framework of human factors to assist in promoting and managing stakeholder involvement during acceptance of EA.*

1.4 RESEARCH QUESTION AND OBJECTIVES OF THE RESEARCH

Enterprises are complex entities, defined by their business goals. Enterprises comprise of different organisations, sub-organisations, systems, operations, processes, resources and people. Whatever the mission, vision, long-term strategies or short-term projects of an enterprise entails, to stay economically viable, competitive and successful, people need to understand how the enterprise's business goals, IM and IT integrates. EA is an enterprise-wide strategy to assist people in understanding of enterprise operations and change management. One main research question, transformed into a main objective, describes the purpose of the research.

The main research question in my research is:

> *What are the human factors that affect the acceptance of enterprise architecture (EA) and how can these factors be used in an organisation to manage the acceptance of enterprise architecture?*

The objective of the research is:

> *To develop a framework of human factors to assist organisations in managing the acceptance of enterprise architecture.*

In order to develop the framework of human factors, two research objectives and related sub-objectives are defined.

> RO1: *To design a model that will assist organisations in management of EA acceptance.*
>
> SO1.1: *To determine the human factors affecting EA acceptance.*
>
> SO1.2: *To determine the work levels applicable to EA.*
>
> SO1.3: *To categorise the human factors per work level into human concerns.*
>
> RO2: *To propose a method to use the model to assist organisations for management of EA acceptance.*

In achieving SO1.1 (*to determine the human factors affecting EA acceptance*), an exploratory study was conducted to identify human factors affecting EA acceptance in one South African enterprise. In the next phase, existing literature was explored to identify human factors related to EA. Human factors identified in the exploratory study was combined with human factors identified from the literature to compile a more representative list of human factors associated with the use of EA. A comprehensive list of human factors was compiled.

Literature was used to identify existing human factors and to determine a classification scheme for human factors identified (Section 5.3). Human factors identified as relevant to the research were named human concerns and used to categorise the comprehensive list of human factors.

The realisation from the exploratory study and the literature that human factors were different for different organisational work levels fostered the actions in the fulfilment of SO1.2 (*to determine the work levels applicable to EA*). Work levels applicable to EA were identified (Section 5.4) and the comprehensive list human factors, categorised into human concerns were mapped into work levels (SO1.3 - *to categorise the human factors per work level into human concerns*).

Human factors identified, categorised into human concerns and mapped into work levels was evaluated in more contexts for validity. In a second research evaluation action, WoLAF for EA was verified and confirmed.

1.5 THE SCOPE AND CONTEXT OF THE STUDY

My research explores and identifies human factors impacting on EA acceptance in South African enterprises. A work-level-related framework for management of EA acceptance (WoLAF for EA) is developed, verified and confirmed. WoLAF for EA comprises of a model and a proposed method.

A design science research (DSR) paradigm was used in my study and a framework artefact is compiled. The study was short-term and of exploratory nature to investigate and identify human factors impacting on EA acceptance in organisations after which a model and a method are proposed to assist organisations for management of EA acceptance. The terms “enterprise” and “organisation” are used interchangeable in my thesis. “Acceptance” and “adoption” are terms often both used to refer to acceptance. A definite distinction is made in my thesis between adoption and acceptance of EA (explained in Section 3.4.1). The focus of the study is on human acceptance of EA in enterprises and therefore human factors related to organisational adoption of EA will not form part of the study. Only *human factors related to EA acceptance in large organisations in a work-level-related context will be explored and analysed.*

The applicability of the study is indicated in a specific area namely Gauteng, in South Africa. The reasons for the delimitation are: 1) this area is the basis for many economic, industrial and governmental enterprises 2) the enterprise chosen for the exploratory study consists of sub-organisations, some of which reside in this area and 3) I was able to meet with, have discussions and interview people from various enterprises within this region. It would be possible in future research to extend the results of the research to other South African regions as well as other countries.

Human factors impacting on EA acceptance were identified in one enterprise after which a literature study was conducted to locate human factors from three well-known EA frameworks and appropriate acceptance models and theories. Although the comprehensive list of human factors that was compiled was distributed and tested in enterprises representing different contexts, I acknowledge that the list of human factors may not be exhaustive and exactly relevant in all the different enterprise contexts that exist world-wide. It is however possible to adapt or extent the list of human factors to ensure that it is relevant for a specific context.

1.6 RESEARCH APPROACH AND OVERVIEW OF THE RESEARCH PROCESS

In this research project the research paradigm of DSR and a methodology of design research are followed. The design research method as described by Vaishnavi and Kuechler (2013) and Adebesin (2011:310) is used as a reference model. As illustrated in Figure 1.4, the research is conducted in one main design research cycle. The WoLAF for EA model is constructed in Development Phase 1 consisting of four circumscriptive sub-phases supported by inductive reasoning. The WoLAF for EA method is constructed in Development Phase 2.

Reviewing the literature it was found that in many cases legacy computer systems, failure of IS and human factors have been recognised to contribute to problems with and even failure of business, IM and IT integration in enterprises (Callon, 1999:181; GERAM, 1999; Kwon & Zmud, 1987:227; Latour, 1999:15; Mitev, 2009:9; Nemeth, 2012; TOGAF, 2009:744; Venkatesh *et al.*, 2003:425; Zachman, 2010d). Participants in the exploratory study of the research agreed that presently the same problems still exist and may have an impact on acceptance of new strategies in enterprises. The focus of the research was on human factors impacting on EA acceptance in organisations.

Human factors impacting on EA acceptance were identified through qualitative data gathering in a single exploratory study at one South African enterprise. The human factors were compared to human factors identified from three different EA frameworks and other acceptance theories. Human factors identified were tested in more South African organisations and in relation to work levels. Human factors were grouped into concerns and, finally, represented in a work-level-related human factor acceptance framework (WoLAF for EA).

The research process followed to complete the research reported on in this thesis is described in more detail in chapters 4 and 5.

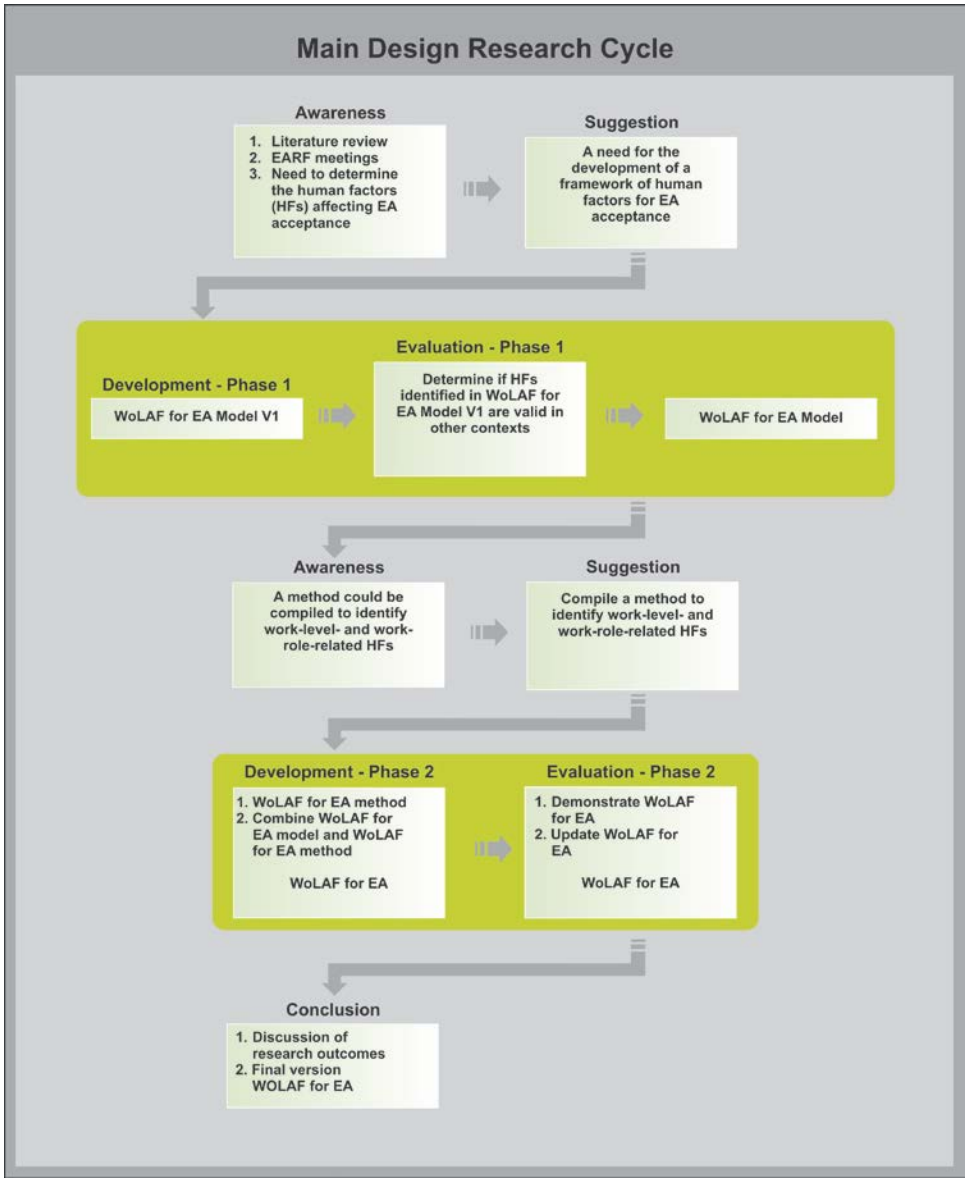


Figure 1.4: Research process

1.7 RELEVANCE AND POTENTIAL CONTRIBUTION OF THE RESEARCH

It is the argument of the research that EA adoption in enterprises happens at executive- and management work levels but that acceptance of EA in organisations and enterprises should come from all stakeholders representing different work levels and work roles. Once EA is adopted as a basic strategy to assist in organisational management and control of organisational knowledge, EA needs to be understood and accepted by all stakeholders to ensure successful implementation. Successful enterprises, however, acknowledge that when EA was adopted and accepted in large organisations, structural- and information management improved as a result of integration of business, IT and IM.

In my research, human factors impacting on EA acceptance are identified, confirmed and presented in a *framework* of human factors (WoLAF for EA) to assist enterprises that are undertaking EA as a strategy in gaining acceptance of EA. For the purpose of my research, a framework is perceived as defined by Business

Dictionary (2010), namely a *broad overview, outline or skeleton of interlinked items, which supports a particular approach to a specific objective, and serves as a guide that can be modified as required by adding or deleting items.*

The purpose of WoLAF for EA is to assist organisations in managing human factors impacting on EA acceptance. WoLAF for EA consists of a model and a method. The model can be applied in two ways in organisations. Human factors of individual stakeholders representing EA work roles and impacting on EA acceptance can be identified or human factors impacting on EA acceptance can be identified for a group of stakeholders representing an organisational work level involved in EA. The model can also be used to identify specific human concerns hindering EA acceptance.

The research findings and recommendations may be specifically useful to three different audiences. Firstly, EA management teams or EA project managers can identify individual or group human concerns to be addressed before these concerns defer or delay EA process modelling and progression. Secondly, enterprise management can identify work-level-related human factors hindering organisational information- and knowledge retention and address these problems from an organisational management level, and thirdly, researchers in EA can utilise the model in EA related and socio-technical organisational acceptance problems. WoLAF for EA makes a contribution to the knowledge base of human behaviour in acceptance of new strategies in organisations.

During the research one paper was presented at an international conference (Gilliland *et al.*, 2013). The reference to the paper is:

> Gilliland, S.; Van der Merwe, A. J. & Kotzé, P. 2013. Human factors affecting enterprise architecture acceptance. Paper presented at the 1st International Conference on Enterprise Systems (ES2013), Cape Town, RSA, 7 November.

The paper is available in Appendix D on the CD provided with the thesis.

1.8 THESIS LAYOUT

Table 1.1 provides an overview of where in the thesis the objectives of the research have been addressed and reached. Table 1.1 is followed by a brief layout of the chapters and their content.

Table 1.1: Research objectives of the thesis addressed

OBJECTIVE	THESIS SECTION
RO1: *To design a model that will assist organisations in management of EA acceptance*	Sections 5.1 to 5.7
SO1.1: *To determine the human factors affecting EA acceptance*	Section 5.2
SO1.2: *To determine the work levels applicable to EA*	Section 5.4
SO1.3: *To categorise the human factors per work level into human concerns*	Section 5.3.1.8

RO2: *To propose a method to use the model to assist organisations for management of EA acceptance*	Section 6.2
Main objective: *To develop a framework of human factors to assist organisations in managing the acceptance of enterprise architecture.*	Section 6.4

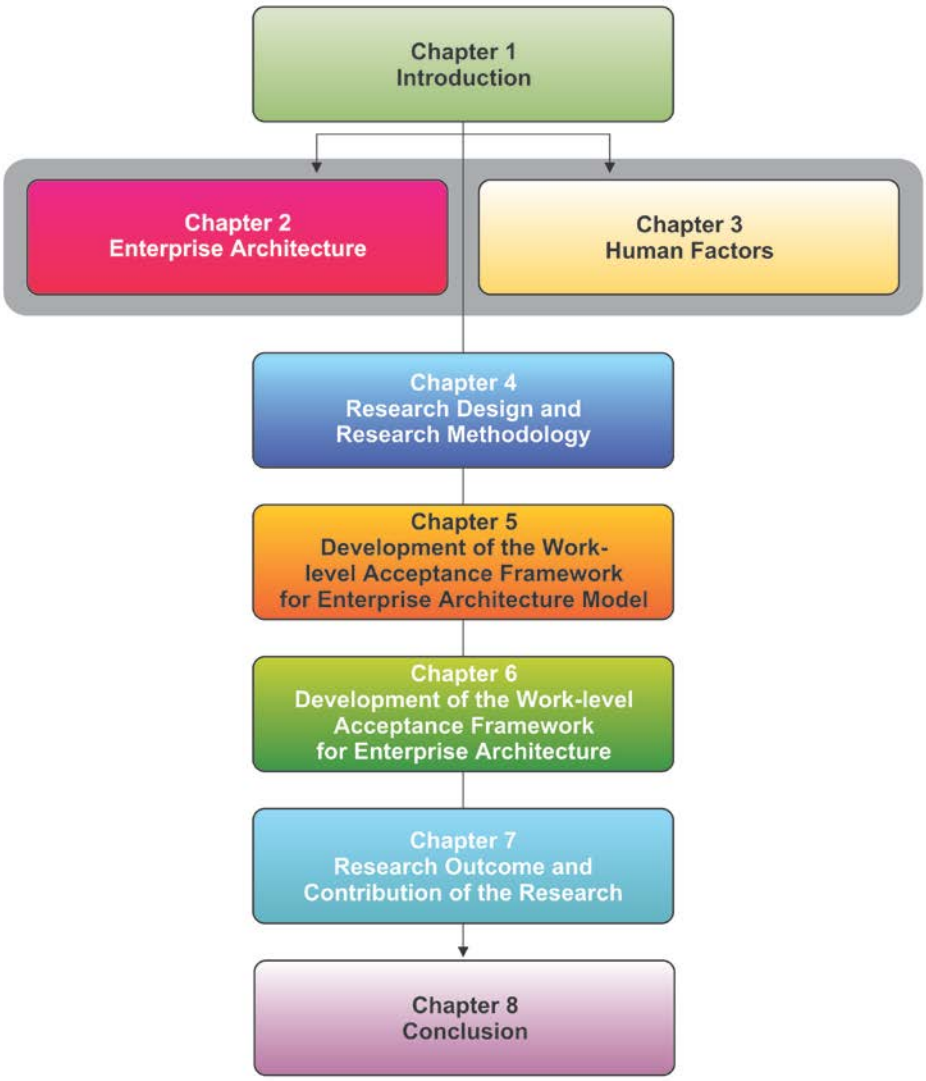
Chapters 2 and 3 comprise discussions of concepts found in the literature and in relevant studies perceived to be basic background knowledge to the research. Such an investigation and subsequent discussion of concepts form a basis for the research and were performed to comply with an initial first and necessary objective of this study: to define and discuss all relevant underlying concepts important to ensure a sound foundation of the study.

In Chapter 2, definitions of EA are given and discussed. With the literature as a basis, the relation between EA and enterprise engineering (EE) is investigated. Three EA frameworks relevant to the research are described: first, EA is presented in a framework described by its inventor and owner as ontology; the second framework is mostly used in industry as a process or methodology; and the third framework is perceived by users as a strategy of EA implementation. Human adoption and acceptance of EA as an organisational strategy are reviewed from the literature.

In Chapter 3, the literature on human factors in organisations and human acceptance of technology in organisations is reviewed and discussed.

In Chapter 4, the research design, research approach and research methodology of the research is discussed. The rationale for conducting the research is discussed.

In chapters 5 and 6, the course of research and methods used is discussed. A single exploratory study was performed in one South African organisation. Interviews and a focus group with employees from different work levels were conducted and recorded. The literature was used to identify human factors related to EA. Human factors retrieved from technology acceptance models and from three EA frameworks were compared to human factors identified from the exploratory study and a comprehensive list of human factors, categorised as human concerns and mapped into work levels was compiled. After the identification of human factors, a questionnaire was compiled to test the human factors in other contexts. A pilot study was conducted first to test the relevance of the questions. After the questionnaire was reviewed and in a follow-up study to reach more participants in more organisations, the relevant human factors were analysed, interpreted and confirmed. In a first development phase, a work-level-related acceptance model of EA was composed (Chapter 5). The second development phase comprised the development of a proposed method to assist organisations in using the model to manage human factors affecting EA acceptance (Chapter 6). The two development phases resulted in a work-level acceptance framework for EA and WoLAF for EA is composed. WoLAF for EA is then presented, adjusted and verified.



In Chapter 7, the contributions of the research to the body of EA knowledge are presented. The scientific contributions include:

1. the WoLAF for EA Model:
2. a contribution to the theories on adoption and acceptance of EA; and
3. a contribution to other theories.

The product contributions of the research include:

1. the WoLAF for EA Method;

2. self-assessment tool to assist organisations in identification of human factors impacting on EA acceptance; and

3. implications of the framework and possible action steps.

In a final chapter, Chapter 8, a summary of the thesis and the research is presented. The research strategy used for the research is revisited and recommendations for further research are presented.