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# Understanding the architect in enterprise architecture: the Daedalus Instrument for architects

by

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Dedicated to my loving family, to my wife who showed inexhaustible patience with me and my impulsivity and ADHD and to my children who cannot wait for me to work less and play more.

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# Abstract

With numerous enterprise architecture management (EAM) methodologies, frameworks, and tools, there is still no universally accepted standard on what Enterprise Architecture (EA) really means to practicing architects. Traditionally practitioners concentrated on specific aspects of EA, such as tools, repositories, components and frameworks. However, little attention was given to the architect, who completes this trio of system perspectives (people, process & technology). This thesis reports on the research findings from multiple studies that investigated diverse factors and attributes that are associated with enterprise architects; the belief systems of enterprise architects as they pertain to enterprise architecture and enterprise architecture management; the behavioural styles of enterprise architects which they follow within their socio-technical environment, as well as enterprise architect profiles, representing a specific enterprise architect viewpoint. The enterprise architect belief systems affect the worldview and ultimately the school of thought of the practicing architect. Similarly, the role and competency of enterprise architects operating within their working environment affects their behavioural style.

This thesis made use of design science research as a foundational strategy, making use of various research methodologies including a systemic literature review and qualitative surveys and the use of the framework for the evaluation of design science research (FEDS). The design science research strategy allowed for the development of the design artefact as well as its technology-based implementation, the Daedalus Instrument for Architects (DIA).

DIA can be used in conjunction with existing EA frameworks and methodologies, such as The Open Group Architecture Framework (TOGAF) for the understanding of architects on why they operate and perform architectural designs in the way they do. The findings may assist enterprise architects and EA stakeholders concerned with having the right calibre of person acting as an enterprise architect fulfilling a specific architecture function within an EA team or EA practice.

Keywords: Enterprise Architecture, Enterprise Architecture Management, Enterprise Architect, EA Factors, Architect Attributes, EA Schools of thought, Architect Belief Systems, Architect Styles, Architect Behavioural Styles, Architect Profiles, Architect Viewpoints, Architect Archetypes, Daedalus Instrument, Daedalus Instrument for Architects, DIA, EA, EAM, TOGAF.

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## Abbreviations and acronyms

| Abbreviation / acronym | Description |
|---|---|
| AEA | Association of Enterprise Architects |
| BPMN | Business Process Modelling Notation |
| CAQDAS | Computer Aided Qualitative Data Analysis Software |
| CIO | Chief Information Officer |
| CRD | Centre for Reviews and Dissemination |
| CSF | Critical Success Factors |
| DIA | Daedalus Instrument for Architects |
| DSR | Design Science Research |
| EA | Enterprise Architecture |
| EAM | Enterprise Architecture Management |
| EARF | Enterprise Architecture Research Forum |
| EC | Enterprise Configuration |
| EEA | Enterprise Ecological Adaption |
| EI | Enterprise Integration |
| EITA | Enterprise IT Architecture |
| EITD | Enterprise IT Design |
| EITP | Enterprise IT Planning |
| EPA | Enterprise Power Authority |
| FEDS | Framework for the Evaluation of Design Science |
| IEEE | Institute of Electric and Electronic Engineers |
| IS | Information Systems |
| ISO | International Standards Organisation |
| IT | Information Technology |
| PM | Project / Programme Manager |
| RSA | Republic of South Africa |
| SALSA | Centre for Reviews and Dissemination |
| SLR | Systematic Literature Review |
| SoT | Schools of Thought |
| SWOT | Strengths, Weaknesses, Opportunities, Threats |
| TOGAF | The Open Group Architecture Framework |
| UML | Unified Modelling Language |

# Terms and definitions

| Term / definition | Description | Source |
|---|---|---|
| Archetype | an inherited idea or mode of thought in the psychology of C. G. Jung that is derived from the experience of the race and is present in the unconscious of the individual | (Merriam-Webster, 2014) |
| Architect | a person who designs and guides a plan or undertaking | (Merriam-Webster, 2014) |
| Attribute | a usually good quality or feature that someone or something has | (Merriam-Webster, 2014) |
| Belief | a feeling that something is good, right, or valuable | (Merriam-Webster, 2014) |
| Concept | an abstract or generic idea generalized from particular instances | (Merriam-Webster, 2014) |
| Construct | to make or create (something, such as a story or theory) by organizing ideas, words, etc. | (Merriam-Webster, 2014) |
| Enterprise architecture | Enterprise Architecture is the continuous practice of describing the essential elements of a socio-technical organization, their relationships to each other and to the environment, in order to understand complexity and manage change | (EARF, 2010) |
| Factor | something that helps produce or influence a result | (Merriam-Webster, 2014) |
| Framework | the basic structure of something : a set of ideas or facts that provide support for something | (Merriam-Webster, 2014) |
| Instrument | a tool or device used for a particular purpose; especially : a tool or device designed to do careful and exact work | (Merriam-Webster, 2014) |
| Profile | a brief written description that provides information about someone or something | (Merriam-Webster, 2014) |
| School of thought | a group sharing a common point of view in respect to some matter | (Merriam-Webster, 2014) |
| Style | a particular way in which something is done, created, or performed | (Merriam-Webster, 2014) |
| System | a regularly interacting or interdependent group of items forming a unified whole | (Merriam-Webster, 2014) |
| Taxonomy | the process or system of describing the way in which different living things are related by putting them in groups | (Merriam-Webster, 2014) |
| Theory | an idea that is suggested or presented as possibly true but that is not known or proven to be true | (Merriam-Webster, 2014) |
| Type | qualities common to a number of individuals that distinguish them as an identifiable class: the morphological, physiological, or ecological characters by which relationship between organisms may be recognized | (Merriam-Webster, 2014) |
| View | an opinion or way of thinking about something | (Merriam-Webster, 2014) |

# 1 Introduction and motivation

## *1.1 Introduction*

Enterprise architects, unlike civil architects, deal with organisations, which are considered socio-technical systems. This socio-technical system is an ever-changing system, which is distinct from mechanistic systems such as buildings, planes, trains or computers. To understand the socio-technical system, one needs to understand each component of this system of people, process and technology. However as Enterprise Architecture (EA) is a relative newly developed discipline, the concepts of EA and Enterprise Architecture Management (EAM) are not universal accepted concepts, which becomes evident in the number of available EA definitions (EARF, 2010; Mentz *et al.*, 2014; Ross *et al.*, 2006; The Open Group, 2009; Zachman, 2008) and EA frameworks (Bernus & Nemes, 1996; Franke *et al.*, 2009; Gout & Robinson, 2006; Smith, 2010; The Open Group, 2009; Zachman, 1987). Literature shows that enterprise architects do not agree on what EA is and how to do EAM, as a result of the difference in understanding of what exactly enterprise architecture is (Mentz, 2014). It is this understanding of the enterprise architect, within the socio-technical system, that this thesis is concerned with. Understanding the architect within EA would allow organisations to have greater insight into the complexities of enterprise architecture, where different organisations may require different profile architects to fit their specific requirements.

### 1.1.1 Chapter layout

This chapter gives an introduction by defining a research problem, proposing a solution and contributing to the discipline of enterprise architecture.

Part I of the thesis is concerned with the introduction and awareness of the problem. The introduction and motivation **Chapter 1** is divided into eleven main parts, depicted with Figure 1-A. Section 1.1 provides an introduction. Section 1.2, provides a detailed understanding of the research problem. The third and fourth sections, section 1.3 and section 1.4 respectively, deal with the research questions and how they align to the research objectives. Section 1.5 offers insight into the research approach, while section 1.6 delivers detailed information on the delineations and limitations. Section 1.7 highlights the principal assumptions of the thesis. The thesis significance is detailed within section 1.8, while section 1.9 provides an overview of the thesis chapter layout. Finally, section 1.10 concludes the introduction and motivation chapter.

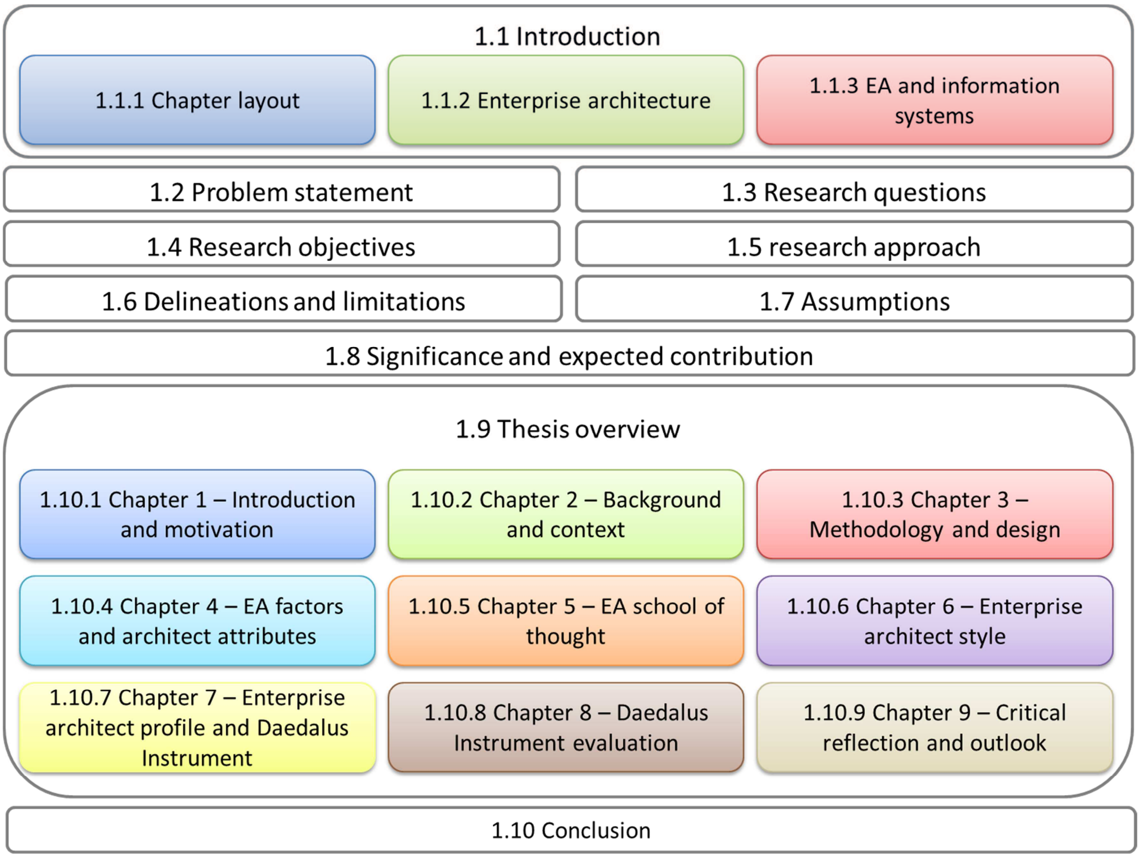



**Figure 1-A: Chapter layout**

### 1.1.2 The enterprise architect

Enterprise architects are responsible for creating an integrated view of the organisation by performing and executing the EA process. Enterprise architects are also responsible for the management process of documentation, analysis, planning, and enactment of EA or simply EAM (Buckl, 2011, p. 4). EAM is seen as a practice to manage and control the rate of change within organisations, thereby reducing the complexity and increasing the efficiency of various aspects of the organisation (Lankhorst, 2004; Ross *et al.*, 2006; Van Der Raadt *et al.*, 2004). The performance of EAM is dependent on and influenced by several contextual factors, including factors relating to the architect (Aier & Schelp, 2010; Riege & Aier, 2009; Van Steenbergen, 2011; Winter *et al.*, 2010). With so much responsibility on EA practitioners or enterprise architects[1] to produce architecture deliverables, they have the added responsibility to embed EAM within the organisation to guide and support the organisation through its transformation of EA (Aier & Schelp, 2010; Strano & Rehmani, 2007). Within the context of EAM, the responsibility of the enterprise architect is diverse

[1] Enterprise architects or enterprise architecture practitioners will be used as synonyms and seen as interchangeable terms.

and can include the roles of change agent, communicator, leader, manager or modeller (Strano & Rehmani, 2007).

Enterprise architecture is a relative new discipline compared to that of engineering, civil architecture or philosophy; as a result it is still in its infancy and by definition immature. The discipline of EA is seen by some as more of an art than science (Wegmann, 2003). An art would imply a reliance on the practitioner's skill and trial-and-error, similar to that of alchemy (Zachman, 2008), which predates chemistry, the discovery of elements and the development of the periodic table. As a result, enterprise architects have a steep learning curve to climb to mature to the level of a scientist rather than that of an artist. EA is concerned with the architecture of an enterprise or organisation[2]. Unlike civil architecture and engineering that deals with closed systems and can have a mechanistic view for the development of buildings, ships, trains and plains; EA deals with organisations, which are socio-technical systems (Buckl *et al.*, 2011; Doherty & King, 2005; Lapalme & De Guerre, 2012). Organisations as complex socio-technical systems have their own challenges with managing change (Armour *et al.*, 2008, 2007; Chuang & Van Loggerenberg, 2010; Kaisler *et al.*, 2005). With a constant changing environment, organisations risk and increase in complexity (Ross *et al.*, 2006; Van Steenbergen, 2011). This complexity can manifest itself in business processes, software products, infrastructure implementations and have unforeseen consequences on other business areas, which could lead to difficulties in information sharing, and the reliability and availability of information. As the rate of change increases, organisations would require a higher level of flexibility to cope with constant change of business demands.

As the organisation is a complex socio-technical system with a high rate of change, it is the responsibility of the enterprise architect to reduce the complexity and increase efficiency within the organisation.

To complicate matters, no standard definition of EA exists; no standard EA framework or methodology, no standard role clarification for the enterprise architect and no standard approach to EAM (Buckl *et al.*, 2009; Buckl, 2011; Ernst, 2010; Mentz, 2014; Mentz *et al.*, 2014). This dilemma is described in detail within **Chapter 2**. Consequently, different profiles of enterprise architects would take different approaches to implement enterprise architecture and EAM, which might or might not align with what the organisation requires from them. For any organisation to successfully embed EAM within the organisation, the organisation needs the right architects with the right profiles to improve organisational performance through the embedment of EAM. The dilemma is not about who is the best

[2] Enterprise and organisation will be used as synonyms and seen as interchangeable terms.

architect but about who is the best architect for the organisation within a specific role (Strano & Rehmani, 2007). It is this problem that this study addresses.

### 1.1.3 EA and IS

The discipline of Information Systems (IS) emerged in the 1960s and later shifted focus in the 1980s to management of information systems (Myers & Avison, 2002). The IS discipline has matured rapidly since then and includes concerns such as collaboration and communication between people, electronic commerce and the Internet. Banville and Landry (1989) classified social sciences according to different dimensions. They defined functional and strategic dependence with strategic task uncertainty. According to this classification, physics is classified as a conceptually integrated bureaucracy, low on strategic task uncertainty and high on functional and strategic dependence. Information Systems on the other hand are considered a fragmented adhocracy, with a low degree of functional and strategic dependence and a high degree of strategic task uncertainty (Banville & Landry, 1989), graphically depicted in Figure 1-B. The information systems discipline has a low degree of strategic dependence since there is a weak need to interrelate and coordinate research strategies and goals with those of specialists. It has a high degree of strategic task uncertainty, indicating the existence of loosely coupled schools of thought. Information systems also have a low degree of functional dependence suggesting a minimal standardisation of research procedures, tools and results interpretation. As a result, several classifications were created of the information systems discipline (Avison *et al.*, 2008; Barki *et al.*, 1993; Gable, 2010; Palvia *et al.*, 2007; Vessey *et al.*, 2002).

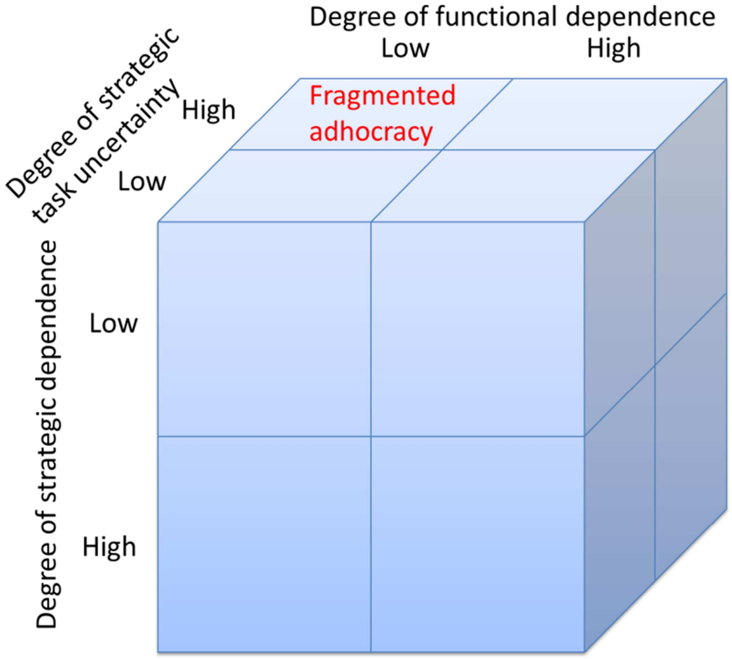



**Figure 1-B: Classification of intellectual fields (Banville & Landry, 1989)**

Studying the differences within the academic fields; these classifications indicate information systems are truly an interdisciplinary field of study, as described by Lee (2001).

> "The information systems field examines more than just the technological system, or just the social system, or even the two side by side; in addition, it investigates the phenomena that emerge when the two interact." (Lee, 2001, p. iii)

Similarly, EA can in many ways, be associated with information systems. It deals with systems and relationships in very similar ways as information systems do. This is made explicit by ISO in the definition of architecture:

> "fundamental concepts or properties of a system in its environment embodied in its elements, relationships, and in the principles of its design and evolution." (ISO/IEC/IEEE JTC1/SC7/WG42, 2011)

In a related way, EA is defined by the EARF (2010):

> "Enterprise Architecture is the continuous practice of describing the essential elements of a socio-technical organization, their relationships to each other and to the environment, in order to understand complexity and manage change." (EARF, 2010)

Considering the definitions, EA and its related topics form part of the IS discipline. In many ways the discipline of EA is very similar to the discipline of IS when considering the functional and strategic dependence as well as strategic task uncertainty. Similarly, understanding the architect in enterprise architecture, which forms part of a larger socio-technical system of people, process and technology, is well suited for the IS discipline.

Due to the high degree of strategic task uncertainty within the discipline of EA, there is an indication of existence of loosely coupled schools of thought. The understanding of the enterprise architects would be well suited within the IS discipline. The evolving discipline has also seen a wide range of work done using several research methods.

## *1.2 Problem statement*

Referring to the execution of EAM within the organisation, the organisation has several challenges and concerns to face with respect to the enterprise architect. The role of the enterprise architect will change and depend on the circumstances of the organisation (Strano & Rehmani, 2007), such as the organisation size, organisation type and organisational governance (Shah & Kourdi, 2007). Depending on the role of the architect, the architect will make use of different techniques to fulfil the specific role resulting in different benefits and success rates (Van Steenbergen *et al.*, 2011).

A concern is that enterprise architects do not agree on what EA is and how to do EAM, essentially not agreeing on any EA definitions, as a result of the silo type understanding of what exactly enterprise architecture is (Mentz, 2014). As a consequence of this difference in opinion or outlook, a disagreement about language and terminology exists (Schöenherr, 2009), as well as, a lack of clarity in the conceptual foundations of EA (Mentz, 2014). Research on the topic indicated that it is complicated to obtain a unique understanding of EA as a result of the difference in understanding of what EA is (Mentz, 2014). An alternative approach is to understand the enterprise architect, to mitigate the problems of enterprise architects understanding EA differently, not agreeing on a standardised EA definition or the use of a single EA framework, methodology and set of techniques. To comprehend EA and the enterprise architect, there needs to be a detailed classification of relevant aspects of the enterprise architect. Figure 1-C depicts the thesis problem statement as a causal loop diagram.

The problem statement diagram, Figure 1-C depicts a "*limits to success*" systems thinking archetype. The first cycle represents a reinforcing loop or virtuous cycle as the organisation, while the second cycle represents a balancing loop or a limiting process as the enterprise architect. The virtuous cycle is concerned with growth action while the constraining action limits the process. The indication of S or "*Same*" represents a directly proportionate relationship between two aspects, while the indication of O or "*Opposite*" represents an in proportionate relationship between two aspects.

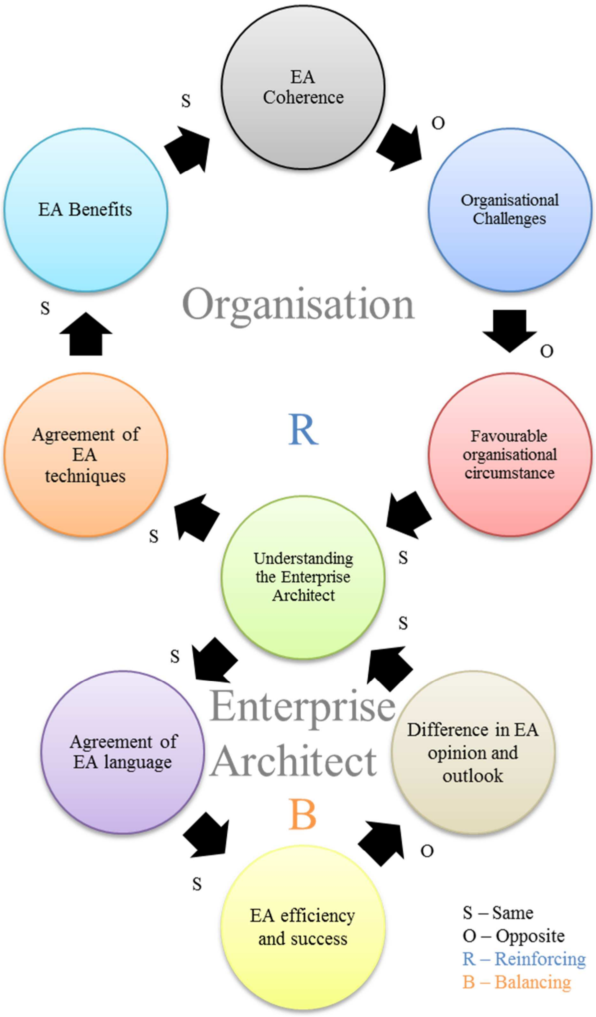



**Figure 1-C: Problem statement causal loop diagram**

In essence:

The research problem is that a lack of a common understanding of EA concepts, methods and frameworks lead to diverse practices by Enterprise Architects, which is difficult to manage and understand. The attempts to come to a unified understanding of EA are on-going and have few practical implications yet (refer to **Chapter 2**). There is a necessity to understand why enterprise architects execute EAM differently, how they go about doing EAM, or what impact it has on EA efficiency and success (Buckl *et al.*, 2009; Van Steenbergen, 2011; Winter *et al.*, 2010). Without an extended classification to understand the different profiles of enterprise architects, there might never be a common understanding of why enterprise architects execute EAM differently, how they go about doing EAM, or what impact it has on EA efficiency and success.

## *1.3 Research questions*

As enterprise architects hail from different backgrounds, have different levels of education, work in different environments and have different interpretations on what EA really is, these architects have different opinions on how to execute an EAM initiative, resulting in very different design based on the same initial requirements. In the absence of a common EA definition, EA framework or EA toolset used within their working environment, these architects will have different perspectives on what EA is, how to go about EAM, and why enterprise architects perform EAM in a certain manner.

The thesis will create an instrument, which will allow an organisation to understand the enterprise architects within their organisation. The instrument will consist of several components to determine specific EA aspects regarding the enterprise architect.

Several research concerns emanate.

> ***Concern 1:*** ***Complete a systematic study on existing literature concerning the enterprise architect.***

> ***Concern 2:*** ***Create an instrument and classification allowing organisations to determine the EA schools of thought of enterprise architects.***

> ***Concern 3:*** ***Create an instrument and classification allowing organisations to determine the enterprise architect styles of enterprise architects.***

> ***Concern 4:*** ***Create a viewpoint that describes the various aspects of enterprise architects as it relates to their enterprise architect styles and EA schools of thought. This viewpoint represents the architect profile enterprise architects have.***

***Concern 5:*** ***Compile an instrument allowing organisations to gain understanding of the architect as it relates to the various enterprise architect profiles.***

***Concern 6:*** ***Construct a technology-based solution allowing organisations to determine the profiles of enterprise architects.***

The main research question that guides the study is:

***MRQ:*** ***What are the components of an architect instrument, assisting organisations to understand enterprise architects?***

The thesis or main research question focuses on the components of an architect instrument, which allows organisations to understand enterprise architects, rather than the methodology on how to create such an architect instrument. In addition to the main research question stated above, the proposed research study will concentrate on a number of secondary research questions. A constructive rather than an informal approach was used to determine the secondary research questions (Cronje, 2011; Roode, 1993).

***SRQ1:*** ***What are the EA factors and architect attributes associated with enterprise architects as described within the literature?***

The aim of the research question is to understand which EA factors and architect attributes are associated with the enterprise architect, using a systematic literature review by considering the frequency of a specific term highlighted within current research.

***SRQ2:*** ***What are the core EA belief systems and associated EA schools of thought of enterprise architects?***

This research question aspires to describe what EA schools of thought exactly mean. The aim is to describe the schools of thought, what they mean, what the implications are and how it helps to clarify belief systems of the enterprise architects. In addition, the aim is to describe the method used to determine in which EA school of thought an enterprise architect belongs. The objective of this research question is to create an EA school of thought indicator and taxonomy that allows organisations to determine the EA school of thought of an architect.

***SRQ3:*** ***What are the core behavioural styles and associated enterprise architect styles of enterprise architects?***

The research question builds on the previous questions, by considering EA factors, architect attributes and combining these aspects to represent a specific enterprise architect style. The aim is to describe the method used to determine in a consistent manner what really constitutes an architect style. The EA factors and enterprise architect attributes will be limited to those found to be relevant. The objective here is to create an architect style indicator and taxonomy to allow organisations to determine the enterprise architect style of an architect.

| |
|---|
| ***SRQ4: What are the perspectives and associated enterprise architect profiles of enterprise architects?*** |

The aim of the research question is to determine what perspectives enterprise architect profiles include to describe the understanding of the enterprise architect. The architect profiles take into account the enterprise architect styles as well as the EA schools of thought. The objective here is to create an enterprise architect profile allowing organisations to understand their enterprise architect.

| |
|---|
| ***SRQ5: What tools can an organisation use to determine enterprise architect profiles?*** |

This research question will determine the tools an organisation can use to determine enterprise architect profiles. The instrument or set of tools include a comprehensive list of EA factors and enterprise architect attributes; the EA schools of thought taxonomy and indicator, the enterprise architect styles taxonomy and indicator, and the enterprise architect profiles viewpoints. These tools provide organisations with an instrument to understand enterprise architects.

| |
|---|
| ***SRQ6: What technology-based solution can an organisation use to determine enterprise architect profiles?*** |

This research question will determine what technology-based solution an organisation can use to determine an individual enterprise architect's profile. The technology solution is web-based and allows architects to determine their individual enterprise architect profile. The aim is to perform an assessment of the technology-based solution allowing organisations to determine enterprise architects' profiles.

## *1.4 Research objectives*

Enterprise architects have different profiles, which make them distinct from other architects. A way of understanding and classifying enterprise architects on their differences is to make use of a style indicator. The objectives of the thesis are to design an enterprise architect instrument and its components for the understanding of enterprise architects. An approach to understand enterprise architects is more practical than trying to understand EA from a philosophical perspective. This enterprise architect instrument allows for a common understanding on what, how and why enterprise architects perform EAM in a certain way. With an instrument, organisations or enterprise architects can better understand their architect styles and understand what EA factors and architect attributes their architect style considers. This Instrument is concerned with the architect and not EA; it is designed to complement existing EA frameworks and methodologies rather than to replace it.

**The purpose of the research reflected on in this thesis is:**

***MRP: Design an instrument allowing an organisation to understand the profiles of their enterprise architects.***

**The objectives of the research reflected on in this thesis are to:**

***SRO1: Determine the enterprise architect associated EA factors and architect attributes described within literature.***

***SRO2: Develop an EA schools of thought indicator for the consistent classification of EA schools of thought.***

***SRO3: Develop an architect style indicator for the consistent classification of the enterprise architect styles.***

***SRO4: Develop architect profile viewpoints for the understanding of the enterprise architect.***

***SRO5: Develop an instrument allowing organisations to understand enterprise architect profiles.***

***SRO6: Develop a technology-based solution allowing organisations to determine the profiles of enterprise architects.***

## 1.5 Research approach

In doing the research, the perspective is that of interpretivism. This philosophy assumes a sociology of regulation and a subjective research approach (Burrell & Morgan, 1985). With the interpretive paradigm perspective, the research questions influence the research paradigm as well as the research approach.

The research study made use of the DSR methodology by conducting the research project as per the DSR process steps. The researcher concentrated on interpretive research during the research project phases. An explicit ontological assumption about the project is that enterprise architects can be classified using enterprise architect profiles and that enterprise architects of the same EA schools of thought have similar belief systems and preferences with regards to EAM. With regards to an ontological perspective, the research study followed a nominalistic viewpoint when creating the enterprise architect profile viewpoint. The research study follows a qualitative data collection approach with regards to epistemology by being insulated from the research process and not interacting with the enterprise architects. This will be done in the form of questionnaires. This demonstrated the flow from research purpose and product to the research process; explaining the interaction with the participants; defining the underlying and accepted paradigm; as well as presenting the research in an appropriate form.

Concerning the quality of the research project, the author's objective was to publish the research to blind peer-reviewed and accredited conferences or journals. On finalisation of the thesis, a number of papers on the research were published, listed within **Appendix F**. This was to ensure that the thesis was continuously reviewed by adding a quality control mechanism during the execution of the research project.

The DSR methodology employed during the research project follows a 5-phase iterative process, depicted within Figure 1-D and Figure 1-E The five iterative phases consist of (Hevner *et al.*, 2004; Vaishnavi & Kuechler, 2007):

1. Awareness [A1] – Problem identification and motivation (**Chapter 1**), identify the need and requirement for an enterprise architect instrument for the understanding of enterprise architects, to supplement existing EA frameworks and methodologies.
2. Suggestion [S1] – Defining objectives for a solution (**Chapter 2 & 3**), describing a tentative design for the enterprise architect instrument, with the alignment of the design artefact to the research objectives.
3. Development[D1-4] – Design (**Chapter 4 – 7**) and development of the design artefact and its components, the comprehensive list of EA factors and architect attributes, the EA schools of thought taxonomy and indicator, the architect style taxonomy and indicator, as well as the enterprise architect profiles.
4. Evaluation [E1] – Demonstration (**Chapter 8**) and evaluation of the design artefact as well as its technology-based solution.
5. Conclusion [C1] – Communication (**Chapter 9**) and presentation of the research and the contribution the research is making to the IS discipline.

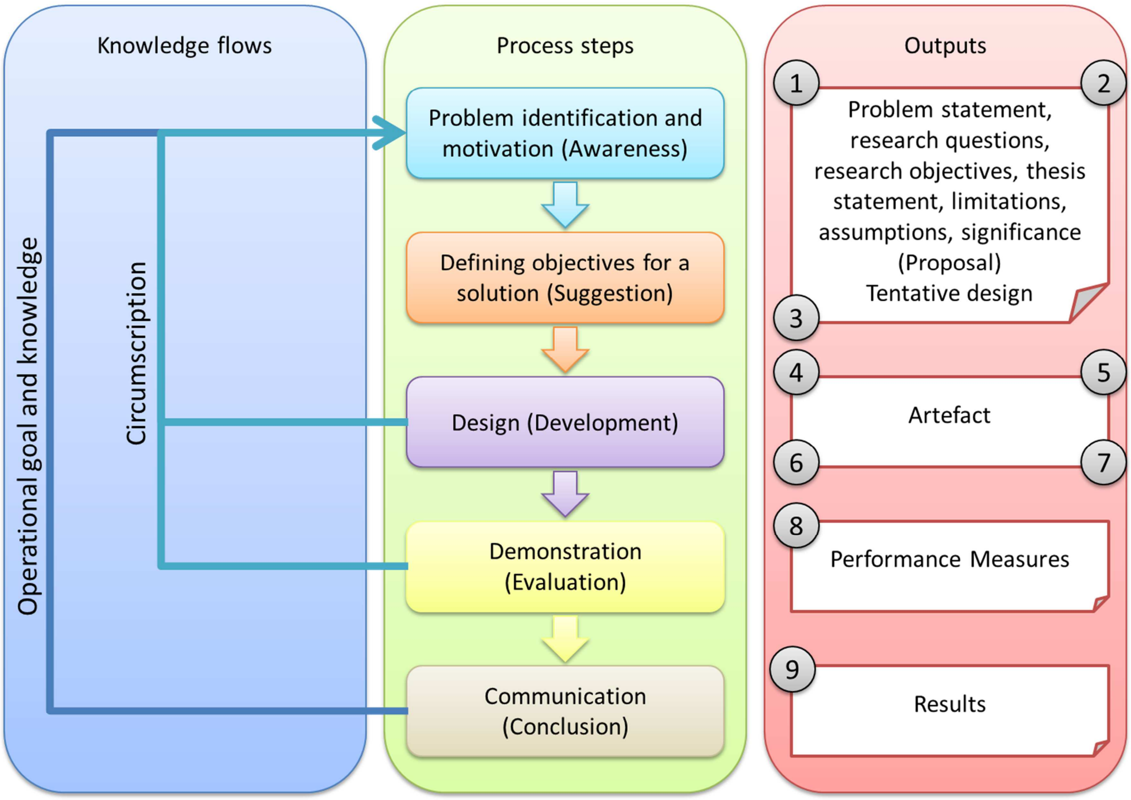



Figure 1-D: Thesis methodology, (based on Vaishnavi & Kuechler, 2007, p. 20)

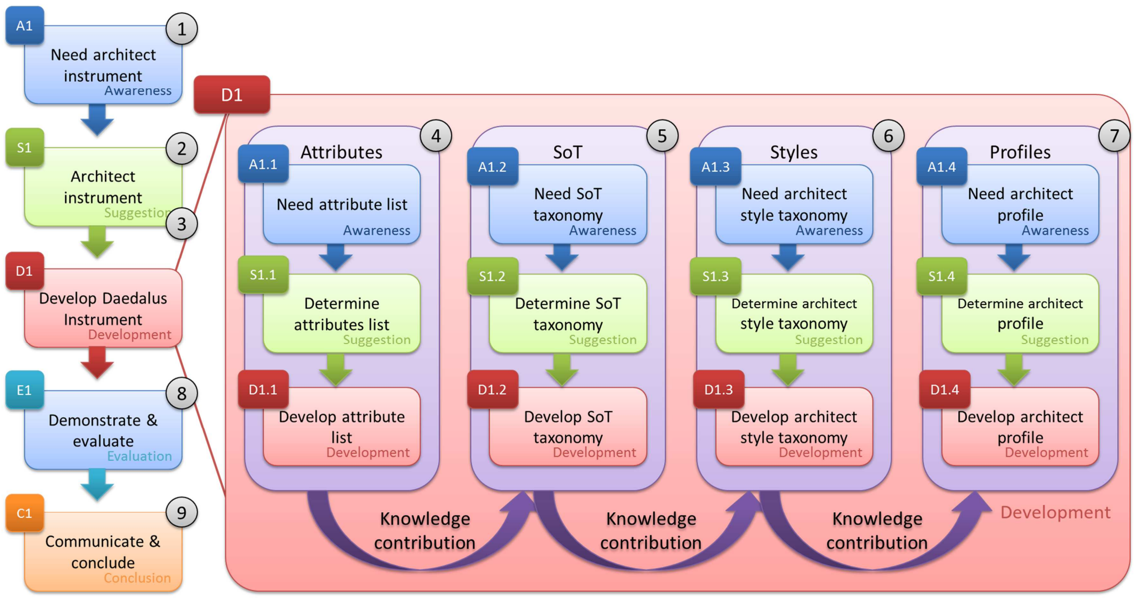



Figure 1-E: Design research phases as applied in the thesis

## 1.6 Delineations and limitations

To narrow down the scope of the research project, the research thesis is only concerned with the people aspect of the EA socio-technical system, the enterprise architect. Aspects regarding EA and EAM only refer to their relation to the enterprise architect itself.

## *1.7 Assumptions*

Assumptions are aspects accepted as being true without providing verification. The underlying assumptions of this study are:

- Different enterprise architect styles exist – the notion is that similar to personality types and people archetypes, that different architect styles exist and that the different styles can be determined.
- A viewpoint can be created to represent enterprise architect profiles – the notion is that sufficient information about the architect profiles can be determined in order to create a viewpoint for each architect profile.
- An instrument can be created to assist organisations in understanding the enterprise architect – the notion is that an instrument or set of tools can be created allowing organisations to determine the architect profiles of architects within their organisation.

## *1.8 Significance and expected contribution*

The rationale or foundation of this research is that similarly to people having different personality types, different beliefs and different cultures, so do enterprise architects. Enterprise architects might have different beliefs about what enterprise architecture is to them, how they would go about performing enterprise architecture management and why they belief EA should be done within an organisation. The motivation is centred on the understanding that a system considers people, process and technology; and to understand the entire system, the people forming part of the system need to be understood. The aim of the research is to understand enterprise architects, their belief systems, their opinions and what EA factors or architect attributes influence the style of architect.

Enterprise architecture has received a fair amount of attention from researchers, standards bodies, practitioners and governmental organisations over the last few years. A number of studies attempt to address the lack of a common understanding of EA (see **Chapter 2**). The research focused mainly on EA frameworks, methodologies, critical success factors, challenges, concerns and effectiveness (Armour *et al.*, 2012, 2007; Van Steenbergen, 2011). One way of mitigating the implications of the lack of conceptual clarity regarding EA is to consider the enterprise architect. Enterprise architects influence the efficiency and success of EA initiatives while residing in various roles within an organisation.

The goal of the research study is to create an instrument, which will allow organisations to understand their enterprise architects. This is done by considering and extending an existing classification on enterprise architect belief systems; proposing a way by which architects can be classified into the belief system categories; proposing different enterprise architect styles; and creating a mechanism to understand a specific architect based on their EA belief systems and enterprise architect style. This gives a view allowing for better understanding of the enterprise architect.

The aim is to create an enterprise architect instrument to complement existing EA frameworks and methodologies by allowing organisations to understand the people aspect of the enterprise socio-technical system.

## 1.9 Thesis overview

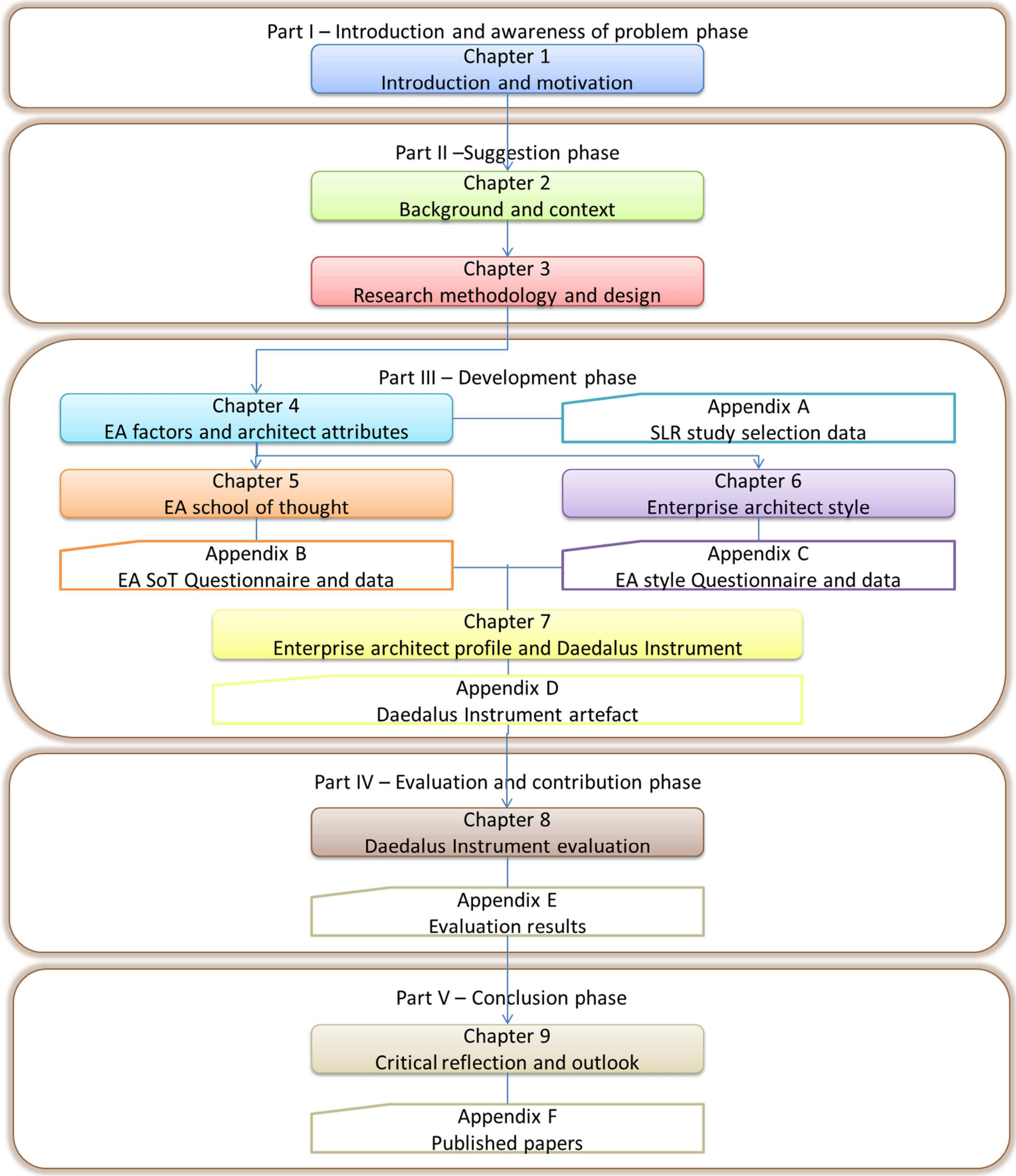



**Figure 1-F: Thesis chapter layout**

Figure 1-F graphically depict an overview of the thesis. This chapter, **Chapter 1** deals with the introduction and motivation for the thesis.

**Chapter 2** deals with the background and context of the research problem. The research problem and tentative design places EA frameworks and methodologies into context, using the open group architecture framework (TOGAF) as an example. The chapter continues to describe the motivation and need for an enterprise architect instrument.

A detailed description of the research methodology and design, explained in **Chapter 3**, covers an in-depth description of the available research methodologies, the research methodology components selected for this research study and how each of the research methodology components are applicable to this research study. In order to answer all the secondary research questions as well as the main research question, the thesis uses the DSR methodology to execute the research.

A comprehensive and in-depth SLR, given in **Chapter 4**, compiles a comprehensive list of various concepts related to the enterprise architect. The aim was to determine the various concepts related to the enterprise architect to provide a foundation for understanding the enterprise architect. The SLR and content analysis determine the concepts in literature relevant to the enterprise architect. A comprehensive list of concepts (EA factors and architect attributes) forms the first construct and input to the architect profile theory.

The systematic literature review assisted in determining what the common concepts are regarding enterprise architects. This will allow a better understanding of each of the architect profiles in order to determine the taxonomical basis of what constitutes each profile. The systematic literature review determines the various EA factors and architect attributes, which assist in determining the various architect profiles and determines if there is any other communality between the architects sharing the same profiles. EA factors refer to EA concepts enterprise architects encounter, such as EA frameworks, methodologies, tools and deliverables. Enterprise architect attributes on the other hand describe concepts of enterprise architects themselves, such as beliefs, behaviours and personal perspectives. It would point to a better understanding on whether any concepts influence an architect or steer them towards a specific profile.

EA factors and architect attributes identified within the systematic literature review were used to classify and categorise different concepts of enterprise architecture. This coding classification was used for the creation of the EA school of thought indicator as a construct. The EA school of thought indicator was based on the initial enterprise architect school of thought taxonomy (Lapalme, 2012a) as well as a systematic literature review and later revised during the data collection and analysis stage. This indicator provided a mechanism for organisations to determine which EA school of thought an architect would belong to, which is described in detail within **Chapter 5**. This questionnaire was then used to collect data to identify the EA school of thought taxonomy.

Based on the data collected from performing the survey on EA schools of thought and which EA school an architect would belong to, a taxonomy is created based on the identified EA schools of thought. A detailed definition and description of each of the EA schools of thought will be determined. This taxonomy will be based on the initial work on EA schools of thought (Lapalme, 2012a) as well as the aspects as they relate to enterprise architecture as defined within the systematic literature review. The identification and definition of the EA schools of thought taxonomy will be described in detail within **Chapter 5**. The EA schools of thought (taxonomy & indicator) construct will form the second construct and input into the architect profile theory.

Considering the associated research question, the objective is to formulate an enterprise architect style indicator, which allows organisations to determine, in a quantitative manner, which enterprise architect style an enterprise architect belongs to. The style indicator is guided and created based on findings from the systematic literature review and the study on the EA schools of thought. The enterprise architect style indicator is described in detail within **Chapter 6**. This questionnaire will then be used to collect data to identify the enterprise architect style taxonomy.

Based on the data collected from performing the study on enterprise architect styles and the verification of different EA schools of thought, a taxonomy was created identifying and defining the various enterprise architect styles. A detailed definition and description of each of the enterprise architect styles was determined. This taxonomy was based on the EA factors and architect attributes as they relate to enterprise architecture, as defined within the systematic literature review as well as the EA factors and architect attributes that were found to be relevant as part of executing the EA schools of thought survey. The identification and definition of the enterprise architect style taxonomy are described in detail within **Chapter 6**. The architect styles (taxonomy & indicator) construct forms the third construct and input into the architect profile.

The results from the EA school of thought study and the enterprise architect style study were analysed. Based on the results from the two studies as well as the definition of the two taxonomies, a view can be created to describe the various EA perspectives as they relate to the architect. The architect profile is described based on the creation of the identified concepts determined within **Chapter 4**, the constructs created within **Chapters 4, 5 and 6**. This view will describe the comprehensive list of EA factors and architect attributes, the identified EA schools of thought and the identified enterprise architect styles. In addition, the perspective of a specific enterprise architect would be included as it relates to the specific EA school of thought the architect would belong to and the specific enterprise architect style an architect would represent. This view will allow organisations to gain a detailed understanding of architects' belief systems and behavioural styles. The description of the enterprise architect profile will be described in detail within **Chapter 7**.

The underlying taxonomies, indicators and the enterprise architect profile would allow for the creation of an instrument or set of tools. This instrument can be used to understand enterprise architects and can be used in addition to other EA frameworks and EA management tools, such as TOGAF. The instrument will assist in understanding the people perspective within the people, process and technology knowledge areas. The instrument could potentially be automated to ensure a quick, consistent and a quality way to gain more insight into understanding the enterprise architect. The Daedalus Instrument for Architects will be described in more detail within **Chapter 7**.

An assessment is conducted in an enterprise architect practice to evaluate the usability, reliability and efficiency of the proposed technology-based Daedalus Instrument for Architects (DIA). The technology-based solution can be used by an organisation to efficiently determine the profile of an architect, to gain understanding of the belief systems and the behavioural styles of architects within the organisation. This assessment of the usability, reliability and efficiency of the technology-based solution is done using a presentation to an EA focus group. The technology-based Daedalus Instrument solution is described in detail in **Chapter 8**.

The communication, conclusion and summary of the research studies and thesis are described in the conclusion as **Chapter 9**. The research contributions and outcomes are reported in this last chapter. Findings from the awareness of the problem, tentative design suggestion, and the design and evaluation of the Daedalus Instrument are summarised highlighting the contributions the thesis is making to EA practitioners, EA stakeholders and researchers. The thesis is also concluded in **Chapter 9**.

Table 1-1 depicts a summary of the thesis.

**Table 1-1: Thesis summary**

| # | Sub-research question | Sub-objective | Concern | Chapter | DSR Process Step | Deliverable |
|---|---|---|---|---|---|---|
| 1 | What are the EA factors and architect attributes, associated with enterprise architects as described within literature? | Determine the enterprise architect associated EA factors and architect attributes described within literature. | Complete a systematic study on existing literature concerning the enterprise architect. | Chapter 4 – Systematic literature review | [D1.1] | List of EA factors and architect attributes |
| 2 | What are the core EA belief systems and associated EA schools of thought of enterprise architects? | Develop an EA schools of thought indicator for the consistent classification of EA schools of thought. | Create an instrument and classification allowing organisations to determine the EA schools of thought of enterprise architects. | Chapter 5 – EA schools of thought | [D1.2] | EA school of thought indicator + classification |
| 3 | What are the core behavioural styles and associated enterprise | Develop an architect style indicator for the consistent classification of the | Create an instrument and classification allowing organisations to determine the enterprise architect | Chapter 6 – Enterprise architect style | [D1.3] | Enterprise architect styles + classification |

| # | Sub-research question | Sub-objective | Concern | Chapter | DSR Process Step | Deliverable |
|---|---|---|---|---|---|---|
| | architect styles of enterprise architects? | enterprise architect styles. | styles of enterprise architect. | | | |
| 4 | What are the perspectives and associated enterprise architect profiles of enterprise architects? | Develop architect profile viewpoints for the understanding of the enterprise architect. | Create a viewpoint that describes the various aspects of enterprise architects as it relates to their enterprise architect styles and EA schools of thought. This viewpoint represents the architect profile enterprise architects have. | Chapter 7 – Enterprise architect profile | [D1.4] | Enterprise architect profiles |
| 5 | What tools can an organisation use to determine enterprise architect profiles? | Develop an instrument allowing organisations to understand enterprise architect profiles. | Compile an instrument allowing organisations to gain understanding into the architect as it relates to the various enterprise architect profiles. | Chapter 7 – Daedalus Instrument for Architects | [D1] | Daedalus Instrument for Architects |
| 6 | What technology-based solution can an organisation use to determine enterprise architect profiles? | Develop a technology-based solution allowing organisations to determine the profiles of enterprise architects. | Construct a technology-based solution allowing organisations to determine the profiles of enterprise architects. | Chapter 8 – Daedalus Instrument evaluation | [E1] | Technology-based Daedalus Instrument and evaluation |

## 1.10 Conclusion

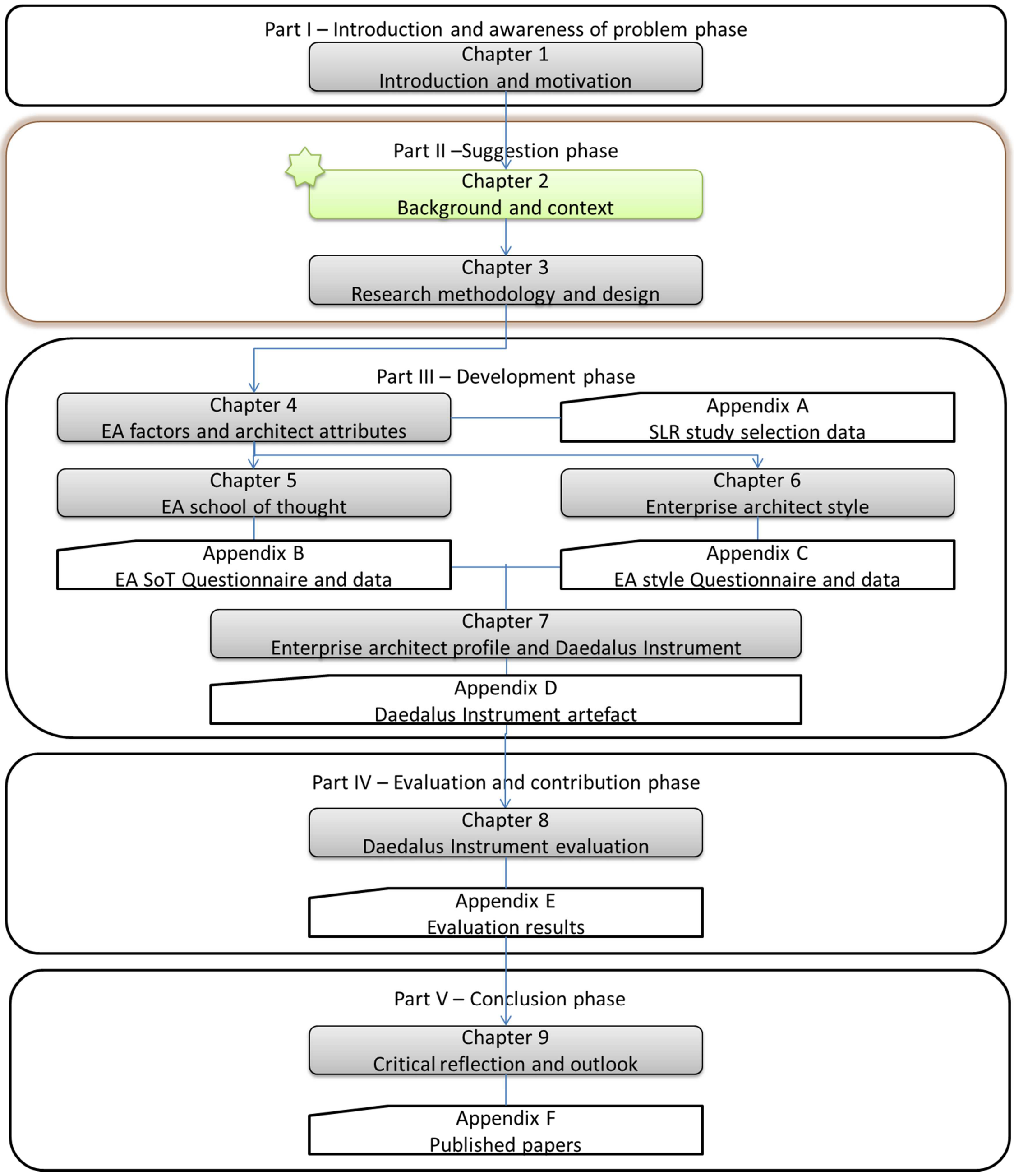
This chapter was used as an introduction and motivation for performing the research study (i.e. Understanding the architect in enterprise architecture: the Daedalus Instrument for architects) by considering the research problems, objectives, research methodology and design as well as providing a description of the expected contribution. Table 1-2 provides a summary of the thesis alignment.

**Table 1-2: Thesis alignment**

| Concept | Description |
|---|---|
| Title | Understanding the architect in enterprise architecture: the Daedalus Instrument for architects |
| Research purpose | Design an instrument allowing an organisation to understand the profiles of their enterprise architects. |
| Research objective | To design an enterprise architect instrument |
| Research question | What are the components of an architect instrument, assisting organisations to understand enterprise architects? |
| Contribution | Create an enterprise architect instrument to complement existing EA frameworks and methodologies by allowing organisations to understand the people aspect of the enterprise socio-technical system. |

As the research study would make use of design science research as a methodology, the next chapter, **Chapter 2**, will provide background and context by providing an awareness of the problem as described as the first step in the DSR methodology.

# 2 Background and context



## *2.1 Introduction*

With numerous enterprise architecture management (EAM) methodologies, frameworks, and tools, there is still no universally accepted standard on what Enterprise Architecture (EA) really means to practising enterprise architects (Buckl *et al.*, 2009; Buckl, 2011; Ernst, 2010; Mentz *et al.*, 2014). In this chapter, by applying the design science research model, the researcher creates an awareness of the difficulties resulting from a lack of a unified conceptual understanding of EA and then proposes an alternative way of overcoming the problem. By focusing on the architect's understanding of EA, the problem of trying to obtain a universally adopted and accepted definition of EA is avoided. Instead, the practical implications of not having a unified view of EA are mitigated.

### 2.1.1 Chapter layout

This chapter gives an awareness of the research problem and a suggestion of a tentative design to address the research problem. This is done in accordance with the design science research methodology, depicted within Figure 2-B. It deals with the motivation for the research study by identifying the research problem as a proposal. The chapter also provides a suggestion by highlighting the objectives and proposing a tentative design.

Part II of the thesis is concerned with the suggestion and tentative design in **Chapter 2** and **Chapter 3**. The background and context chapter, **Chapter 2** is divided into four main parts, depicted within Figure 2-A. Section 2.1 provides an introduction. Section 2.2 provides a detailed awareness of the research problem. The third section, Section 2.3, deals with the solution suggestion and what the solution objectives are. Finally, section 2.4 concludes the awareness and suggestion chapter.

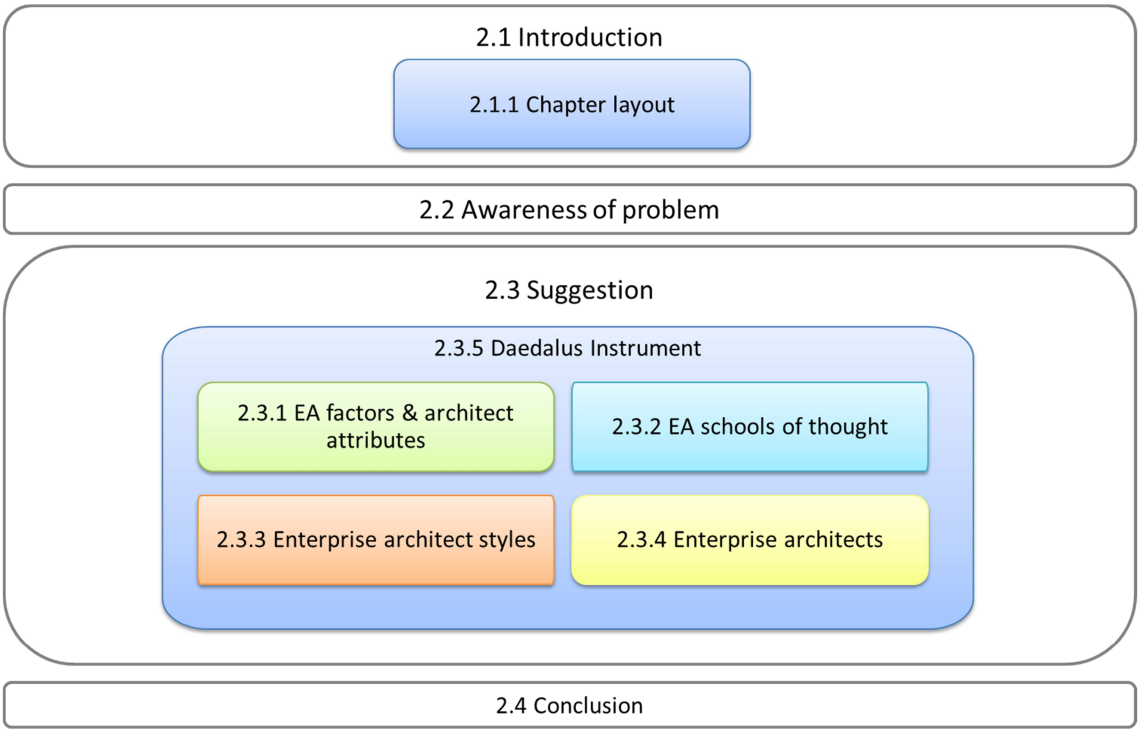



**Figure 2-A: Chapter layout**

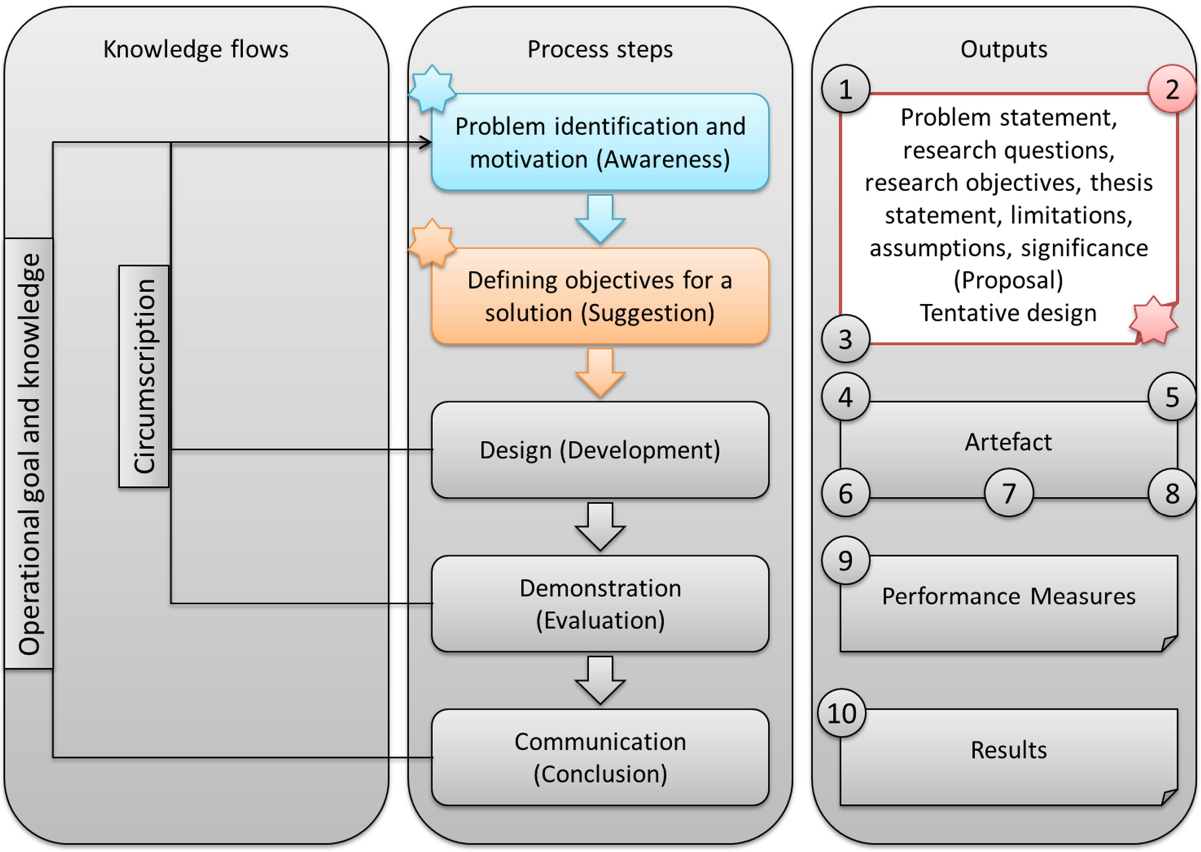



**Figure 2-B: Awareness and suggestion steps, (based on Vaishnavi & Kuechler, 2007)**

## 2.2 Awareness of problem

### 2.2.1 Defining EA

Several EA definitions exist (EARF, 2010; FEA PMO, 2007; Gartner, 2014; ISO/IEC/IEEE JTC1/SC7/WG42, 2011; Ross *et al.*, 2006; The Open Group, 2009, p. 9), each addressing EA from different perspectives; so much so that no universal definition of EA exists (Kappelman *et al.*, 2008; McCarthy, 2006; Rood, 1994; Simon *et al.*, 2013a). These perspectives represent EA as a continuous or management practice (EARF, 2010), a discipline (Bonnet, 2009), a framework or tool (Besker *et al.*, 2015; Pereira & Sousa, 2004), concepts of a system (ISO/IEC/IEEE JTC1/SC7/WG42, 2011; Lillehagen & Karlsen, 2006; Rood, 1994), the purpose of EA (Dankova, 2009; Ross *et al.*, 2006), a view or perspective (Jonkers *et al.*, 2006; Kotusev *et al.*, 2015), a political instrument (Kappelman *et al.*, 2008) or even EA as a process (Bernard, 2005). With so many diverse variations in the definition of EA, it is understandable that enterprise architects do not agree on what EA is (Mentz *et al.*, 2014; Rodrigues & Amaral, 2010; Schekkerman, 2004). It is not only the definitions that enterprise architects do not agree on; the inconsistency of EA frameworks, their analysis, selection, descriptions and characterisation (Abdallah & Galal-Edeen, 2006; Greefhorst *et al.*, 2006; Lim *et al.*, 2009; Ohren, 2005; Tang *et al.*, 2004) are also problematic. These inconsistencies or the lack of commonality can also be interpreted using different perspectives, indicating that the EA discipline is developing (Simon *et al.*, 2013a) or simply a "horrible mess" (Schöenherr, 2009). Various approaches exist for the integration of EA frameworks (Adenuga & Kekwaletswe, 2013; Magoulas *et al.*, 2012; Zarvić & Wieringa, 2006), for selecting the most appropriate EA framework (Cameron & McMillan, 2013; Odongo *et al.*, 2010; Sessions, 2007), or for the application of EA within the organisation (Alghamdi, 2010; Franke *et al.*, 2009; Kozina, 2006; Leist & Zellner, 2006; Magoulas *et al.*, 2012; Urbaczewski & Mrdalj, 2006).

Some authors tried to address this concern of diversification by proposing a solution framework for the consistent classification of EA terms (Langenberg and Wegmann, 2004). Others argued that the definition and description of EA terms are technically correct, but that enterprise architects do not use these terms in a technically correct manner, i.e. enterprise architects' understanding of the EA terms differ (Goethals, 2005). Another approach proposed to address the lack of commonality is to investigate EA in terms of a shared structure and to develop an EA core theory (Schöenherr, 2009) or to make use of propositions to describe the intended meaning of EA (Mentz *et al.*, 2014).

Taking a people perspective in trying to understand the lack of agreement with EA terms, Kappelman *et al.* (2008) state that the lack of agreement is due to the different interpretations of what the word 'enterprise' means and what the word 'architecture' means, where the understanding of enterprise implies scope, and the understanding of architecture implies purpose. Continuing with the theme of architects' understanding of the EA terms, Lapalme (2012a) approached this diversity concern by considering the beliefs and belief systems of enterprise architects and why they define EA in a certain manner. Lapalme investigated the EA definitions of several EA authors and academics and determined a golden thread in the way these individuals defined EA by addressing both EA scope and EA purpose in their individually defined EA definitions. It is this diversification in the understanding of what EA is, that led Lapalme to the realisation that three distinct schools of thought exist for the enterprise architects that share the same beliefs on what EA means to them (Lapalme, 2012a).

As the EA discipline still has no universally agreed definition for EA, even though it was highlighted as a concern more than two decades ago by Rood (1994), not having an agreed definition has some implications for the field and the discipline of EA.

### 2.2.2 Implications

The absence of an universal acceptable EA definition or commonality regarding the description of EA frameworks and EA terms, leads to unintended consequences or implications for developing the EA discipline (Boucharas *et al.*, 2010). For example, the uncertainty regarding the core EA literature makes it difficult for new researchers to enter the discipline (Mykhashchuk *et al.*, 2011). The implications of not having a universal understanding of EA stretches from the competency of enterprise architects (Lu & Lin, 2012) and the curriculum of EA programs in higher education facilities (Morneau & Talley, 2007) to the use of EA as a political instrument (Kappelman *et al.*, 2008) and the realisation of EA as a profession (Besker *et al.*, 2015).

As was argued above, the different attempts to address the problem by some academics and EA practitioners, can hardly be considered successful in finding a universal way to execute an EA initiative or project. The approach of Lapalme (2012a), namely to accept that people (enterprise architects) are diverse and have different beliefs in terms of EA, seems to hold much promise.

Rather than defining a new EA definition or a new EA framework, a more practical approach is therefore to understand enterprise architects within their environment. Knowing that people are diverse and have diverse views, it is more practical to understand the enterprise architect and why they hold certain views regarding enterprise architecture.

In Greek mythology, the function and importance of the architect become evident with Daedalus as the architect and creator of the Labyrinth on Crete (Fenyvesi *et al.*, 2013). Architects not only need to understand the environment they operate within, they also need to understand the problem and the context of the situation they find themselves in as well as the understanding of the conceptual foundations of EA thinking and practice (Mentz *et al.*, 2014). The context of the situation is complicated by the opinions and belief system of the architect. This observation is apparent in the almost de facto answer "it depends", which is given to respond to a number of questions asked about EA, e.g. 'How would you define EA?'. In addition, the organisation has several challenges and concerns to face with respect to the enterprise architect. The role of the enterprise architect will change depending on the circumstances of the organisation (Strano & Rehmani, 2007), such as the organisation size, organisation type, and organisational governance (Shah & Kourdi, 2007). Depending on the role of the architect, the architect will make use of different techniques or competencies to fulfil the specific role resulting in different benefits and success rates (Van Steenbergen *et al.*, 2011).

As there is still no globally universal standard on what constitutes EA by different practising architects (Buckl *et al.*, 2009; Buckl, 2011; Ernst, 2010; Mentz *et al.*, 2014); architects spend much time arguing and disagreeing. The matter is complicated by the notion that enterprise architects perform their duties within an organic system, a socio-technical system (Doherty & King, 2005; Lapalme & De Guerre, 2012). Within these ecological systems, changes are inevitable, challenges are rife, and differences in opinions are the order of the day (Armour *et al.*, 2008, 2008; Chuang & Van Loggerenberg, 2010). With this dynamic and constant changing environment organisations risk an increase in complexity (Ross *et al.*, 2006; Van Steenbergen *et al.*, 2011). This change manifests itself within areas such as business process, information, software products, and technology that the enterprise architect has to manage.

From researching disciplines such as sociology and psychology, we know that we are all individuals and even though we have the same profession, it does not imply we have the same personality, worldview or belief system. When considering EA and the architect, many aspects need to be considered to better understand architects within their environment. This thesis aims to address the problem of commonality in the understanding of EA by instead of contributing to the on-going attempt to find such conceptual clarity, rather focusing on a practical level on understanding enterprise architects, their profiles and their perspectives and understanding the dynamics of the architect as it relates to EA and EAM.

## *2.3 Suggestion*

The concern is that enterprise architects do not think the same about what EA is and how to do EAM, essentially not agreeing on the definitions of EA (Kappelman *et al.*, 2008; Mentz *et al.*, 2014; Simon *et al.*, 2013a). As a consequence of this difference in characteristics, opinion or outlook, it leads to the disagreement about language and terminology (Schöenherr, 2009). Several authors focus on trying to understand the role the enterprise architect plays (Strano & Rehmani, 2007), the competency an architect should have to be competent in EAM (Steghuis & Proper, 2008), the belief systems enterprise architects have concerning EA (Lapalme, 2012a) and the profession of enterprise architecture (Besker *et al.*, 2015). This thesis however addresses the concern by understanding enterprise architects as people; by understanding enterprise architect profiles. To allow organisations to truly comprehend the architect in enterprise architecture, there needs to be a simple usable instrument that can guide and inform enterprise architects and EA stakeholders alike on the different profiles of enterprise architects.

An instrument can be seen as "a tool or device used for a particular purpose; especially: a tool or device designed to do careful and exact work" (Merriam-Webster, 2014). An instrument should not be confused with a framework, which can be seen as "the basic structure of something: a set of ideas or facts that provide support for something" (Merriam-Webster, 2014).

The open group architecture framework (TOGAF) is an EA framework: it provides a basis of support on how to go about executing EAM, it provides various components such as the Architecture Development Method (ADM), the Architecture Content Framework, the Enterprise Continuum and Tools, the TOGAF reference models and the Architecture Capability Framework (The Open Group, 2009).

However, TOGAF mentions few components, which affect several aspects as it relates to the enterprise architect, depicted within Figure 2-C.

These components are developed to assist architects in the EAM process but not to understand how these components affect the architect's way of thinking or behaving about EA and EAM. In this respect, TOGAF largely ignores the understanding of the architect, the people aspect, and focuses primarily on the process and technology aspects.

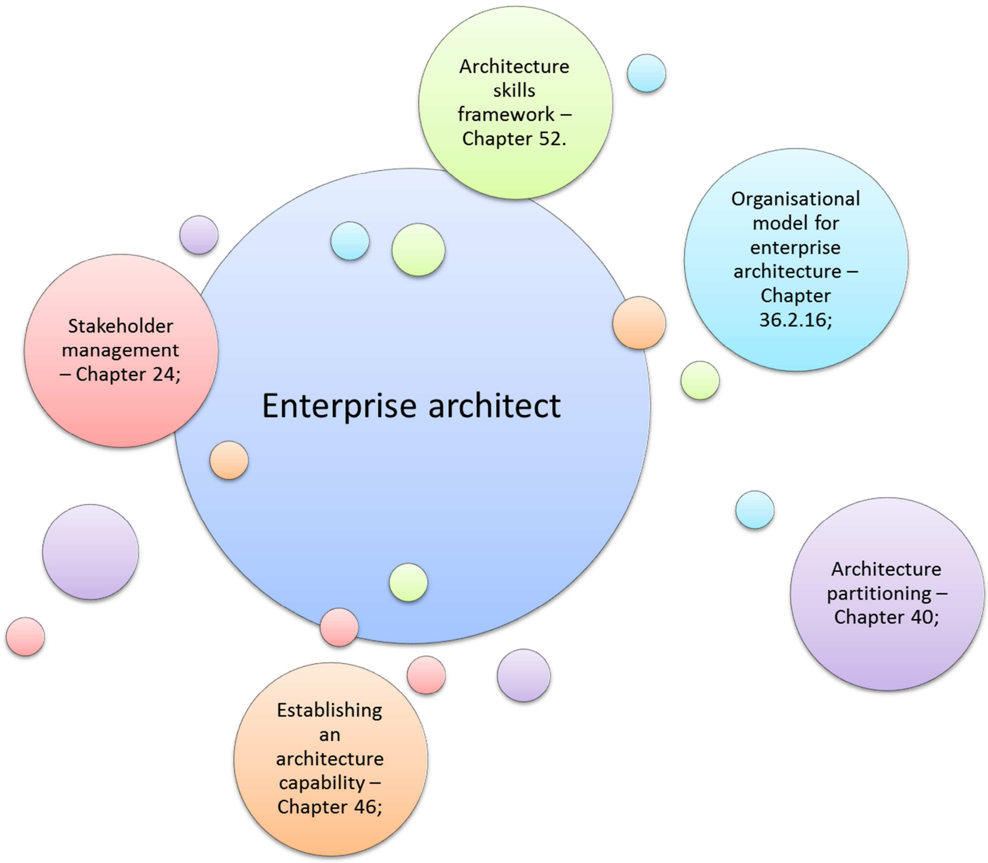



**Figure 2-C: Aspects in TOGAF affecting the enterprise architect (The Open Group, 2009)**

In order to understand the EA system in its entirety, popular EA frameworks such as TOGAF, DODAF and FEA need to adequately address the people aspect or be supplemented using an enterprise architect instrument. Organisations, architects and stakeholders alike need to understand the motivation and drive behind their beliefs and behaviour on EA and EAM.

The Daedalus Instrument suggested by this research, is a set of tools to be used by organisations, architects and EA stakeholders alike for the specific purpose of understanding the architect. The Daedalus instrument is named after Daedalus from Greek mythology, the architect of the Labyrinth on Crete, which was designed and constructed to imprison the Minotaur. Daedalus is also considered to be the 'first' known architect. The Daedalus Instrument aims to fill the gap in EA frameworks, such as TOGAF, by addressing the people component.

The proposition is to develop an instrument that could supplement EA frameworks such as TOGAF on addressing the need to adequately manage and understand enterprise architects. The instrument can be used as a set of tools to determine enterprise architect profiles, what each architect's styles and schools of thought are and their aligned EA factors and architect attributes, thus supplementing EA frameworks by addressing the people component, as depicted within Figure 2-D. EA frameworks such as TOGAF concentrate on what artefacts are produced and how these artefacts should be produced. The understanding of the enterprise architect, as the people aspect in the trio of system perspectives, is not addressed with TOGAF. This is where the Daedalus Instrument for Architects or DIA can supplement existing EA frameworks by addressing the people aspect in this trio of system perspectives.

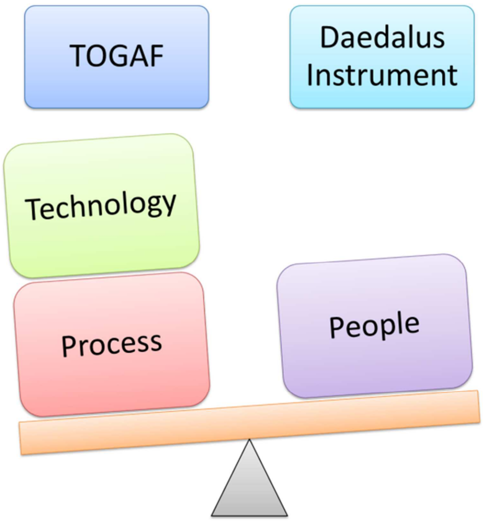



**Figure 2-D: Daedalus Instrument supplements understanding of the architect to TOGAF**

Without a set of tools or an instrument that can assist organisations in understanding the different profiles of enterprise architects, there might never be a common understanding of why enterprise architects execute EAM differently, how they work together as a team, how they go about doing EAM, or what impact it has on EAM efficiency and success within the organisation (Van Steenbergen, 2011; Van Steenbergen *et al.*, 2011).

From the identification and motivation described within Section 2.2 the first awareness of the problem on which the research would focus is:

***MRQ:*** ***What are the components of an architect instrument, assisting organisations to understand enterprise architects?***

### 2.3.1 Social cognitive theory

The design of the Daedalus Instrument for Architects (DIA) makes use of the social cognitive theory as a foundational theory for the understanding of enterprise architects' profiles when operating within their respective EA practices or socio-technical environment (Bandura, 1986). The theoretical model explains psychosocial functioning in terms of three mutual connections (personal factors, behavioural factors and environmental influences), as depicted within Figure 2-E.

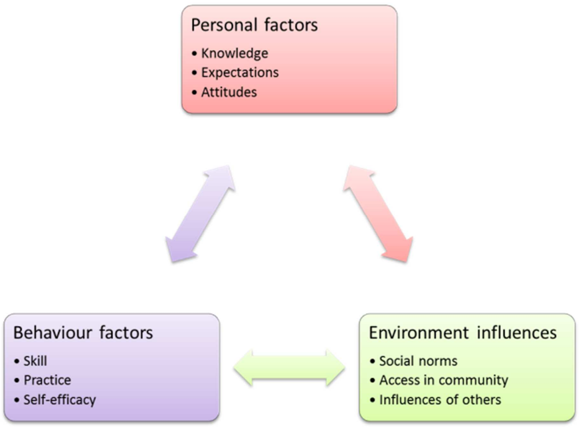



**Figure 2-E: Social cognitive theory connections (Bandura, 1986)**

In this foundational structure, behaviour, personal factors and environmental influences operate as interacting elements that influence each other in a bidirectional manner.

Social cognitive theory assumes an agentic perspective to change, adaptation, and self-development (Bandura, 2001). Agents intentionally influence their own functioning and life circumstances. In this interpretation, people are proactive, self-organising, self-reflecting, and self-regulating. People as agents contribute to their circumstances of life and are not just products of their circumstances. This human agency includes core features, such as intentionality and temporal extensions. These intentions include strategies and action plans to realise their intentions. Temporal extensions include setting goals, anticipating certain outcomes and take action to guide their efforts. As human functioning is ingrained in social systems, personal agency functions within a complex system of socio-structural influences, where people create social systems to guide human activity. Human learning is thus not just based on trial-and-error activities but also social modelling where people learn from observing other people (Bandura, 2005).

Enterprise architect can be seen as change agents, influencing their own actions and their understanding of enterprise architecture, which were influenced by their previous learning experience from their own activities, the observation of others and the environment in which they operate. Their understanding of EA is also influenced by specific organisational context and their specific activities. As a result no one enterprise architect will have the exact same understanding of EA as they all had different learning experiences, different influences and different skill sets. It is these differences in the human agency, which makes the understanding of a specific concept such as enterprise architecture so complex. Rather than focusing on getting the enterprise architects within an organisation to share the same understanding of enterprise architecture, this thesis proposes to develop an enterprise architect instrument or set of tools, which allows organisations to understand the different enterprise architects, thereby ensure that those architects sharing a similar architect profile, also share the same understanding of enterprise architecture.

The Daedalus Instrument for Architects (DIA) makes use of social cognitive theory by considering enterprise architect profiles, described within **Chapter 7**; taking into account the personal factors of the enterprise architect as the EA schools of thought, described within **Chapter 5**; architect attributes, described within **Chapter 4**; the behavioural factors as enterprise architect behavioural styles, described in **Chapter 6**, as well as EA factors, described within **Chapter 4**, influencing their socio-technical environment, as depicted within Figure 2-F.

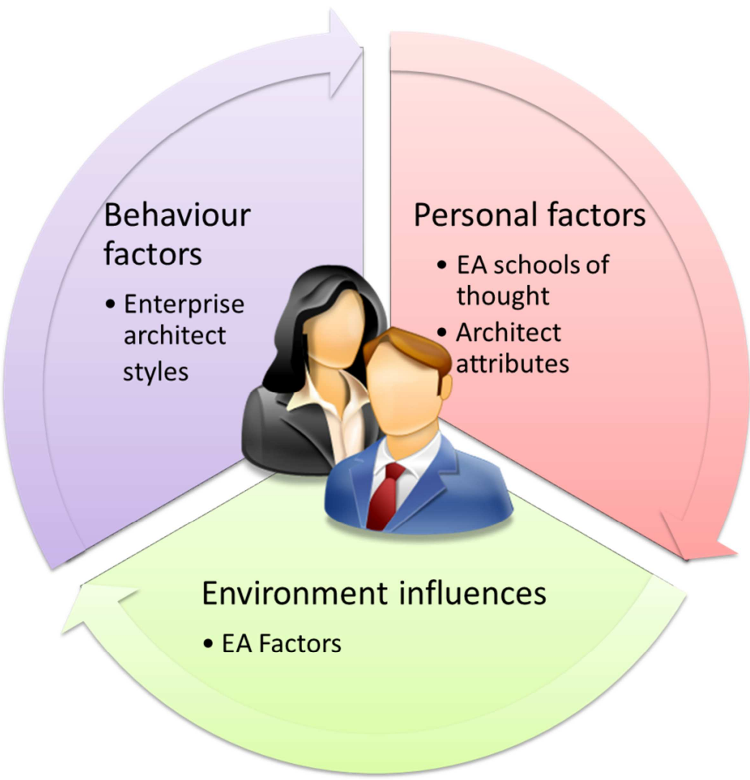


**Figure 2-F: Enterprise architects profile, based on Bandura (1986)**

### 2.3.2 EA factors and architect attributes

A Systematic Literature Review (SLR) was executed to determine aspects that are associated with the enterprise architect. The SLR follows general rules to ensure good quality information is included within the study (Biolchini *et al.*, 2005; Mian *et al.*, 2005). It was executed in this manner to obtain relevant results, which allows for the identification, selection and production of research evidence.

The SLR concluded with a comprehensive list of EA factors and architect attributes found within current literature, depicted within Table 2-1. The EA factors and architect attributes list form the first component of the Daedalus Instrument, which is also used as input into the next internal development design science research (DSR) cycle.

**Table 2-1: Comprehensive list of EA factors and architect attributes – Tentative design**

| # | EA factor | Architect attribute |
|---|---|---|
| 1 | Factor | Attribute |
| 2 | Factor | Attribute |
| 3 | Factor | Attribute |
| 4 | Factor | Attribute |
| 5 | Factor | Attribute |

### 2.3.3 EA schools of thought

A survey was executed to determine if any of the EA factors and architect attributes identified within the SLR, are relevant to the understanding of enterprise architects' belief system. A survey study was used to question architects around the world using a questionnaire, where each question within the questionnaire is aligned to a specific EA factor or architect attribute to explore any relevance to architects' belief systems.

The shared belief systems of architects on EA, groups architects into the same EA school of thought, with the understanding of scope and purpose being directly related to the motivation behind decisions, and is concerned with the architect and not EA or EAM. Lapalme emphasised that "EA scope" and "EA purpose" form the foundation of the EA belief system and defines which EA school of thought an architect belongs to (Lapalme, 2012a) , depicted in Figure 2-G.

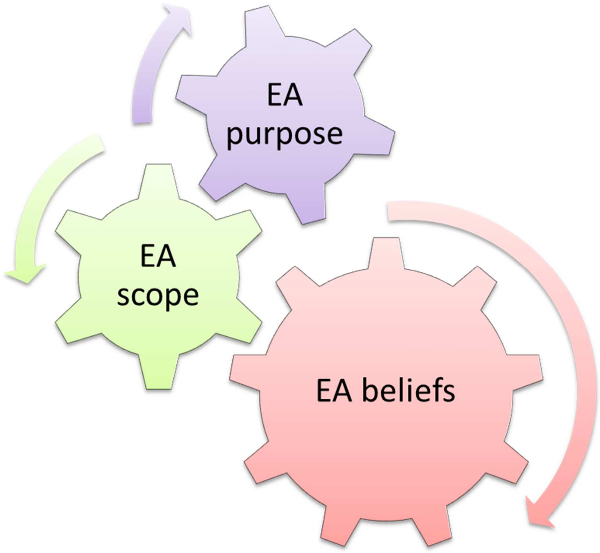



**Figure 2-G: Enterprise architect belief system – Tentative design**

### 2.3.4 Enterprise architect styles

A survey was executed to determine if any of the EA factors and architect attributes identified within the SLR, are relevant to the understanding of enterprise architects' behavioural style. A survey study was used to question enterprise architects within South African organisations using a questionnaire, where each question within the questionnaire aligned to a specific architect attribute to explore any relevance to architects' behavioural style in terms of architect roles and competencies.

Architect roles represent the different roles architects can fulfil in their duties as enterprise architects, while architect competencies represent the different competencies architects are proficient at while assuming a specific architect role.

Architect roles (Akenine, 2008; Gøtze, 2013; Ouriaghli & Nsubuga, 2012; Strano & Rehmani, 2007) and architect competencies (Bredemeyer & Malan, 2004; Lu & Lin, 2012; Steghuis & Proper, 2008; Tambouris *et al.*, 2012) address behavioural aspects with regards to enterprise architects (Ouriaghli & Nsubuga, 2012; Strano & Rehmani, 2007; Tambouris *et al.*, 2012). Architect roles and architect competencies are closely related (Akenine, 2008; Gøtze, 2013; Ouriaghli & Nsubuga, 2012; Steghuis & Proper, 2008; Strano & Rehmani, 2007) and are crucial in the understanding of enterprise architects' behavioural aspects or styles (Gøtze, 2013; Strano & Rehmani, 2007).

Understanding the behavioural styles classification scheme allows for the better understanding of enterprise architects in terms of their architect roles and architect competencies, as depicted within Figure 2-H.

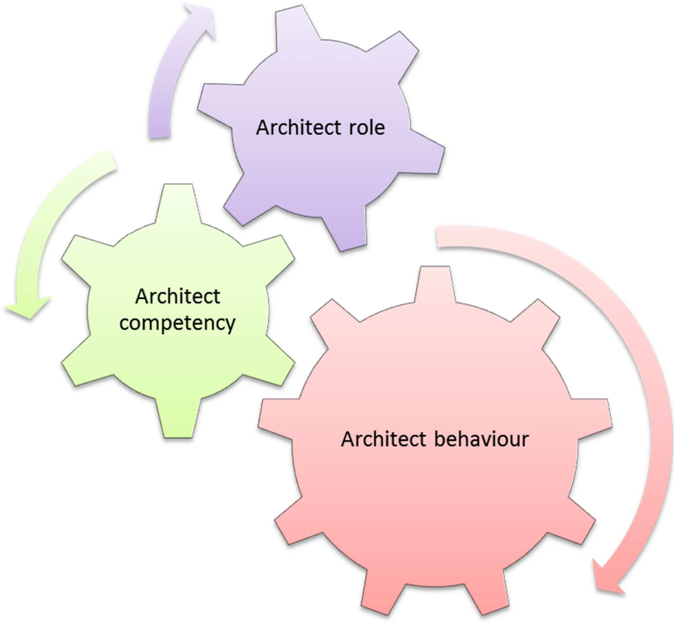



**Figure 2-H: Enterprise architect behavioural styles – Tentative design**

### 2.3.5 Enterprise architect profiles

Architects' rationale profiles can be determined based on architect aligned EA factors and architect attributes as well as their belief systems (EA schools of thought) and their behavioural styles (Architect styles) regarding enterprise architecture. A tentative design for the development of the architect rationale profiles are depicted within Figure 2-I and Figure 2-F.

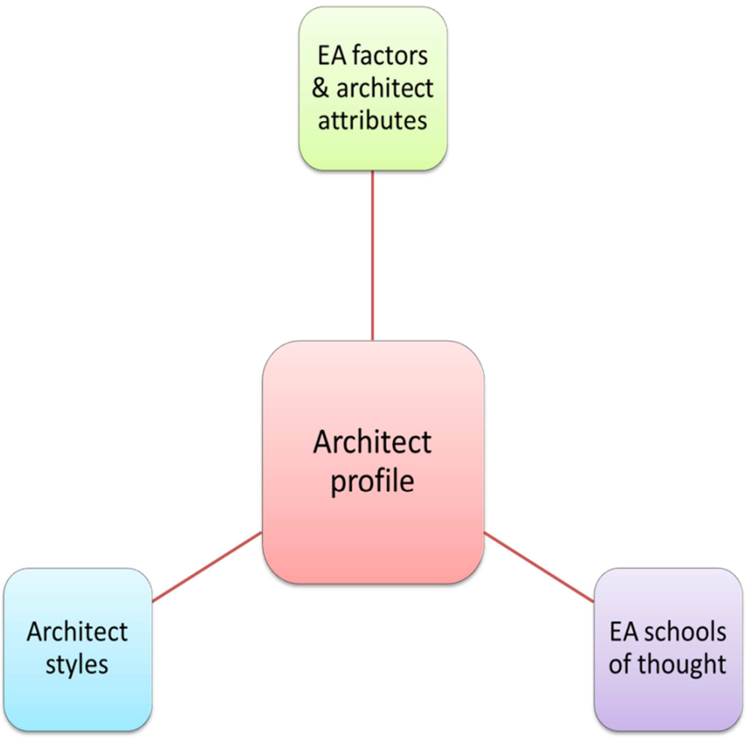



**Figure 2-I: Enterprise architect profiles – Tentative design**

### 2.3.6 Daedalus Instrument for Architects (DIA)

The comprehensive list, EA schools of thought, architect styles and architect profiles align to the:

- research questions
- research objectives
- thesis chapters
- design science research process steps
- design science research deliverables

The components together form a set of tools called the Daedalus Instrument, which allow organisations and architects alike to understand the architect profiles. The Daedalus Instrument can supplement existing EA frameworks to better allow organisations to understand architects. EA frameworks such as TOGAF focus on EAM process and tools. However, EA is concerned with more than just the process and technology, which includes the architect. Zachman understands the context of EA, and as such has developed an ontology (Zachman Framework Ontology), which acts as the foundation for understanding the enterprise (Zachman Enterprise Framework) and also the enterprise-produced product (Zachman Product Framework) developed by professionals (Zachman Profession Framework) within the enterprise (Kotzé, 2011; Zachman, 2011).

A tentative design of all the components included within the Daedalus Instrument is suggested within Figure 2-J.

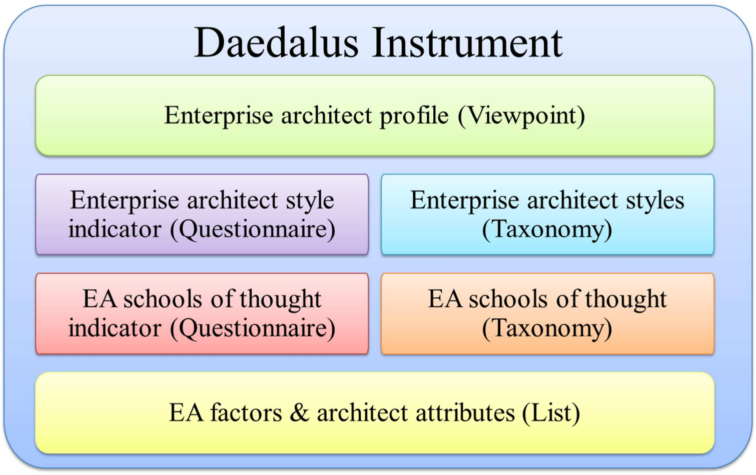



**Figure 2-J: Daedalus Instrument for Architects (DIA) – Tentative design**

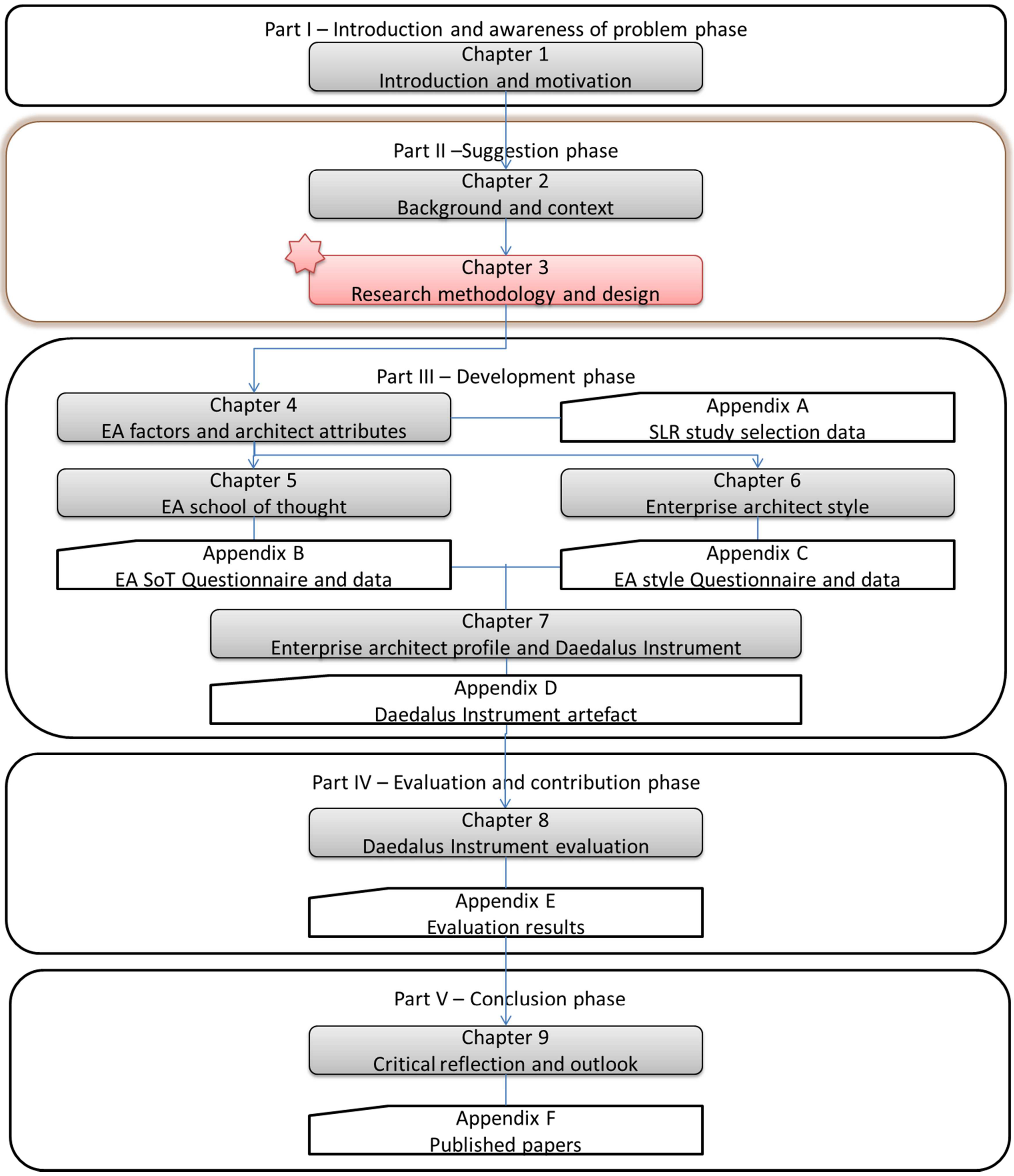
## *2.4 Conclusion*

There are still no universally accepted standard on what EA really means to practising enterprise architects (Buckl *et al.*, 2009; Buckl, 2011; Ernst, 2010; Mentz *et al.*, 2014). This manifests itself in the number of available EA frameworks, methodologies, tools and EA definitions available. Rather than trying to get universal agreement on these concepts, this research thesis took an alternative approach to address the problem by focusing on the architect's understanding of EA.

Social cognitive theory was use to understand the enterprise architect, which led to the different perspectives of enterprise architects being investigated. These are the EA belief systems, the behavioural styles and the enterprise architect attributes that architects associate with. The proposed solution to the problem was for the development of an instrument or a set of tools that would supplement existing EA frameworks by addressing the people perspective. EA frameworks and specifically TOGAF have a significant focus on EA tools and EA methods, concentrating mainly on EA-related process and technology. Little consideration is given to the people aspect of enterprise architecture. Although TOGAF addresses several components within the EA framework that touches on the architects, the organisation and stakeholders, those components are described from the perspective as a tool to be used by the architect to performing EAM. Thus, TOGAF does not consider the understanding of the architect or the architect from the people aspect and how the relationship between people process and technology is influenced because of architects' belief systems and behavioural styles when performing EAM.

The Daedalus Instrument for Architects or DIA should address this gap in EA frameworks by supplementing the EA frameworks with an instrument that will assist architects, organisations and EA stakeholders to understand the EA schools of thought, the EA styles and the EA factors and architect attributes that influence the different architect rationale profiles. Understanding the different enterprise architect rationale profiles should assist organisations to form better architect teams by understanding the different perspectives architects might have when executing an EA initiative.

# 3 Research methodology and design



## 3.1 Introduction

**Chapter 1** gave an introduction and provided a motivation for the thesis, while **Chapter 2** presented the background and context of the thesis and the research problem. This chapter deals with research methodology and design, providing background on existing research philosophies, methodical choice, strategies, time horizon with techniques and procedures, as well as addressing how the research was done in order to answer the research questions and achieve the research objectives. This chapter provides the research justification for the research approach in order to address the main research question and objectives including a definition of the scope and limitations of the research design.

Part II of the thesis is concerned with the suggestion and tentative design. The research methodology and design chapter, **Chapter 3,** is divided in four main parts, as depicted within Figure 3-A. Section 3.1 provides an introduction. Section 3.2 provides background on existing research methodologies including research philosophies, methodical choices, strategies, time horizons as well as techniques and procedures. The third section, section 3.3, deals with the research design applicable to this study including the motivation on why it is applicable. The chapter sections on research methodology and design follow the research onion model, as depicted within (Saunders & Tosey, 2012).

Both sections 3.2 and 3.3 within the chapter include several subsections describing the various aspects of research as it relates to the field of information systems research. Finally, the chapter concludes with a summary in section 3.4.

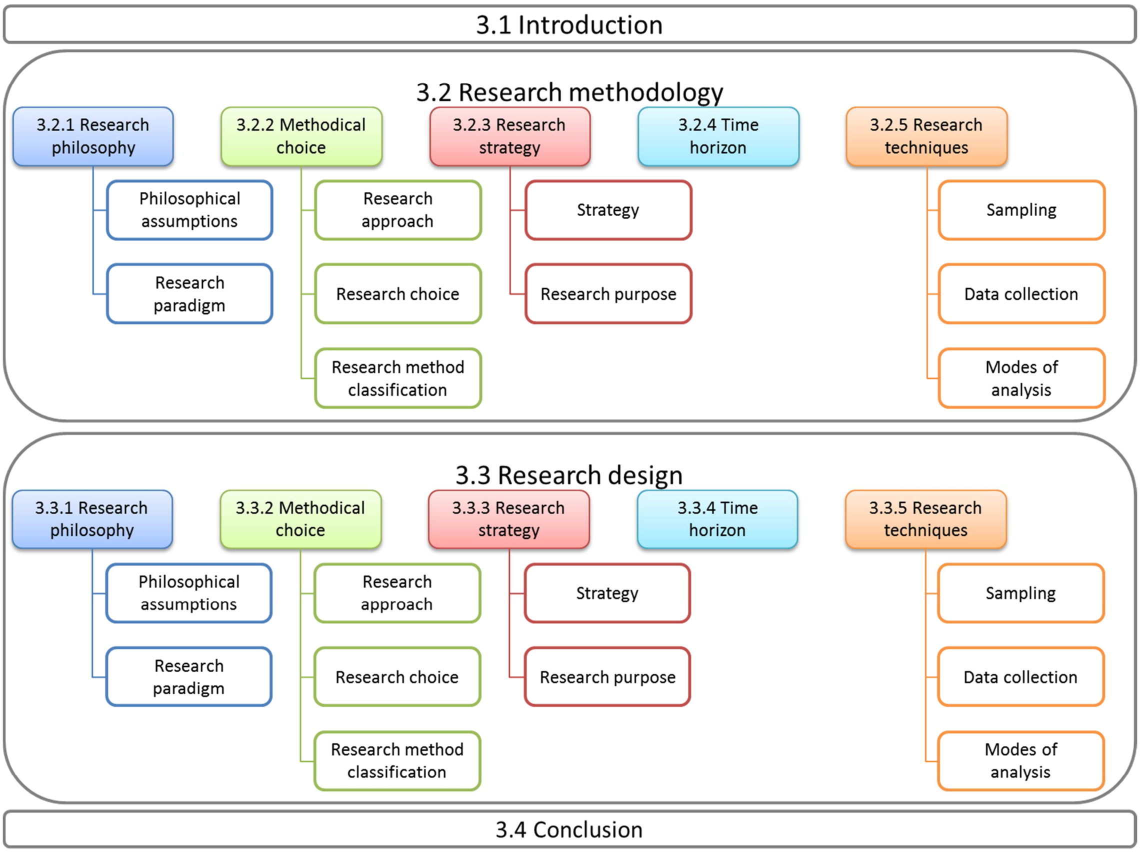



**Figure 3-A: Chapter layout**

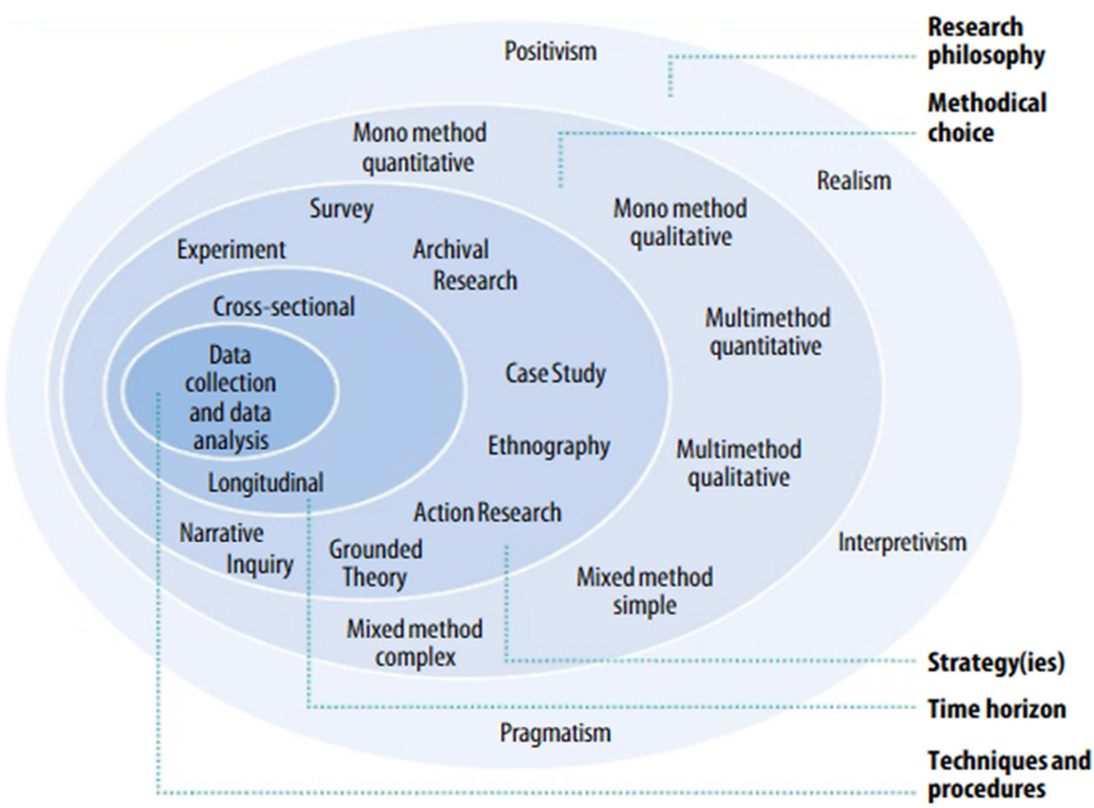



**Figure 3-B: The research onion (Saunders & Tosey, 2012, p. 59)**

## 3.2 Research methodology

Within each subsection of this section, the background, terminology and definitions are explained and described. The research onion, depicted within Figure 3-B, is used as a model for describing the research methodology and design. Section 3.2.1 describes research philosophies in context of the research at hand. Section 3.2.2 depicts the methodical choice, while section 3.2.3 illustrates the research strategies used in Information Systems, while section 3.2.4 illustrates time horizon and finally section 3.2.5 identifies the different research techniques and procedures available.

### 3.2.1 Research philosophy

This subsection describes the background, terminologies and definitions of research philosophies.

#### 3.2.1.1 Philosophical assumptions

Considering research philosophy, all research is based on primary assumptions on what research methods are suitable and what constitutes binding research (Myers, 1997). The key importance is to understand the obvious assumptions as well as the hidden assumptions of the research. Philosophical assumptions about the nature of social science can be described in four distinct categories (Myers, 1997; Terre Blanche *et al.*, 2006).

*Ontological assumptions*: Describe the nature of reality, which forms the basis of metaphysics. It is concerned with the very essence of the phenomena under investigation, i.e. what is the form and nature of reality?

*Epistemological assumptions*: Concerned with the grounds or nature of knowledge, understanding and communicating the knowledge to others (Hirschheim, 1985), i.e. what is the researcher's basic belief about knowledge? It refers to the kind of relationship between the researcher and the research phenomenon being studied. Epistemological categories or paradigms are discussed in more detail in section 3.2.1.2.

*Axiological assumptions*: The study of human values primarily concerned with human nature, i.e. the relationship between human beings and their environment. It aims to answer questions regarding what values an individual or group holds and why.

*Methodological assumptions*: Concerned with the methods used in scientific inquiry, i.e. how the researcher investigates and acquires knowledge concerned with the research subject. A research method classification is discussed in more detail in section 3.2.2.3.

The axiological assumptions (Saunders *et al.*, 2009) are separate from the ontological and the epistemological assumptions as it describes assumptions about human values. The three assumption categories mentioned also have implications of a methodological nature (Burrell & Morgan, 1985). These four sets of assumptions can then be conflated into a polarised 'subjective-objective' dimension, stating that the research can be subjective or objective depending on the assumptions of the nature of social science. Figure 3-C graphically depicts one dimension representing assumptions of the nature of social science.

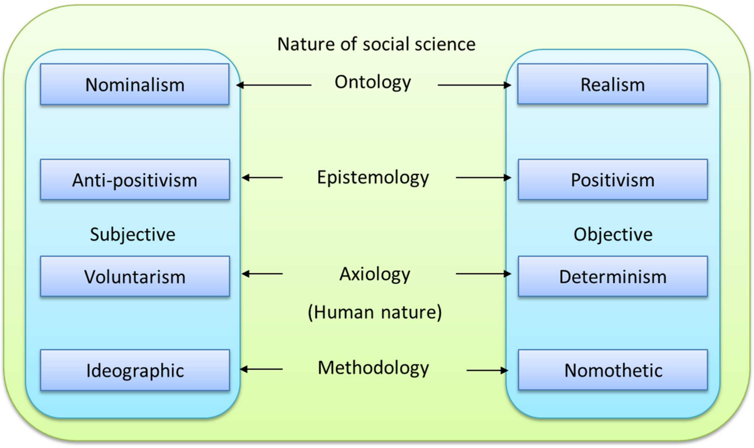



**Figure 3-C: Assumptions about the nature of social science (Burrell & Morgan, 1985)**

Considering the ontological viewpoint, realism assumes that a researcher sees the world as separate and independent of their consciousness, whereas the nominalism is assuming that there is no real invariant structure external from the researcher.

Referring to the epistemological viewpoint, positivism assumes the researcher can objectify the phenomena under investigation i.e. the object and the subject of study can be separated whereas from an anti-positivism viewpoint, it denies any objective reality and is essentially relativistic in claiming that reality can only be studied from the point-of-view of the individuals directly involved in the research.

Concerning the axiological (human nature) viewpoint, determinism regards human beings and their activities as being completely determined by the situation in which they are located, contrasted to the viewpoint of voluntarism where human beings are completely autonomous and free-willed.

Regarding the methodological viewpoint, the nomothetic approach emphasises the importance of basing research upon systematic protocol and technique, which in contrasts to the ideographic approach, which is concerned with understanding the world as a social system by obtaining first-hand knowledge of the subject being researched.

Unlike the first dimension describing the assumptions of the nature of social science, Figure 3-C, a second dimension, presented in Table 3-1, describes the characterisation of the nature of society (Burrell & Morgan, 1985), which is based on the work of Dahrendorf describing two theories of society categorised by 'conflict' and 'order' (Hirschheim & Klein, 1989).

**Table 3-1: Characterisation of the nature of society (Burrell & Morgan, 1985)**

| Sociology of regulation | Sociology of radical change |
|---|---|
| The status quo | Radical change |

| Sociology of regulation | Sociology of radical change |
|---|---|
| Social order | Structural conflict |
| Consensus | Modes of domination |
| Social integration and cohesion | Contradiction |
| Solidarity | Emancipation |
| Need satisfaction | Deprivation |
| Actuality | Potentiality |

Taking into consideration the nature of social science as well as the nature of society, a two-dimensional taxonomy is used to describe the classification of the theories resulting in a four quadrants matrix. Each quadrant corresponds to a specific paradigm in sociology, which most researchers strongly align and associate with. The quadrants are graphically depicted in Figure 3-D.

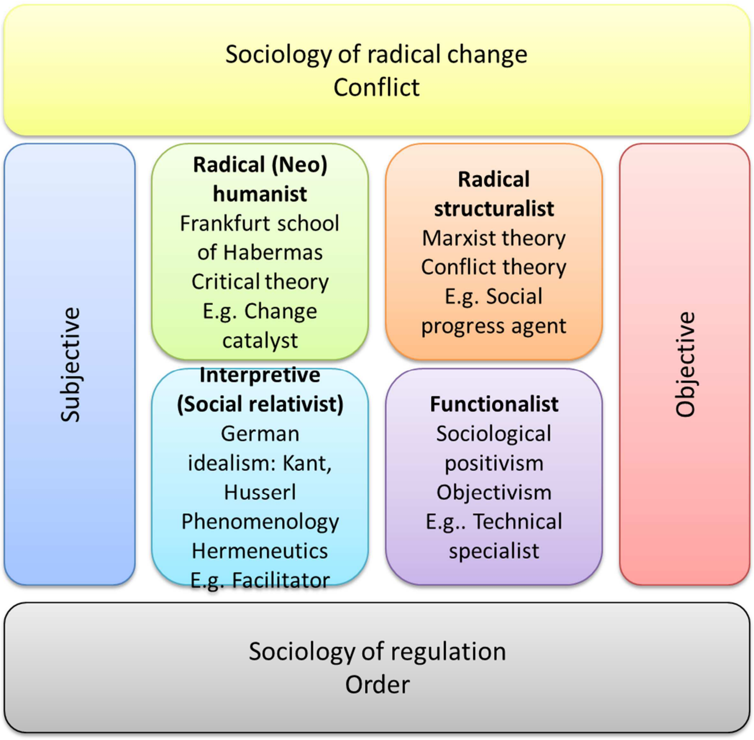



**Figure 3-D: Social theory paradigm (Burrell & Morgan, 1985; Hirschheim & Klein, 1989)**

### 3.2.1.2 Research paradigm

Similarly to the four paradigms described by Burrell and Morgan (1985), Myers (1997) described three research paradigms: positivist, interpretive and critical. Research paradigms can also be referred to as research philosophies.

*Positivist*: Positivist research falls within the functionalist paradigm. The positivist paradigm assumes that reality is presented objectively, and can be described by measurable properties, which are independent of the researcher. Positivism primarily assumes that a single truth can be discovered and that they reside in a regular ordered world. Positivist studies usually attempt to test theory, to increase the predictive understanding of occurrences (Fitzgerald & Howcroft 1998; Myers, 1997; Oates, 2005; Orlikowski & Baroudi, 1991).

Positivism can be traced back to the founding father, French philosopher Auguste Comte (1798-1857) in his book “A general view of positivism”, where he developed the doctrine of positivism (Comte, 2009). As a guide, positivists’ research attempts to test hypotheses to find greater understanding of the research phenomena. Positivist research includes evidence of theory testing, formal propositions, drawing inferences about phenomena, and quantifiable measures of variables (Orlikowski & Baroudi, 1991).

Similar to positivist paradigm, interpretivists share the belief that they reside in a regular ordered world (Burrell & Morgan, 1985). Initially interpretive paradigm was not as prominent in Information Science discipline; many researchers have looked beyond positivism and seen the necessity for interpretivism within the information science discipline.

*Interpretive*: The interpretive paradigm assumes that access to reality is only through social constructions such as language, consciousness and shared meanings. Interpretive studies usually attempt to understand experiences, rather than predicting experiences, through the meanings that people assign to them (Klein & Myers, 1999; Myers, 1997; Oates, 2005; Orlikowski & Baroudi, 1991; Terre Blanche *et al.*, 2006). During the research process, the researcher interacts with human subjects, thereby changing the preconceptions and perceptions of both parties, thus, as a result, value-free data cannot be obtained. Interpretive methods of research in information systems are "aimed at producing an understanding of the context of the information system, and the process whereby the information system influences and is influenced by the context" (Walsham, 2006, 1993, pp. 4–5).

Interpretivists have a worldview that reality is socially constructed only through shared meaning, consciousness and language. Unlike positivists, interpretivists attempt to understand the research phenomena through the interpretation people give to it. Interpretive research methods attempt to understand the information system context as well as the interdependent relationship between the information system and its context (Walsham, 1993). Researchers conducting and evaluating interpretive research can follow a set of suggested principles as described by Klein and Myers ( 1999). Examples of interpretive research approach to qualitative research can be found in the work of Walsham and Boland (Boland, 1991; Walsham, 1995a, 1993).

Unlike the positivist and interpretive paradigms, which assumes a regular ordered world, the critical paradigm has a conflict and coercion view of the world.

*Critical*: The critical paradigm assumes that social reality is historically constituted, which is produced and reproduced by people. Critical researchers recognise that people’s ability to change their social and economic circumstances, is constrained by various forms of cultural, social and political domination (Myers, 1997; Oates, 2005; Orlikowski & Baroudi, 1991; Terre Blanche *et al.*, 2006).

Critical research studies are mainly concerned with social critique and highlighting the restrictive and alienating conditions of the status quo. It concentrates on the conflicts, contradictions and oppositions in society and tries to emancipate society from the causes of domination and alienation.

Table 3-2 exhibits a summation of the different philosophical assumptions (ontology, epistemology, axiology and methodology) with respect to their research paradigms (positivist, interpretive, and critical) based on the works of Myers (1997) and Terre Blanche *et al.* (2006).

**Table 3-2: Philosophical assumptions and research paradigms taxonomy (Myers, 1997; Terre Blanche *et al.*, 2006)**

| Philosophical assumptions / Research paradigm | Positivist | Interpretive | Critical |
|---|---|---|---|
| Ontology | • Single stable reality<br>• Law-like | • Multiple realities<br>• Socially constructed | • Socially constructed reality<br>• Discourse<br>• Power |
| Epistemology | • Objective<br>• Detached observer | • Empathetic<br>• Observer subjectivity | • Suspicious<br>• Political<br>• Observer constructs versions |
| Axiology | • Truth (objective)<br>• Prediction | • Contextual understanding<br>• Researcher's objective values | • Inquiry is value bound<br>• Contextual understanding<br>• Researcher's values affect the study |
| Methodology | • Experimental<br>• Quantitative<br>• Hypothesis testing | • Interactional (participative)<br>• Interpretation<br>• Qualitative | • Deconstruction<br>• Textual analysis<br>• Discourse analysis |

Research philosophies are independent from research approach and strategies, although most often certain research approaches are better suited to a specific research philosophy. Research approaches are discussed in more detail in the following section (section 3.2.2).

### 3.2.2 Methodical choice

Although it might not add value or have little value, the chosen research philosophy could have a potential correlation with the fitting research approach.

The methodical choice allows the researcher to make a better-informed decision about the research design being undertaken. It assists the researcher in choosing the correct research strategy for the research topic and allows the researcher to adapt the research design to cater for any unforeseeable constraints (Easterby-Smith *et al.*, 2008; Saunders *et al.*, 2009).

#### 3.2.2.1 Research approach

The research approach determines whether the research makes use of a *deductive* approach or an *inductive* approach. With a deductive approach, the researcher develops a hypothesis and designs a research strategy to test the hypothesis. With an inductive approach, the researcher collects data and develops a theory as a result of the data analysis (Saunders *et al.*, 2009). Table 3-3 depicts the major differences between the different research approaches.

**Table 3-3: Research approach differences (Saunders *et al.*, 2009, p. 120)**

| Deduction emphasises | Induction emphasises |
|---|---|
| Scientific principles | Gaining an understanding of the meanings humans attached to the event |
| Moving from theory to data | A close understanding of the research context |
| The need to explain causal relationships between variables | The collection of qualitative data |
| The collection of quantitative data | A more flexible structure to permit changes of research emphasis as the research progresses |
| The application of controls to ensure validity of data | A realisation that the researcher is part of the research process |
| The operationalisation of concepts to ensure clarity of definition | Less concern with the need to generalise |
| A highly structured approach | |
| Researcher independence of what is being researched | |
| The necessity to select samples of sufficient size in order to generalise conclusions | |

### 3.2.2.2 Research choice

The research choice is primarily based on what is best suited for the thesis; depends on what research techniques are used, and in which way the thesis utilised these techniques. This also determines whether the data collection and data analysis techniques (research method classification), are *qualitative* or *quantitative*.

Selecting a research choice for the thesis is partly based on whether a single or several methods are used in conjunction with qualitative or quantitative data collection and analysis techniques. The research choice is graphically depicted in Figure 3-E to illustrate the point.

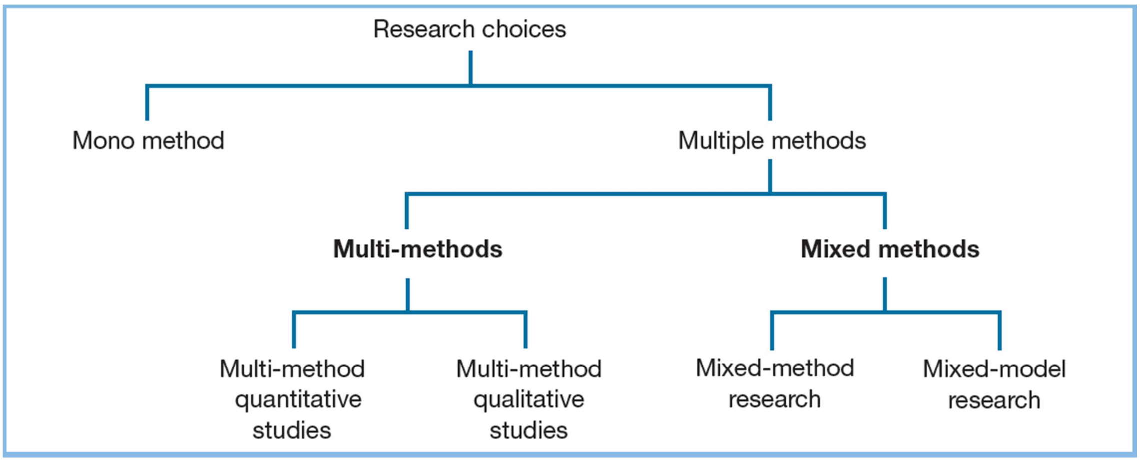



**Figure 3-E: Research choices (Saunders *et al.*, 2009, p. 146)**

### 3.2.2.3 Research method classification

Research methodology refers to the theory of how research is undertaken, while research methods refer to techniques and procedures used to obtain and analyse data (Saunders *et* *al.*, 2009). Research methods are most often affected by the purpose of the research, which is often referred to as the nature of the study.

Together with the research purpose, the researcher considers the classification of research methods. Research methods can be classified according to two distinct categories, *quantitative* and *qualitative* research methods.

Quantitative refers to any data collection or data analysis technique that produces or uses numerical data. Quantitative research methods were developed primarily to study natural phenomena as part of the natural sciences discipline. Quantitative methods used within the social sciences include methods such as laboratory experiments, survey methods, mathematical models and econometrics (Myers & Avison, 2002).

In contradiction to quantitative research methods, qualitative research methods refer to any data collection or data analysis techniques that produce or use non-numerical data, which includes data such as images and videos (Saunders *et al.*, 2009). Qualitative research methods were developed to study social and cultural phenomena. These methods were designed to assist researchers to understand people and the cultural and social context in which people work and live. Several qualitative methods exist, which include methods such as action research, ethnography and case study research. Qualitative data sources can include observations, fieldwork, questionnaires and interviews, documents and archives, as well as the researcher's own interpretations (Galliers & Land, 1987; Hirschheim, 1985; Markus, 1983; Mingers & Stowell, 1997).

Depending on the research philosophy and the philosophical assumptions of the researcher, the research may be qualitative or quantitative. Although research philosophy is associated with specific research methods, there is no direct relationship between them (Klein & Myers, 1999; Orlikowski & Baroudi, 1991; Walsham, 2006, 1995b).

The research choice and method classification directly relates to and influences the selection of research techniques and procedures, described within section 3.2.5. Regardless of the research choice and method classification, the research strategy represents the underlying model that operationalises the study (De Villiers, 2005). The research strategy is a process, plan of action, or design conveying the research approach and choice combination and use of research methods. In addition, the researcher always considers the nature of the research topic; the time available for the research study; the extent of risk being taken; as well as the audience of the completed research. The following section, section 3.2.3, describes various strategies available to the researcher.

### 3.2.3 Research strategy

The selection of research strategy is determined by several predetermined factors, including the research questions and objectives; the degree of existing knowledge on the research topic; the available amount of time and other resources to conduct the research; the researcher's philosophical foundations; and the purpose of the research.

#### 3.2.3.1 Strategy

*Experiment* – Experiments are considered the 'gold standard' for rigour against what research strategies are measured against. It is a classical research strategy often used within the natural sciences. An experiment involves the definition of a theoretical hypothesis; selection of samples from known populations; random allocation of samples; the introduction of planned intervention; the measurement on a small number of dependent variables; and the control of all other variables (Saunders *et al.*, 2009).

*Action research* – Action research is an interventionist approach to acquire scientific knowledge. Action research can be explained in two simple steps: firstly, the diagnosis and the analysis of the social situation by which a hypothesis is formulated, and secondly the performing of change experiments in a collaborated manner whereby the effects are studied (Baskerville & Wood-Harper, 1998). This is a strategy where the researcher is involved and can influence the research study itself.

*Grounded theory* – Grounded theory is a theory that is inductively and systematically arrived at through on-going collection and analysis of data (Glasser, 1978; Strauss & Corbin, 1994). The research process begins with no preconceived ideas or existing theories; it is grounded systematically in the data. The process starts with no research problem, just curiosity in a particular area whereby the research problem becomes evident during data collection (Glasser, 1978; Strauss & Corbin, 1994).

*Survey* – The survey strategy is popular with the deductive approach in business and management research, where it is commonly used to answer the six interrogative pronoun questions. As a result, survey use is widespread in exploratory and descriptive research studies. Surveys are used for the collection of sizeable amounts of data from a large population in an efficient and economical way. A frequent data collection technique used in a survey strategy is to make use of a questionnaire, which allows standardised data to be easily compared. This gives the perception that the survey strategy is authoritative or convincing. As the survey strategy leans towards the deductive approach, it allows for the collection and analysis of quantitative data. A researcher can use a survey strategy to investigate possible relationships between variables and generate models of the identified relationships. The survey samples need to be representative of the greater population, so the researcher is required to get a good response rate and to plot the data collection instruments. A well-executed survey strategy gives the independence required for a deductive approach. Other data techniques popular with the survey strategy, is to make use of structured observation and structured interviews (Saunders *et al.*, 2009). As the survey strategy is so popular, it does not guarantee a research strategy without any problems.

Although not common, surveys can be used successfully with other research strategies in a multi-method research study (Gable, 1994).

*Ethnography* – Ethnography aims to describe and explain the social world inhabited by the researcher. The study is normally a longitudinal study, naturalistic and involves extended participant observation (Saunders *et al.*, 2009). The ethnography research strategy involves the use of three elements in combination: firstly, the researcher makes use of a set of ethnographic data-gathering methods, including participant observation, formal and informal interviewing and in some instances the analysis of documentary sources; secondly, the methods are grounded in theory; and thirdly, these methods are applied in the context of a distinctive philosophical stance (Forsythe, 1999).

*Case study* – A case study can be described as "a strategy for doing research which involves an empirical investigation of a particular contemporary phenomenon within its real life context using multiple sources of evidence" (Robson, 2002, p. 178). The strategy provides a strong understanding of a real life setting, which uses and triangulates multiple sources of data. The strategy is in complete inverse of the controlled experiment research strategy and differs from the survey strategy in the ability to explore and understand the research context (Saunders *et al.*, 2009). This strategy is well suited for instances where the thesis is concerned with the research context and the processes being performed. It is also useful where answers are sought surrounding motivation or "why" questions are being asked. It implies that the case study research strategy is well suited for exploratory and explanatory research. A case study can be classified in one of four ways and based on a two dimensional quadrant of single case v. multiple case and holistic case v. embedded case (Yin, 2003). The case study research strategy focuses on understanding the dynamics present within a specific settings. It combines data collection methods such as interviews, questionnaires, archives and observations. The data collected and analysed may be qualitative, quantitative, or both (Eisenhardt, 1989). Case studies can also be applied to build theories as in the example of Eisenhardt (1989) and an interpretive case study research strategy of Walsham (Benbasat *et al.*, 1987; Walsham, 2006). An example of a multiple case study research approach is that of Benbasat *et al.*, Gable, Broadbent and Weill, and Cavaye and Cragg respectively (1987; 1993; 1995; 1994).

*Archival research* – The archival research strategy makes use of administrative records and documents as the principal source of data. The research strategy allows answering research questions, which focus on the past and are constrained by the nature of records and documents (Saunders *et al.*, 2009).

*Design science research* – The concept of design science research and specifically design science research in information systems involves "learning through the act of building" (Kuechler & Vaishnavi, 2008, p. 489). Building a new and innovative design artefact is the primary concern (Hevner *et al.*, 2004); in doing so the artefact addresses the primary research problem or question (Vaishnavi & Kuechler, 2007). The design artefact must be effectively described, ensuring the implementation and application of the design artefact within its intended domain. Weaknesses may be identified during research assessment, resulting in a subsequent need for refinement and reassessment of the design artefacts (Hevner *et al.*, 2004).

Design can be seen as both a verb and a noun; as both the method and the resulting artefact. Design in essence is both an incremental and an iterative activity and can be seen as "knowledge in the form of techniques and methods for performing this mapping — the knowhow for implementing an artefact that satisfies a set of functional requirements" (Vaishnavi & Kuechler, 2007, p. 9).

Taking into consideration design as a verb, defining the incremental and iterative activity or the method on how to perform design science research, design science research is an iteration of five distinct phases or process steps as depicted within Figure 3-F.

1. *Awareness of problem* – The awareness of a problem can originate from multiple sources. The awareness can be because of new industry developments, from reference disciplines or from academic research publications. The resulting output of the awareness phase is an informal or formal proposal used as justification for a new research study.
2. *Suggestion* – The suggestion phase, closely linked and following immediately after the awareness phase, is concerned with providing a tentative design. The suggestion phase defines the objectives for a solution and is in essence a creative phase wherein new functional components are proposed based on an innovative configuration of a combination of new or existing elements. The tentative design can for example be reified by a prototype or proof-of-concept.
3. *Development* – The tentative design is further refined in an incremental and an iterative activity resulting in the implementation of the complete design artefact during the development phase. The implementation techniques differ depending on the specific design artefact being constructed. It is not essential for the artefact implementation to be innovative, as the innovation is concentrated within the design and not necessarily the construction of the artefact. The foundation of the cyclic iteration, describing the progress from partial completion of the development cycle back to awareness of the problem phase, is indicated by the circumscription flow.
4. *Evaluation* – On completion and creation of the artefact, the artefact is evaluated according to the criteria defined within the awareness phase. The evaluation is done using qualitative or quantitative methods and any deviations from initial expectations are tentatively explained. Rooted within the evaluation phase is an analytic sub-phase in which exploratory hypotheses about the behaviour of the

artefact are made. The evaluation results, together with any additional information gained, form the development phase feedback into another iteration of the suggestion phase. These iterative suggestions, development and evaluation cycles or circumscription, nurture the explanatory hypothesis until such time that it is assessed as sufficient.

5. *Conclusion* – The conclusion phase is the final phase of the research study, which results in the development of a reasonable artefact, or where the behaviour of the artefact is pronounced as being of a satisfactory state. It is not a necessity that the artefact be optimal in its performance. In conclusion, of the research study, the research results are consolidated and presented. Research findings and other knowledge gained as part of the research study are classified as either facts or anomalies, which might serve as motivation for further research.

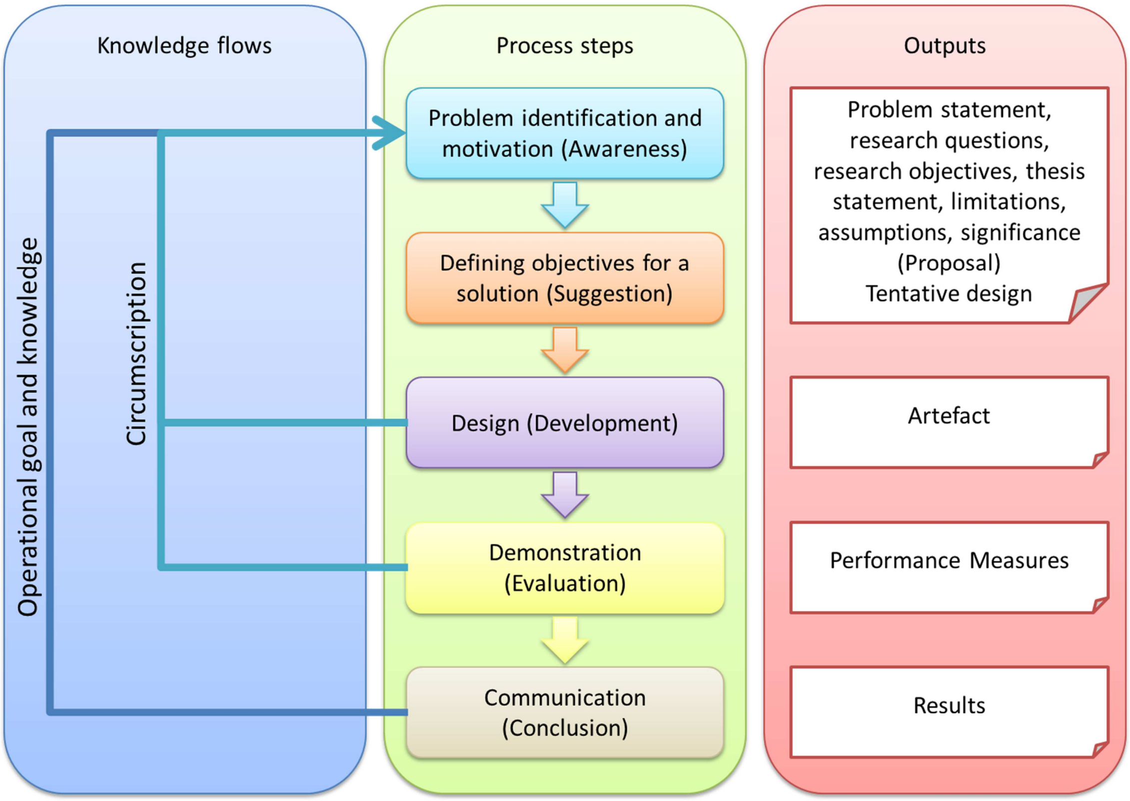



**Figure 3-F: Design science research methodology (Vaishnavi & Kuechler, 2007, p. 20)**

Considering design as a noun resulting in a design artefact, artefacts or outputs for design science research can be classified in one of five categories (Hevner & Chatterjee, 2010; Hevner *et al.*, 2004; Vaishnavi & Kuechler, 2007, 2004), namely:

1. Constructs: Constructs represent the conceptual language in which solutions and problems are described and communicated, i.e. vocabulary and symbols. Constructs result from the conceptualisation of the problem and subsequently refined throughout iteration of the design cycle.

2. Models: A model is "a set of propositions or statements expressing relationships among constructs" (Vaishnavi & Kuechler, 2007, p. 13). Models represent the relationship between the solution components and the research problem with the intent focused on situated utility. A model is a representation of what the model does, rather than in terms of construct relationships.
3. Methods: Methods define process steps, represented as a guideline or an algorithm to perform a specific activity. "Methods are goal-directed plans for manipulating constructs so that the solution statement model is realised" (Vaishnavi & Kuechler, 2007, p. 13). Models can be represented as formal mathematical algorithms to informal textual descriptions of best practice approaches and may be the object of the research study.
4. Instantiations: Instantiations "operationalise constructs, models, and methods" (Vaishnavi & Kuechler, 2007, p. 13). Instantiation is the attainment of the design artefact within its environment. It represents the implemented artefact.
5. Better design theories: Better design theories or theory building encompass "artefact construction as analogous to experimental natural science" (Vaishnavi & Kuechler, 2007, p. 14).

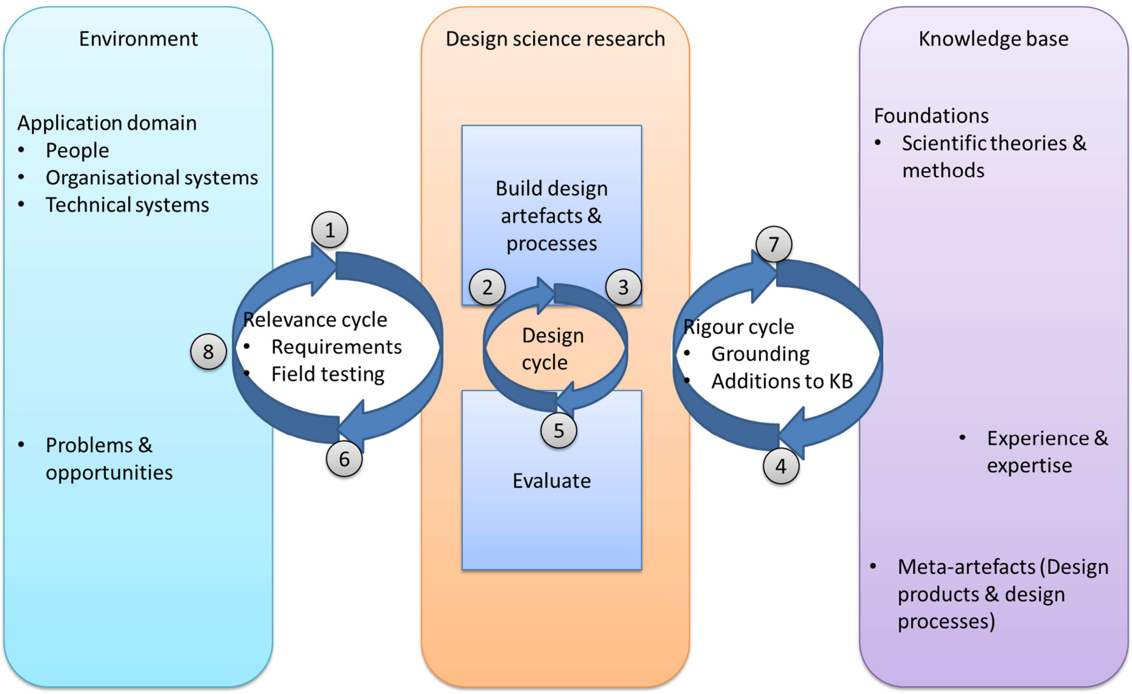



**Figure 3-G: Design science research cycle (Hevner & Chatterjee, 2010, p. 16)**

Within the design science research cycle, depicted within Figure 3-G, five essential design research elements can be observed and which thesis chapters it is addressed (Hevner & Chatterjee, 2010; Hevner *et al.*, 2004):

- Environment: The environment considers the problems and opportunity space as well as the application domain. The application domain comprises of people, organisational systems and technical systems.
- Relevance cycle: The relevance cycle depicts the contextual relationship between the environment and the design science activities. Relevance is concerned with the delineating of research activities to address business needs.
- Design cycle: The interior design cycle is an iterative cycle between the core activities of building and evaluating the design artefacts and processes of the research. This is continually done through assessment and refinement.
- Rigour cycle: The rigour cycle represents the relationship between design science activities and the knowledge base.
- Knowledge base: The knowledge base encompasses scientific foundations, expertise and experience, which inform the research project.

#### 3.2.3.2 Research purpose

The classification of research purpose can be classified as *exploratory*, *explanatory* or *descriptive*. They are however not mutually exclusive and are based on the research question, which can be both descriptive and explanatory. The purpose of a study may also change over time, affecting the classification of the study.

The following section, section 3.2.4, describes various time horizon selections available to the researcher.

### 3.2.4 Time horizon

Time horizon is concerned with the duration of the research being executed: Whether the researcher is considering taking a “snapshot” or cross-section of the research at a specific time or whether the researcher is considering taking a “diary” or longitude representation of events over an extended period of time (Saunders *et al.*, 2009). The selection of the time horizon is very much dependent on the research question being addressed in the research study.

Cross-sectional studies – As research is often time constrained, the selection of time horizon for a study of a particular phenomenon at a specific time is often cross-sectional. This is most likely as many academic research projects undertaken have time constraints. Cross-sectional studies can apply a variety of research strategies such as using a survey strategy or a case study strategy. A survey strategy can explore certain aspects from a specific target group at a specific time, while a case study strategy can determine how factors are currently related in different organisations. Time horizon selection is also independent of research method classification, which might make use of quantitative or qualitative methods (Saunders *et al.*, 2009).

Longitudinal – The advantage of making use of longitudinal research for a specific research study is that development and change over time can be studied, which could greatly benefit the contribution the study is trying to make. Longitudinal studies allow researchers to implement a measure of control over study variables. Medical research often uses longitudinal studies to study the effects of an illness, a vaccine or medication on a specific population over an extended period. Another example of a longitudinal study is where employee satisfaction is measured on a yearly basis and the change in employee satisfaction is measured over an extended period (Saunders *et al.*, 2009).

### 3.2.5 Research techniques and procedures

According to Saunders (2009), research techniques include data collection as well as data analysis, which are also referred to as modes of analysis.

The selection of research technique is also dependent on the research method classification; the research philosophy; the research approach; as well as the research strategy (Saunders *et al.*, 2009).

Research techniques are concerned with the collection or the generation of data, while research procedures are concerned with data analysis. Several data collection techniques exist, which include interviews, observations, questionnaires and documents (Saunders *et al.*, 2009).

A clear distinction does not always exist between what exactly constitutes data collection and what constitutes data analysis, as in the case of qualitative research. A clear example of this is in the case of the hermeneutic method, where the analysis effects the data and the data effects the analysis in a substantial way (Myers & Avison, 2002). It is then more appropriate to speak of 'modes of analysis' rather than data analysis with regards to qualitative research (Myers & Avison, 2002).

Prior to data collection, sampling needs to be considered as it is most often impractical to collect data from every possible case or group member (census).

#### 3.2.5.1 Sampling

Sampling techniques provide a range of methods that enable researchers to reduce the amount of data they need to collect by considering only data from a subgroup rather than all possible cases (Saunders *et al.*, 2009). Sampling is done when it is impractical to survey the entire population; when limited resources, such as time and money, are available to survey the entire population; and when all the data is available but a rapid result is required. Two classifications exist for sampling techniques: *probability or representative* sampling techniques, and *non-probability or judgemental* sampling techniques.

A non-probability sampling techniques is used when the probability of each case being selected from the total population is unknown or when research questions or objectives require the researcher to make statistical inferences about the characteristics of the population (Saunders *et al.*, 2009).

The researcher can ask a series of questions in order to get an indication of what sampling technique to consider, graphically depicted within Figure 3-H. This can be done for both probability and non-probability sampling techniques. The logic on which researchers base their strategy for selecting cases is dependent on their research questions and objectives (Saunders *et al.*, 2009).

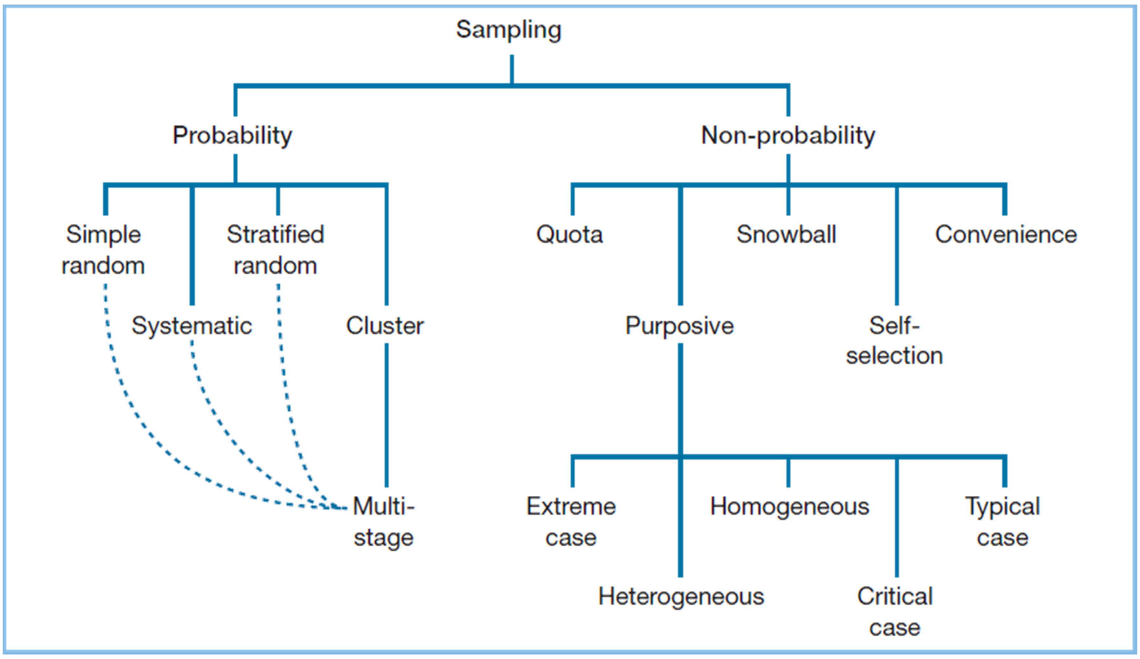



**Figure 3-H: Sampling techniques (Saunders *et al.*, 2009, p. 207)**

Based on the sampling technique, the researcher determines the data collection technique.

### 3.2.5.2 Data collection

Considering qualitative research methods, several data collection or generation techniques exist, which are common across several academic disciplines, including that of information systems. These techniques include but are not limited to, interviewing, observing and ethnography, focus groups, documents, and visual methods (Denzin & Lincoln, 2005; Miles & Huberman, 1984; Rubin & Rubin, 2011; Silverman, 2011).

An *interview* can be seen as a specific type of conversation between people, which has a set of assumptions. Researchers can make use of interviews to gather reliable and valid data that are relevant to their research questions and objectives. The nature of an interview is consistent with the purpose of the research, the research strategy, and the research questions and objectives. Unlike a "normal" conversation, an interview has a specific purpose, which is to gain information and which has been planned, has a specific agenda and has not happened by chance (Oates, 2005; Rubin & Rubin, 2011; Silverman, 2011). Several types of interviews exist, including structured (standardised), semi-structured; unstructured or in-depth interviews (non-standardised). Interviews can also be classified as respondent or informant interviews (Saunders *et al.*, 2009).

To observe means to "watch" and to "pay attention". *Observations* are about determining what people actually do (Saunders *et al.*, 2009). Most often observations are confined by interpretation of sight only, but other senses can also be included in the observations, such as sound, touch, taste and smell. Two distinctive types exist when doing observations. The first, called "covert" is when observations are done without the knowledge of the participants and without their consent. The second, called "overt" is when observations are done with the people's consent as well as their being aware that they are being observed (Denzin & Lincoln, 2005; Miles & Huberman, 1984; Oates, 2005).

A *questionnaire* is a set of predefined questions, ordered in a predefined manner in order to collect or generate data to be analysed. Frequently associated with the survey research study, the questionnaire technique can also be successfully used in case studies and action research. A great advantage of questionnaires is that they can be self-administered without the researcher being present. Equally, it can be presented as a structured interview where the researcher asks the question and notes down the answer (researcher-administered). Questionnaires are popular as they provide an efficient way of collecting data from many people (Denzin & Lincoln, 2005; Oates, 2005; Silverman, 2011).

*Documents* are an alternative to the other data collection techniques. Data can be generated from using both found documents, as well as researcher-generated documents. Found documents are documents which are in existence prior to the initiation of the research project. Researcher-generated documents on the other hand are created for the purpose of the research project and are not available without the research project being done. Existing documents available can be categorised into three categories, namely: organisational documents, individual documents and publications; these include books, journals and conference papers (Denzin & Lincoln, 2005; Oates, 2005).

*Literature reviews* and specifically systematic literature reviews (SLR) is a form of secondary study using an exact methodology to identify, analyse and interpret available evidence related to a specified research question, allowing for an unbiased and generally repeatable study (Keele, 2007).

Based on the data collection technique selected, a researcher determines the modes of analysis to analyse the research data collected or generated.

### 3.2.5.3 Modes of analysis

Data analysis, also referred to as modes of analysis, defines different approaches to gathering, analysis and interpreting data. Data analysis techniques are dependent on the research method selected by the researcher.

Modes of analysis of qualitative data are primarily concerned with verbal or written textual analysis. Several approaches of modes of analysis exist, which include but not being limited to hermeneutics, semiotics and approaches focused on narrative and metaphor (Myers & Avison, 2002).

Quantitative data analysis techniques are used to analyse raw quantitative data or unprocessed and unanalysed data as it has very little meaning to most people. As a result, the quantitative data therefore need to be processed to translate the data into information. Quantitative analysis techniques include techniques such as graphs, charts and statistics allowing the researcher to explore, present, describe and examine relationships and trends within the quantitative data. Quantitative data exists in almost all cases; as such quantitative data analysis can be a valid data analysis technique for all research strategies, regardless of research strategy, choice or method. It can include the use of simple tables or diagrams that show the frequency of occurrence and using statistics such as indices to enable comparisons, through establishing statistical relationships between variables to complex statistical modelling (Saunders *et al.*, 2009).

Qualitative data refers to all non-numeric data or data that have not been quantified and similar to quantitative data can be used in most research strategies. Qualitative data can include textual and non-textual data and include anything from a short list of responses to open-ended questions in an online questionnaire or include more complex data such as transcripts of in-depth interviews or entire policy documents. In order for qualitative data to be useful it needs to be analysed and its meanings understood. This allows the researcher to develop a theory from the data, including both deductive and inductive approaches. Qualitative data analysis can include activities such as sorting research data into categories and locating subsets of the data according to specified criteria. Just as in the case of quantitative data analysis, data collected for qualitative modes of analysis needs to be prepared; this includes activities such as transcribing of interviews or preparing electronic textual data for analysis. Qualitative data can be classified according to four aspects and includes activities such as categorisation; unitising data; recognising relationships and developing categories; and developing and testing theories (Saunders *et al.*, 2009).

The researchers should understand the research approach and whether they have a deductive or inductive approach to their research strategy. These research approaches are used to determine the approach for qualitative data and whether the research is making use of a theory at the commencement of the research to analyse qualitative data, or starting the research by collecting and exploring data without a predetermined theoretical or descriptive framework (Yin, 2003).

Considering the research approaches, specific analytic strategies exist for both deductive and inductive approaches to research. Deductively-based analytical procedures include activities such as coding, pattern matching and explanation building, while inductively-based analysis procedures includes activities such as data display and analysis; template analysis; analytic induction; grounded theory; discourse analysis; and narrative analysis (Saunders *et al.*, 2009).

## *3.3 Research design*

Section 3.2 gave background information about research philosophies, methodological choices, research strategies, time horizons and research techniques and procedure. Section 3.3 describes the research design of this thesis. What are the applicable research philosophy, methodical choice, research strategy, time horizon and what are the applicable research techniques and procedures to the thesis. In section 3.3.1 the research philosophy, interpretivism, is discussed and why it is applicable. Section 3.3.2 describes the methodological choice, the multi-method qualitative choice and why it is applicable to this research. Section 3.2.3 details the research strategies, and design science research. Section 3.2.4 described the time horizon, cross-sectional study, and why a cross-sectional study is appropriate. The final section, section 3.3.5, describes the research techniques and procedure, questionnaire research techniques for data collection as well as qualitative techniques for modes of analysis.

### 3.3.1 Research philosophy

#### 3.3.1.1 Philosophical assumptions

Concerning the nature of social science classification graphically depicted in Figure 3-C, the research aligns with the following philosophical assumptions:

- *Ontology*: The researcher has a world-view where the world is separate and independent of the individual consciousness (realism).
- *Epistemology*: The assumptions are concerned with the grounds of knowledge, where the researcher plays the role of participant as observer and adopts an empathetic stance understanding the enterprise architect’s world from their point of view (Anti-positivism).
- *Axiology*: The assumptions are based on the researcher’s judgement about values. The researcher is concerned with understanding the context of the environment under which the research was being conducted as well as having a subjective stance with regards to their personal values system (voluntarism).

- *Methodology*: The researcher assumes that research is conducted from a participative, interpretative and qualitative perspective (ideographic).

Based on the applicable nature of social science assumptions, the researcher believes in the research study being *subjective*. Concerning the two theories of the nature of society, the research assumes a *regular ordered world*. As a result, the researcher has an *interpretive* or *social relativist's* believe system, graphically depicted in Figure 3-I.

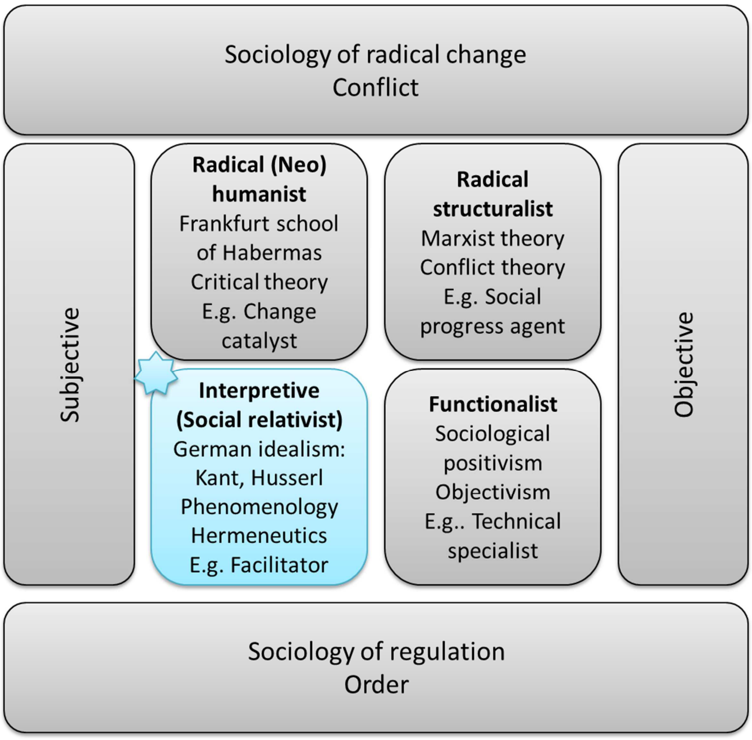



**Figure 3-I: Research philosophy applicability**

### 3.3.1.2 Research paradigm

The choice of research paradigm was based on the nature of the research questions; the researcher's own personal belief system (philosophical assumptions); the type of research the researcher was doing, which aligned to the research discipline; and whether the researcher was willing to take a risk and challenge the status quo (Oates, 2005).

Based on the researcher's philosophical assumptions and paradigms presented in Table 3-2 and the paradigm criteria presented in Table 3-4, i*nterpretivism* was selected as the research philosophy for the thesis (Understanding the architect in enterprise architecture: the Daedalus Instrument for architects).

**Table 3-4: Research paradigm applicability and alignment**

| Research paradigm | Research question | Philosophical assumptions | Research discipline | Challenge status quo |
|---|---|---|---|---|

| | | | | |
|---|---|---|---|---|
| Interpretivism | How can an instrument be designed for the understanding of the enterprise architect? | Interpretive (Subjective & assumes an ordered world) | Information systems | No |

The purpose of the thesis was to identify and determine an instrument that allows an organisation to understand the architects within the organisation.

### 3.3.2 Methodological choice

#### 3.3.2.1 Research approach

When selecting the applicable research approach (being deductive or inductive), the researcher considers the nature of the research topic (research purpose); the time available for the research study; the extent of risk being taken; as well as the audience of the completed research.

The researcher acknowledges that he was part of the research process; was less concerned to generalise research results, did make use of an initial theory; had a close understanding of the research context; and aimed to gain understanding of the meanings humans attach to events.

Based on the research approach considerations, the different research approaches, as described in Table 3-3, and the researcher's stance on the research approach, the applicable research approach the researcher took was an *inductive* approach to collect data and develop a theory, which was then based on the results of the data analysis done. Table 3-5 depicts the applicability and alignment of the research approach to the thesis.

**Table 3-5: Research approach applicability and alignment**

| Research approach | Research purpose | Available research time | Risk factor | Research audience |
|---|---|---|---|---|
| Inductive | To design an instrument that allows an organisation to understand the architects within the organisation. | Limited | Moderate | Enterprise architects, EA researchers, EA authors, EA consultants |

#### 3.3.2.2 Research choice

The applicable research choice, as depicted in Figure 3-E, for the thesis was determined based on the research techniques used and how these techniques were applied as well as how the data collection and data analysis techniques aligned with the research choice.

The research choice makes use of multiple research methods. The intention of using a multi-method methodological choice focuses upon the need to use an inductive approach to collect data and formulate a theory based on enterprise architecture (EA) factors and architect attributes, the different architect schools of thought and enterprise architect styles, and the different architect profiles. When analysing the data from the systematic literature review, and two questionnaires, the thesis makes use of qualitative analysis to analyse the structured qualitative data collected. Table 3-6 depicts the applicability and alignment of the research choice.

**Table 3-6: Research choice applicability and alignment**

| Research choice | Research philosophy | Research approach |
|---|---|---|
| Multi method | Interpretive | Inductive |

### 3.3.2.3 Research method classification

The selection of the applicable research method classification, as describe in section 3.2.2.3, depends on the applicable research philosophy and the philosophical assumptions of the researcher.

In line with and because of the applicable research approach, choice and purpose described, qualitative research methods are well suited to the study of enterprise architects, their schools of thought, the various enterprise architect styles and the enterprise architect profiles. Qualitative research methods are well suited to understand people. The goal here was to explore and describe the phenomena from the point-of-view of the enterprise architect and their particular functional context. Consideration was taken to ensure that the understanding of the phenomena was not largely lost when textual data were qualified. As a result, qualitative methods suit the study of enterprise architects well, as depicted within Table 3-7.

**Table 3-7: Research method classification applicability and alignment**

| # | Research question | Research objective | Research method classification |
|---|---|---|---|
| 1 | What enterprise architect associated EA factors and architect attributes are described in literature? | To determine which enterprise architect associated EA factors and architect attributes are described within literature. | Qualitative |
| 2 | How can an EA schools of thought indicator be developed for the consistent classification of EA schools of thought? | To develop an EA schools of thought indicator for the consistent classification of EA schools of thought. | Qualitative |
| 3 | How can an enterprise architect style indicator be developed for the consistent classification of an enterprise architect styles? | To develop an enterprise architect style indicator for the consistent classification of the enterprise architect styles. | Qualitative |
| 4 | How can enterprise architect profiles be developed for the understanding of the enterprise architect? | To develop enterprise architect profiles for the understanding of the enterprise architect. | Qualitative |
| 5 | How can an instrument be developed allowing organisations to understand enterprise architects? | To develop an instrument allowing organisations to understand enterprise architects. | Qualitative |
| 6 | How can a technology-based solution be developed allowing organisations to efficiently determine the profiles of enterprise architects? | To develop a technology-based solution allowing organisations to efficiently determine the profiles of enterprise architects. | Qualitative |

## 3.3.3 Research strategy

The selection of a research strategy was guided by the research question; the research objectives; the extent of existing knowledge on the research topic; the amount of time available; the research philosophy; as well as the research approach (Saunders *et al.*, 2009).

#### 3.3.3.1 Strategy

The tentative design of the artefact described within the thesis was the proposed Daedalus Instrument for Architects. The Daedalus Instrument for Architects is a toolset assisting organisations to understand enterprise architects within the organisation. Making use of the design science research as a strategy, the requirements or suggestions for the artefact were informed by a systematic literature review, which is described in detail within **Chapter 4**. To evaluate the artefact, an assessment was executed in an enterprise architecture practice making use of the proposed Daedalus Instrument for Architects as the foundation of the assessment. The final phase of the design science research process presents the conclusion and contributions the thesis was making. The design science strategy is graphically depicted in Figure 3-J.

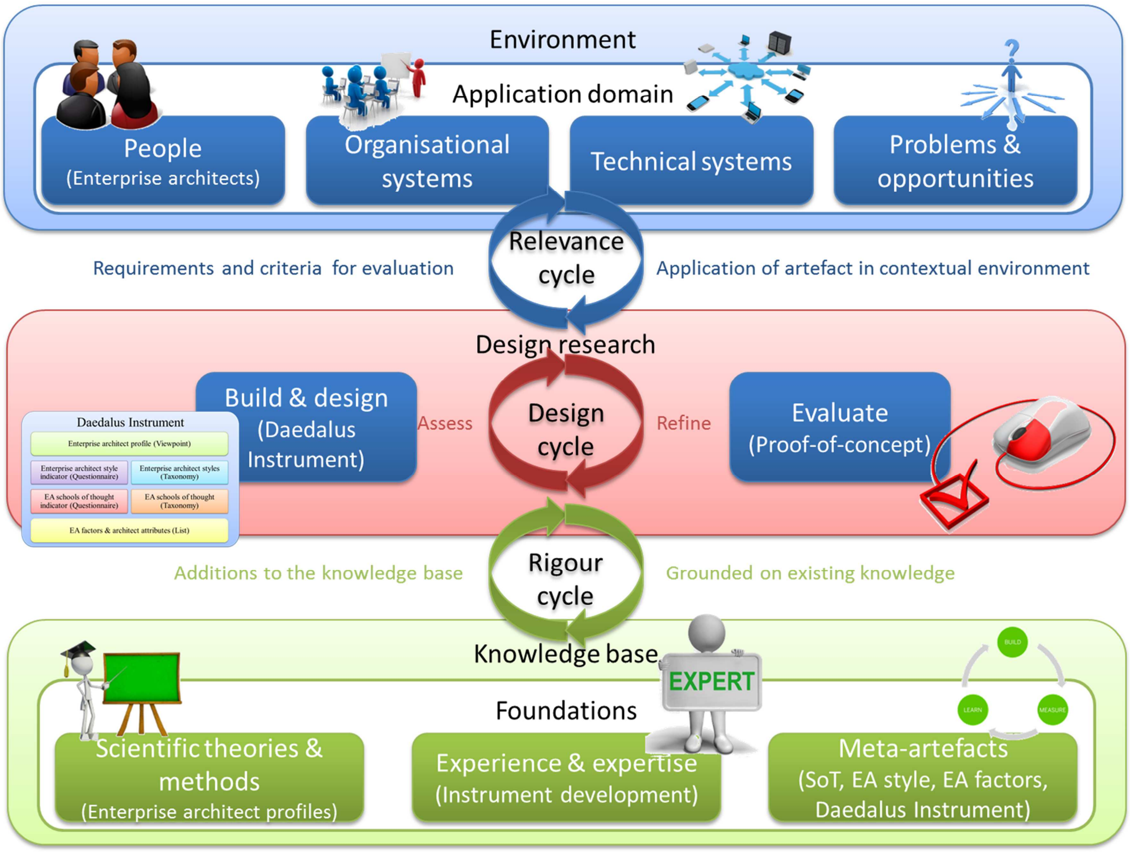



**Figure 3-J: Design science research elements and cycles**

The Daedalus Instrument for Architects was developed through four internal iterations as part of the development research phases, as depicted within Figure 3-K. The findings from one phase add value to the next development phase. The primary cycle encompasses the entire design research process including the awareness phase [A1], the suggestion phase [S1], the main development phase [D1], the evaluation phase [E1] and finally the conclusion phase [C1].

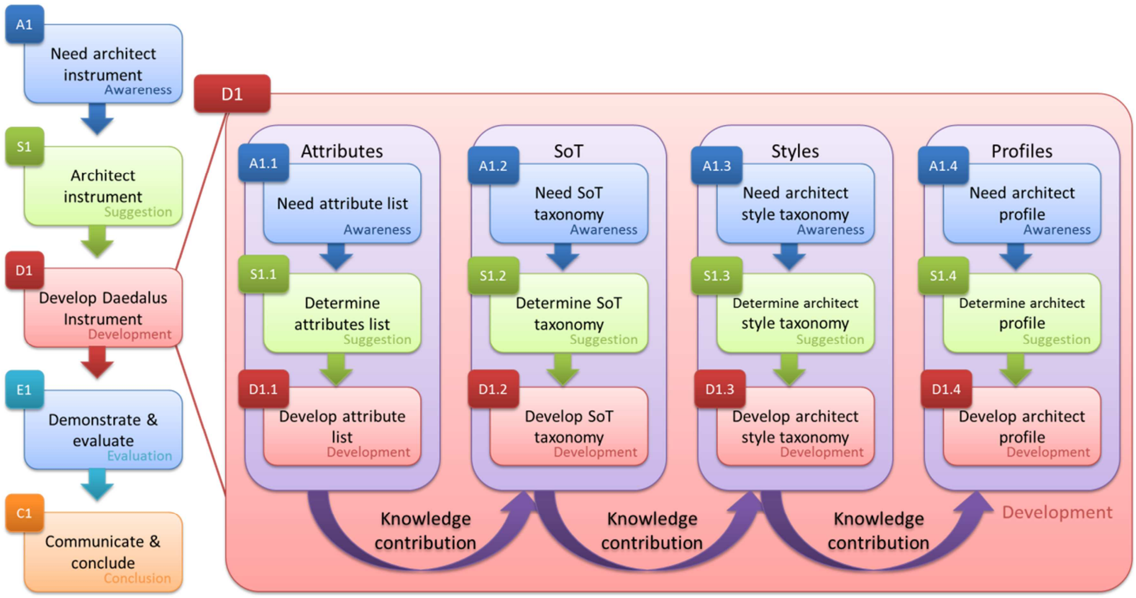



**Figure 3-K: Design research phases with applicability to this thesis**

The design science research strategy applicable to this thesis is described in detail below:

A1. Problem identification and motivation (awareness): The first step in the design research process is the identification of the business requirement or business need. The business requirement defines a need for an instrument organisations can use to supplement existing EA frameworks and methodologies to understand the architect that works within the organisation. The argument is centred on the understanding that architects do not think the same way about architecture and do not approach architecture in similar ways even when EA standards are defined and agreed upon. Companies struggle with the misalignment between architects because of the difference in opinions and worldviews that the architects hold concerning EA. As a result, the outcome of this design science research (DSR) step is the recognition of the need for an enterprise architect instrument for the understanding of the architect [A1]. **Chapter 1** dealt with the identification of the problem as well as the awareness of the problem, which resulted in the proposal for the research thesis.

S1. Defining objectives for a solution (suggestion): This DSR step involved the definition of objectives, which provided an initial suggestion for the development of the design artefact, the Daedalus Instrument for Architects [S1]. **Chapter 2** described the research objectives as well as providing a tentative design for the proposed Daedalus Instrument for Architects.

D1. Design and development: The DSR [D1] step is concerned with the primary development cycle of the design of the Daedalus Instrument for Architects. The primary development cycle initiates four internal development cycles, each cycle building on the successes of the previous internal development cycle. The internal development cycles of the primary development cycle [D1] consist of the following four cycles:

1. To be aware of, suggest and develop the list of EA factors and architect attributes [A1.1, S1.1 and D1.1]. The list of EA factors and architect attributes were determined through the execution of a systematic literature review. The list of EA factors and architect attributes formed the basis and input to the next internal development cycle and represent the first component of the Daedalus Instrument for Architects, described within **Chapter 4**.
2. To be aware of, suggest and develop an indicator as well as a taxonomy regarding the different EA schools of thought. The indicator assists organisations, in a consistent manner, to determine in which EA school of thought an architect belongs to. The taxonomy allows for the simple classification and understanding of the different EA schools of thought [A1.2, S1.2 and D1.2]. The indicator and the taxonomy are determined in a study using an Internet-mediated questionnaire of architects across the globe. The EA schools of thought indicator and taxonomy form the next component of the Daedalus Instrument for Architects, described within **Chapter 5**.
3. To be aware of, suggest and develop an indicator as well as a taxonomy regarding the different enterprise architect styles. The indicator assists organisations, in a consistent manner, to determine which enterprise architect style an architect represents. The taxonomy allows for the simple classification and understanding of the different enterprise architect styles [A1.3, S1.3 and D1.3]. The indicator and the taxonomy are determined through a study using an Internet-mediated questionnaire of architects within organisations across South Africa. The enterprise architect style indicator and taxonomy form the next component of the Daedalus Instrument for Architects, described within **Chapter 6**.
4. To be aware of, suggest and develop the different enterprise architect profiles. These enterprise architect profiles are descriptions of the understanding of each of the enterprise architect profiles [A1.4, S1.4 and D1.4]. The enterprise architect profiles consider all three the previous internal development cycles' artefacts and Daedalus Instrument for Architects components as input for the definition and description of the architect profiles, described within **Chapter 7**.

The primary design and development cycle [D1] considers the four internal development cycles and their design artefacts, which are also components of the Daedalus Instrument for Architects for the definition and development of the complete and final Daedalus Instrument for Architects, described within **Chapter 7**.

E1. Demonstration and evaluation: In this DSR step, the Daedalus Instrument for Architects is evaluated using the Framework for the Evaluation of Design Science (FEDS) using a focus group [E1]. The use and efficiency of the proposed Daedalus Instrument for Architects is evaluated through interaction by gaining feedback from the participants, described within **Chapter 8**.

C1. Communication and conclusion: In this final DSR step, the research contributions and outcomes of the DSR are described within **Chapter 9** [C1]. **Chapter 9** also concludes the thesis.

Figure 3.12 depicts the design science research process steps in relation to the design artefacts as outputs and the alignment to the thesis chapters.

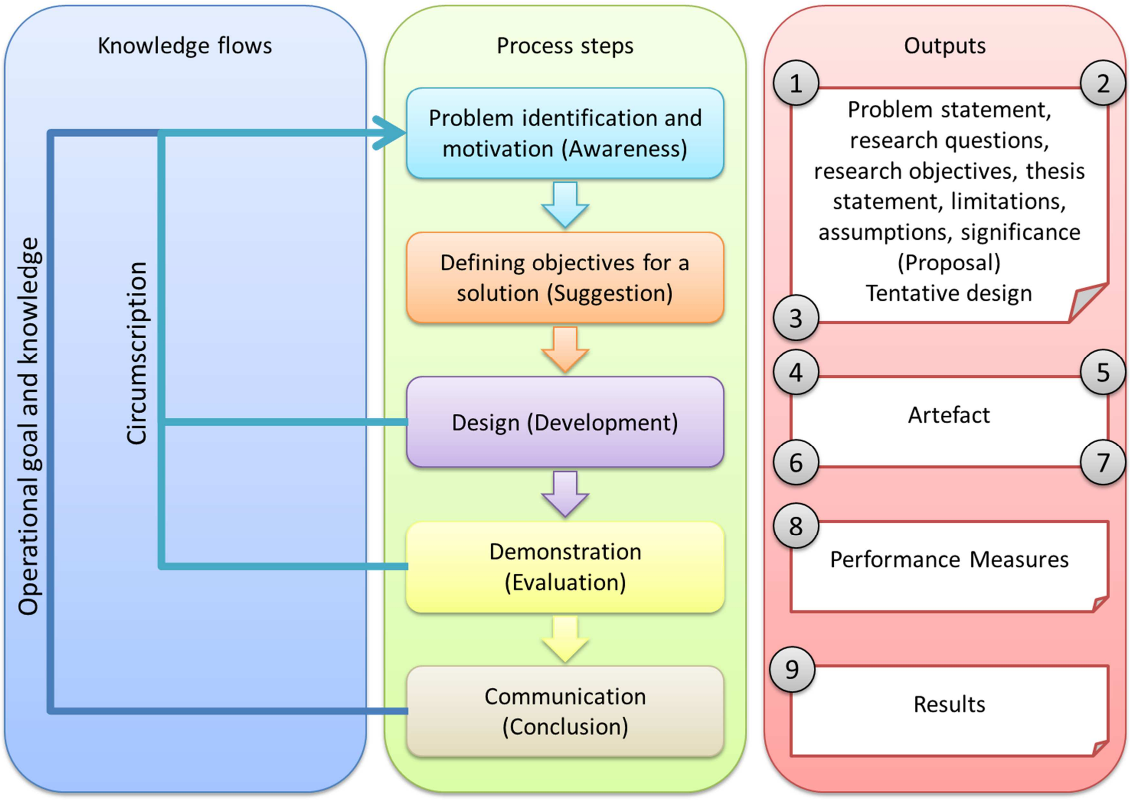



**Figure 3-L: Design science research steps, outputs and aligned chapters**

Table 3-8 indicates the applicability and alignment of the research strategy to the design.

**Table 3-8: Research strategy applicability and alignment**

| | |
|---|---|
| Research strategy | Design science research |
| Research question | How can an instrument be designed for the understanding of the enterprise architect? |
| Research purpose | To design an instrument that allows an organisation to understand the architects within the organisation |
| Extend of research topic knowledge | Moderate |
| Available time | Limited |
| Research philosophy | Interpretivism |
| Research approach | Inductive approach |

The applicable research strategy is primarily concerned and aligned to the main objective and research question of this thesis (i.e. Understanding the architect in enterprise architecture: the Daedalus Instrument for architects). The researcher aims to identify and determine an instrument that allows an organisation to understand the architects within the organisation.

Table 3-9 highlights the fundamental principles of this thesis aligned to the design science research guidelines. These fundamental principles are derived from the seven guidelines for ensuring a top quality design science research study (Hevner & Chatterjee, 2010; Hevner *et al.*, 2004). The foundational principles include the creation of a purposeful and innovative artefact encapsulated within Guideline 1 in a solution to a relevant business problem captured with Guideline 2. The artefact efficiency and usability is required to be rigorously demonstrated as is summarised within Guideline 3, while the research study needs to provide verifiable and clear contributions to the relevant knowledge base, defined within Guideline 4. Design science research relies on rigorous methods in the evaluation and the construction of the design artefact, described within Guideline 5. The precise search for an effective solution requires the utilisation of available means to reach the desired outcome, encapsulated within Guideline 6. Lastly, the final guideline presents the effectiveness of the results of the research to the relevant audiences, described within Guideline 7.

**Table 3-9: Research approach based on the design research guidelines**

| # | Guideline | Description | Applicability of the guideline |
|---|---|---|---|
| 1 | Design as an artefact | Design science research must produce a viable artefact in the form of a construct, a model, a method, or an instantiation | Develop the proposed Daedalus Instrument (A technology-based toolset for understanding the enterprise architect) |
| 2 | Problem relevance | The objective of design science research is to develop technology-based solutions to important and relevant business problems | Similarly to people having different personality types, different beliefs and different cultures, so do enterprise architects. Enterprise architects might have different beliefs, styles and profiles about what enterprise architecture is to them, how they go about performing enterprise architecture management and why they believe EA is done within an organisation. The motivation is centred on the understanding that a system considers people, process and technology; and to understand the entire system, the people forming part of the system need to be understood. The aim of the research is to understand enterprise architects, their belief systems, their behavioural styles and what EA factors or architect attributes influence the architect profiles by delivering a technology-based solution that can assist organisations in determining their architect's profile. |
| 3 | Design evaluation | The utility, quality, and efficacy of a design artefact must be rigorously demonstrated via well-executed evaluation methods | An assessment is conducted in an enterprise architect focus group to evaluate the use and efficiency of the proposed technology-based Daedalus Instrument. |
| 4 | Research contributions | Effective design science research must provide clear and verifiable contributions in the areas of the design artefact, design foundations or design methodologies | The Daedalus Instrument contributes to the discipline of EA by providing:<br>An enterprise architect technology-based instrument to complement existing EA frameworks and methodologies by allowing organisations to understand the people aspect of the enterprise socio-technical system. |
| 5 | Research rigour | Design science research relies upon the application of rigorous methods in both the construction and evaluation of the design artefact | A variation of methods are employed during the execution of the research study:<br>Systematic literature review<br>Internet-mediated questionnaires<br>Design and development of the Daedalus Instrument<br>Observational evaluation of the Daedalus Instrument through a focus group. |
| 6 | Design as a search process | The search for an effective artefact requires utilising | The process of designing the Daedalus Instrument artefact is fundamentally modular and characterised through the |

| # | Guideline | Description | Applicability of the guideline |
|---|---|---|---|
| | | available means to reach desired ends while satisfying laws in the problem environment | "build and evaluate" cycle. This artefact is constructed through the additions of sub-components as the design for the artefact evolves. Initially the sub-components are independent to a certain extent, which are then combined at the end for a toolset of components organisations can use to understand the enterprise architect. |
| 7 | Communication of research | Design science research must be presented effectively to both technology-oriented and management-oriented audiences | This research study is presented to both enterprise architect practitioners and stakeholders through academic publications. At the time of this print, one peer-reviewed article based on this research was published: Du Preez, J.A., Van Der Merwe, A. & Matthee, M.C., 2014. Enterprise Architecture Schools of Thought: An Exploratory Study. In 2014 IEEE 18th International Enterprise Distributed Object Computing Conference Workshops and Demonstrations. International Enterprise Distributed Object Computing Conference Workshops and Demonstrations. Ulm, Germany: IEEE Computer Society, pp. 3–12. The final research was also presented to a focus group of academics and EA practitioners. |

In addition to addressing the seven guidelines for ensuring a top quality design science research study, the eight question checklist is used to ensure that the thesis addresses key aspects of design science research, described within Table 3-10 (Hevner & Chatterjee, 2010). The relationship between the three research cycles and the eight-question checklist is depicted within Figure 3-G.

**Table 3-10: Design science research checklist and answers**

| # | Question | Answer |
|---|---|---|
| 1 | What is the research question (design requirements)? | How can an instrument be designed for the understanding of the enterprise architect? |
| 2 | What is the artefact? How is the artefact represented? | Daedalus Instrument. As a technology-based toolset to supplement existing EA frameworks and methodologies assisting organisations to understand the enterprise architects within the organisation. |
| 3 | What design processes (search heuristics) were used to build the artefact? | Profiling; Hypothesis testing; Research; Lateral thinking; |
| 4 | How are the artefact and the design processes grounded by the knowledge base? What, if any, theories support the artefact design and the design process? | Each internal design cycle addresses a research question and objective, which builds on the effort of the previous design cycle.<br>A systematic review and the three schools of thought form the basis of the design of the Daedalus Instrument as architects make sense of Enterprise Architecture by impose their own meanings and understandings of enterprise architecture. |
| 5 | What evaluations are performed during the internal design cycles? What design improvements are identified during each design cycle? | Each iteration of the internal design cycle builds on the previous design cycle. There are no formal evaluations during the internal design cycle.<br>1ste cycle: EA Factors and architect attributes used as a foundation component in the Daedalus Instrument<br>2$^{nd}$ cycle: EA schools of thought taxonomy of architects used as a component in the Daedalus Instrument<br>3$^{rd}$ cycle: Architect styles used as a component in the Daedalus Instrument<br>4$^{th}$ cycle: Architect profiles used as a component in the Daedalus Instrument |
| 6 | How is the artefact introduced into the application environment and how is it field-tested? What metrics are used to demonstrate artefact utility and improvement over previous artefacts? | The development of the Daedalus Instrument is done as a proof-of-concept as no current artefacts exist to test the Daedalus Instrument against. The Daedalus Instrument was presented to and evaluated by a focus group to evaluate the use and the efficiency of the artefact. |
| 7 | What new knowledge is added to the | Peer-reviewed publications; systematic literature review; |

| # | Question | Answer |
|---|---|---|
| | knowledge base and in what form (e.g., peer-reviewed literature, meta-artefacts, new theory, and new method)? | Instrument for assessing architects |
| 8 | Has the research question been satisfactorily addressed? | The research questions, objectives, chapters, deliverables and design science process steps are all in alignment. This is done to ensure what is delivered at the end, validates the main research question and research purpose. |

### 3.3.3.2 Research purpose

The research purpose, as described in section 3.2.3.2, also referred to as the nature of study, directly affects the selected research methods used for collection or generation of data. To ensure a clear understanding of the research phenomena prior to the collecting of research data, the thesis has a dual purpose: Firstly, to accurately explore the EA factors and architect attributes; secondly to explore the EA schools of thought, their architectural choices and worldviews. In addition, a third exploratory study was performed to determine the various enterprise architect styles while validating the identification and definition of the EA schools of thought.

As the thesis has a dual purpose, making use of three exploratory studies, the research purpose changes through the execution of the research. As a result, the research purpose can be aligned to the research questions and objectives. Table 3-11 depicts the relationship between the thesis research questions, objectives and purpose.

**Table 3-11: Research purpose applicability and alignment**

| # | Research question | Research objective | Research purpose |
|---|---|---|---|
| 1 | What are the EA factors and architect attributes, associated with enterprise architects as described within literature? | Determine the enterprise architect associated EA factors and architect attributes described within literature. | Exploratory study |
| 2 | What are the core EA belief systems and associated EA schools of thought of enterprise architects? | Develop an EA schools of thought indicator for the consistent classification of EA schools of thought. | Exploratory study |
| 3 | What are the core behavioural styles and associated enterprise architect styles of enterprise architects? | Develop an architect style indicator for the consistent classification of the enterprise architect styles. | Exploratory study |
| 4 | What are the perspectives and associated enterprise architect profiles of enterprise architects? | Develop architect profile viewpoints for the understanding of the enterprise architect. | Descriptive |
| 5 | What tools can an organisation use to determine enterprise architect profiles? | Develop an instrument allowing organisations to understand enterprise architect profiles. | Descriptive |
| 6 | What technology-based solution can an organisation use to determine enterprise architect profiles? | Develop a technology-based solution allowing organisations to determine the profiles of enterprise architects. | Descriptive |

## 3.3.4 Time horizon

The selection of time horizons for the consideration of the research design are independent of which research strategy is being pursued as well as being independent of the selection of methodological choice and research method classification. Cross-sectional studies are concerned with taking a specific “snapshot” of the research and presenting the results, whereas longitudinal studies are concerned with understanding and measuring the development of factors or the change of factors over an extended period.

The selection of the applicable time horizon, as described in section 3.2.4, is dependent on the applicable research questions and research objectives, described within Table 3-12.

**Table 3-12: Relationship between research questions, objectives and time horizon**

| # | Research question | Research objective | Time horizon |
|---|---|---|---|
| 1 | What are the EA factors and architect attributes, associated with enterprise architects as described within literature? | Determine the enterprise architect associated EA factors and architect attributes described within literature. | Cross-sectional |
| 2 | What are the core EA belief systems and associated EA schools of thought of enterprise architects? | Develop an EA schools of thought indicator for the consistent classification of EA schools of thought. | Cross-sectional |
| 3 | What are the core behavioural styles and associated enterprise architect styles of enterprise architects? | Develop an architect style indicator for the consistent classification of the enterprise architect styles. | Cross-sectional |
| 4 | What are the perspectives and associated enterprise architect profiles of enterprise architects? | Develop architect profile viewpoints for the understanding of the enterprise architect. | N/A |
| 5 | What tools can an organisation use to determine enterprise architect profiles? | Develop an instrument allowing organisations to understand enterprise architect profiles. | N/A |
| 6 | What technology-based solution can an organisation use to determine enterprise architect profiles? | Develop a technology-based solution allowing organisations to determine the profiles of enterprise architects. | N/A |

### 3.3.5 Research techniques and procedures

Using design science research as a strategy, the main development cycle [D1] as well as the four internal development cycles [D1.1, D1.2, D1.3, D1.4], each have their own respective methods, sampling, data collection and modes of analysis techniques. Sampling is discussed within section 3.3.5.1, while data collection is discussed in section 3.3.5.2, and finally modes of analysis are discussed in section 3.3.5.3.

#### 3.3.5.1 Sampling

This thesis makes use of non-probability or judgemental sampling techniques, depicted within Figure 3-H, as the research study scope is constricted to enterprise architects across the globe. For this reason, the *heterogeneous purposive non-probability sampling technique* is used when the researcher adopts the design science research as a strategy.

The selection plan of the participants being researched is dependent on their research questions and objectives, depicted within Table 3-13.

**Table 3-13: Relationship between research questions, objectives and cases**

| # | Research question | Research objective | DSR process step | Sampling frame | Sampling size | Sampling technique |
|---|---|---|---|---|---|---|
| 1 | What are the EA factors and architect attributes, associated with enterprise architects as described within literature? | Determine the enterprise architect associated EA factors and architect attributes described within literature. | [D1.1] | Systematic literature review | Electronic platforms | Systematic elimination method |

| # | Research question | Research objective | DSR process step | Sampling frame | Sampling size | Sampling technique |
|---|---|---|---|---|---|---|
| 2 | What are the core EA belief systems and associated EA schools of thought of enterprise architects? | Develop an EA schools of thought indicator for the consistent classification of EA schools of thought. | [D1.2] | Association of enterprise architects | 3000 AEA LinkedIn group members | Self-selection sampling |
| 3 | What are the core behavioural styles and associated enterprise architect styles of enterprise architects? | Develop an architect style indicator for the consistent classification of the enterprise architect styles. | [D1.3] | TOGAF certified companies in RSA | 100+ TOGAF certified companies | Self-selection sampling |
| 4 | What are the perspectives and associated enterprise architect profiles of enterprise architects? | Develop architect profile viewpoints for the understanding of the enterprise architect. | [D1.4] | N/A | N/A | N/A |
| 5 | What tools can an organisation use to determine enterprise architect profiles? | Develop an instrument allowing organisations to understand enterprise architect profiles. | [D1.4] | N/A | N/A | N/A |
| 6 | What technology-based solution can an organisation use to determine enterprise architect profiles? | Develop a technology-based solution allowing organisations to determine the profiles of enterprise architects. | [E1] | N/A | N/A | N/A |

### 3.3.5.2 Data collection

The data collection techniques are described based on the design science research process steps. The primary cycle incorporates the entire design science research process including awareness [A1], suggestion [S1], development [D1], evaluation [E1] and conclusion [C1], as depicted within Figure 3-11. The data collection techniques in relation to the design science research process steps and the thesis' research objectives are summarised in Table 3-14.

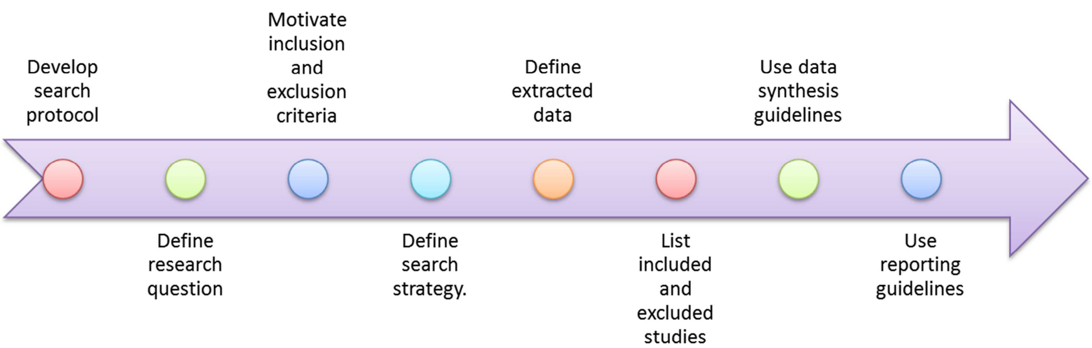
A1. Problem identification and motivation (awareness): The initial awareness as the need for an enterprise architect instrument to supplement existing EA frameworks and methodologies [A1] is presented as a proposal in **Chapter 1** and **Chapter 2** by executing an initial literature review. The literature review concentrated on enterprise architecture whilst understanding gaps that exist within current literature. This was done to substantiate the need and requirement for an enterprise architect instrument (Daedalus Instrument for Architects) to supplement existing EA frameworks and methodologies.

S1. Defining objectives for a solution (suggestion): The data collected through the first awareness cycle was used to propose an initial enterprise architect instrument (Daedalus Instrument for Architects) that could be used to understand the enterprise architect. The initial proposed instrument supplements existing EA frameworks and methodologies closing the gap identified by not just understanding EA process and technology but people as well. The awareness and suggestion of the research problem was described within **Chapter 2**. The tentative design of the proposed architect instrument (Daedalus Instrument for Architects) was created to be in line with the research questions and objectives [S1].

D1. Design and development: The design and development design science research process step comprises of the primary cycle [D1], namely the development of the Daedalus Instrument for Architects, and internal design cycles [D1.1, D1.2, D1.3 and D1.4]. Within each of these internal design cycles, data is collected using different data collection techniques. The internal design cycle data collection techniques include:

1. D1.1 Attributes: EA factors and architect attributes forms the foundation of the Daedalus Instrument for Architects. The EA factors and architect attributes were collected through the execution of a systematic literature review, which are used as input into the subsequent internal design cycles. The EA factors and architect attributes represented as a list, form the first component of the Daedalus Instrument for Architects. The systematic literature review on aspects related to the enterprise architect is described in detail within **Chapter 4**.

The determination and definition of the EA factors and related architect attributes are determined through a systematic literature review [D1.1], depicted within Figure 3-M.




| # | EA factor | Architect attribute |
|---|---|---|
| 1 | Factor | Attribute |
| 2 | Factor | Attribute |
| 3 | Factor | Attribute |
| 4 | Factor | Attribute |
| 5 | Factor | Attribute |

**Figure 3-M: Architect attributes internal design cycle [D1.1]**

2. D1.2 Schools of thought: Enterprise architect schools of thought represent the different architect worldviews and opinions of architects who share the same EA school. The worldviews and opinions of architects are fundamental to understanding the enterprise architects as they represent their beliefs regarding EA and are fundamental to their motivation behind performing EAM. **Chapter 5** describes the execution of a study using a self-mediated online questionnaire of architects across the globe to determine various factors affecting the enterprise architect, as well as

determining the existence of the various EA schools of thought. The EA schools of thought form the second component of the Daedalus Instrument for Architects.

The description and definition of the EA schools of thought are determined using an exploratory questionnaire [D1.2], depicted within Figure 3-N.

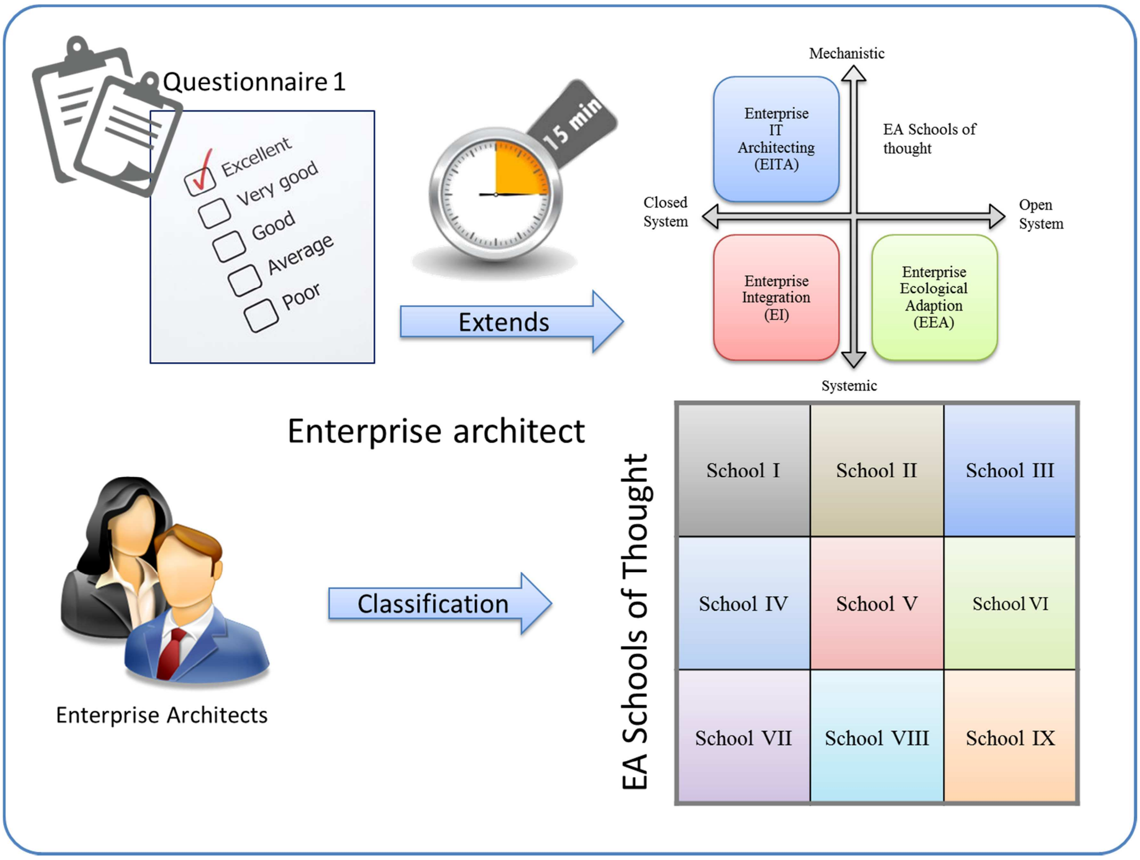



**Figure 3-N: EA schools of thought internal design cycle [D1.2]**

3. D1.3 Styles: The EA factors and architect attributes are used as input into the development of the architect styles. The architect styles consider only those aspects identified within the previous internal design cycles to form the third component of the Daedalus Instrument for Architects. Data is collected once again using a self-mediated online questionnaire by focusing on enterprise architect behaviours whilst considering different architects within the same EA practise. **Chapter 6** describes the execution of a study using a self-mediated online questionnaire of practising architects within South African organisations to determine the different architect styles.

The description and definition of the enterprise architect styles are determined using an exploratory questionnaire [D1.3], depicted within Figure 3-O.

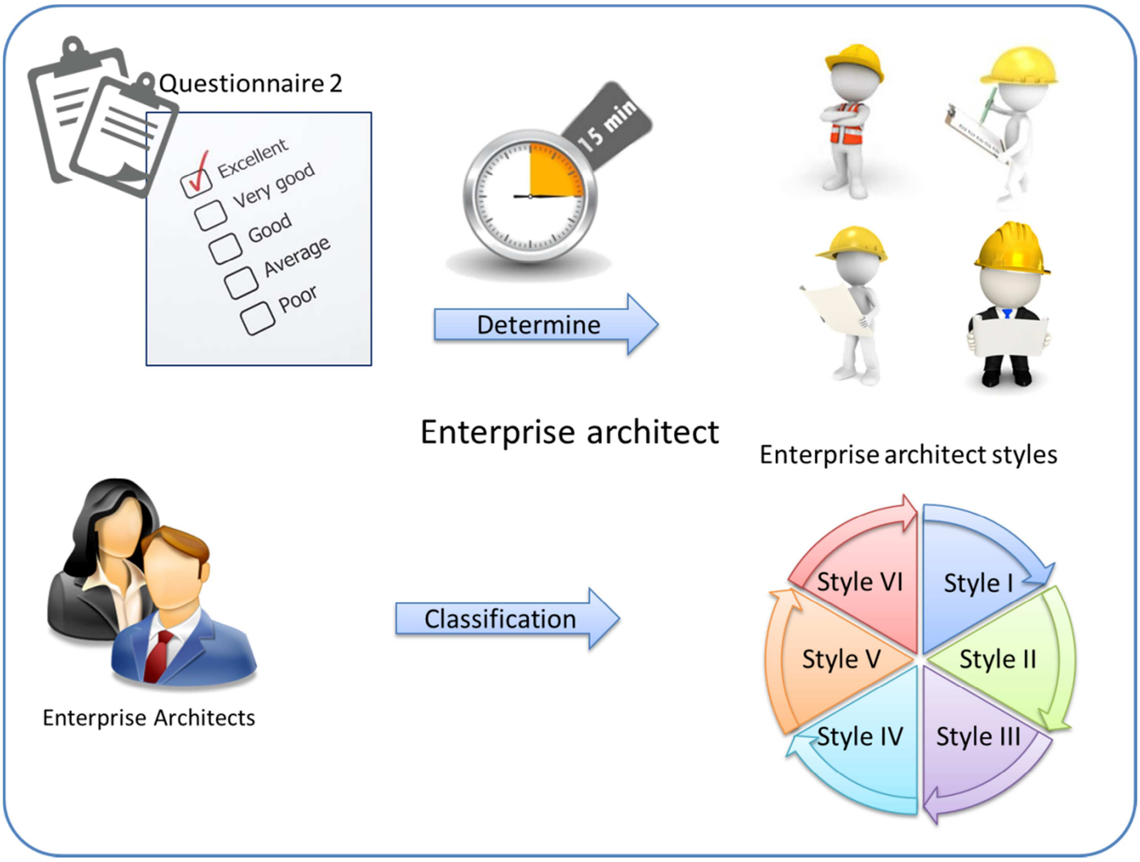



**Figure 3-O: Enterprise architect styles internal design cycle [D1.3]**

4. D1.4 Profiles: The enterprise architect profiles form the last component of the Daedalus Instrument for Architects. The architect profiles consider inputs from the previous three internal design cycles to formulate the architect profiles. These profiles are descriptive viewpoints of the different enterprise architect profiles. The different architect profiles are described in detail within **Chapter 7**. The architect profiles describe architect archetypes in relation to a specific EA school of thought as well as in relation to a specific architect style. The construction research method is used to derive data from the published literature, to analyse the data, and to summarise the data for inclusion into the Daedalus Instrument for Architects.

The description and definition of the enterprise architect profiles are created using input from the previous internal design cycles and components of the Daedalus Instrument for Architects [D1.4], depicted within Figure 3-P.

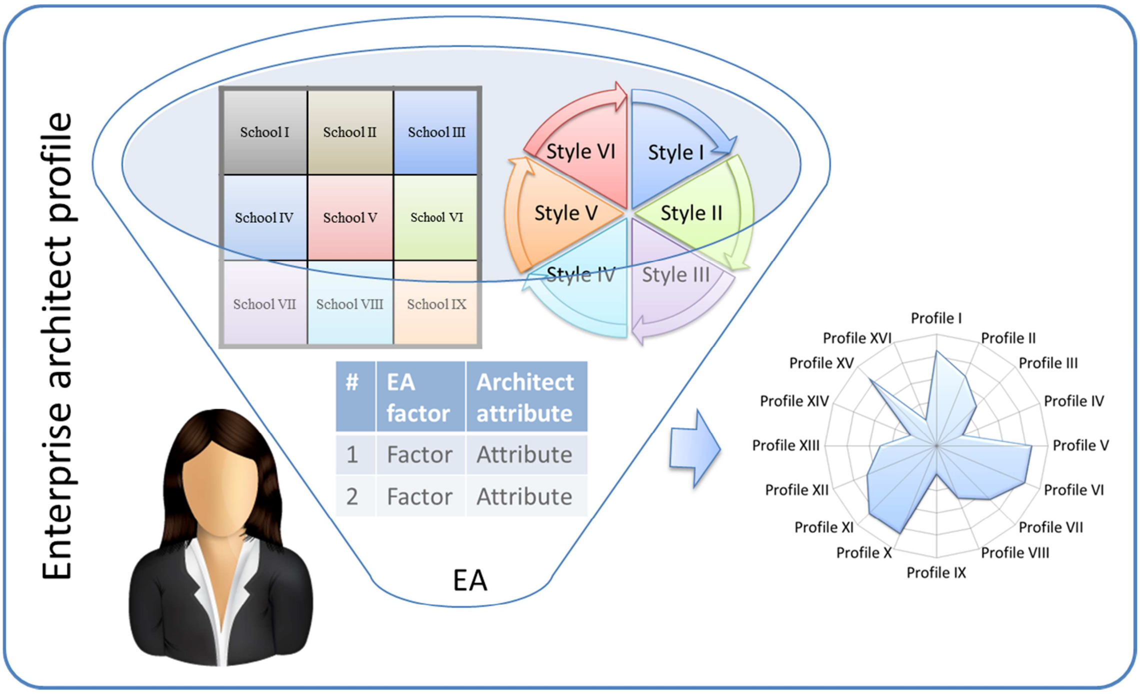



**Figure 3-P: Enterprise architect profiles internal design cycle [A1.4]**

The design and development cycle [D1] concludes in **Chapter 7**, where the four identified components as part of the internal design cycles are incorporated into a toolset or instrument, which forms the Daedalus Instrument for Architects, depicted within Figure 3-Q. A method to apply the Daedalus Instrument for Architects is developed, which includes guidelines on using the Daedalus Instrument for Architects to understand the enterprise architects being assessed.

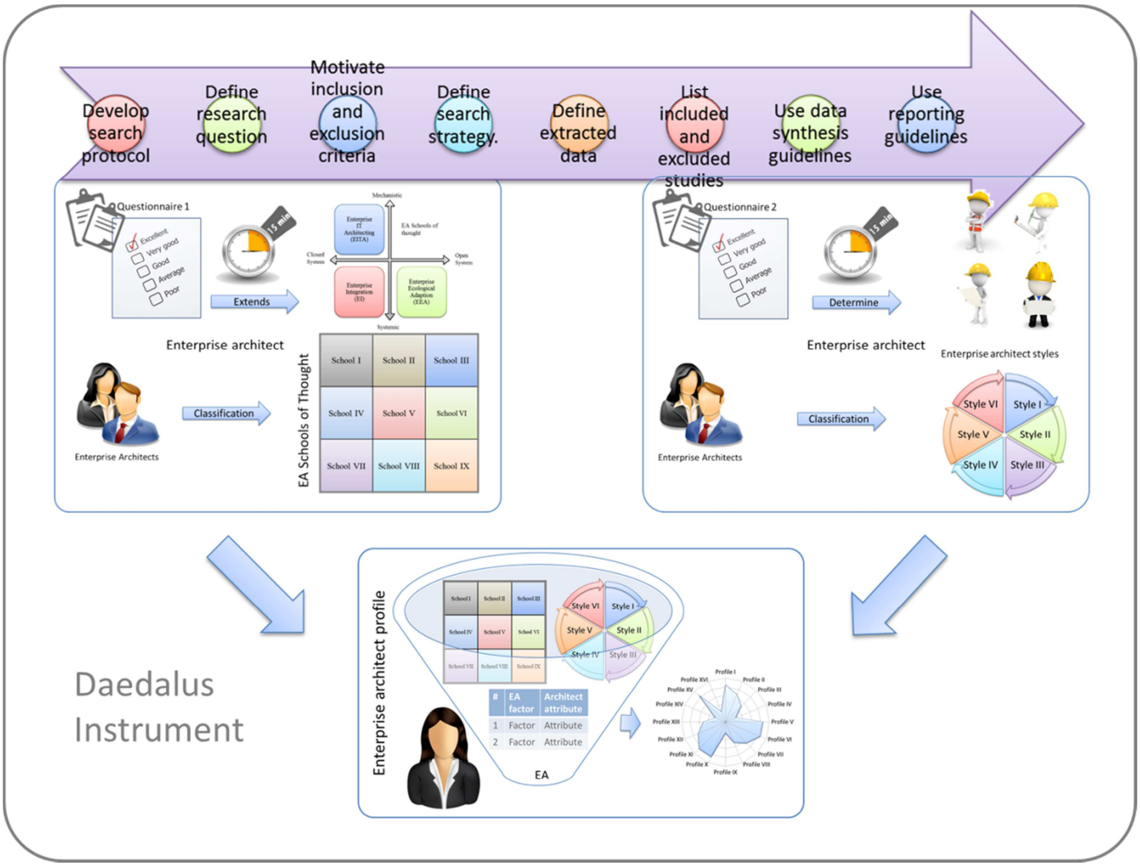



Figure 3-Q: Develop Daedalus Instrument for Architects (DIA) primary design cycle [D1]

E1. Demonstration and evaluation: Based on the Framework for the Evaluation of Design Science (FEDS), a focus group was used for the evaluation of the technology-based Daedalus Instrument for Architects [E1]. Feedback was obtained from the focus group on the efficiency and use of the technology-based solution. The metric for the evaluation of the Daedalus Instrument for Architects includes usability, reliability as well as the efficiency of the Daedalus Instrument for Architects. **Chapter 8** describes the evaluation method, the metrics and the results of the focus group. The evaluation step provides essential feedback on the design and refinement of the Daedalus Instrument for Architects, depicted within Figure 3-R.

C1. Communication and conclusion: The research contributions and outcomes are reported in this last and final design research phase [C1]. Findings from the design and evaluation of the Daedalus Instrument for Architects are summarised, highlighting the contributions of this thesis to EA practitioners, EA stakeholders and researchers. The thesis is also concluded in **Chapter 9**.

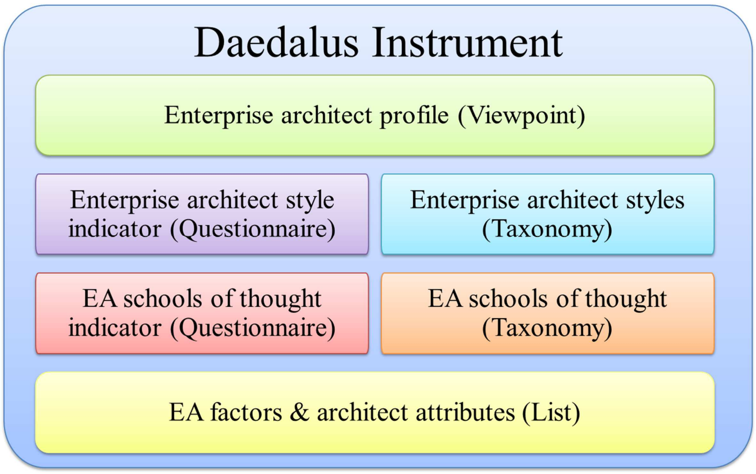



**Figure 3-R: Daedalus Instrument for Architects (DIA)**

Table 3-14 presents the applicability and alignment of the research strategy to that of the research questions.

**Table 3-14: Research techniques and procedures applicability and alignment**

| # | Research question | Research proposition (objectives) | DSR process step | Research techniques | Deliverable |
|---|---|---|---|---|---|
| 1 | What are the EA factors and architect attributes, associated with enterprise architects as described within literature? | Determine the enterprise architect associated EA factors and architect attributes described within literature. | [D1.1] | Systematic literature review | List of EA factors and architect attributes |
| 2 | What are the core EA belief systems and associated EA schools of thought of enterprise architects? | Develop an EA schools of thought indicator for the consistent classification of EA schools of thought. | [D1.2] | Questionnaire + model | EA schools of thought indicator + taxonomy |
| 3 | What are the core behavioural styles and associated enterprise architect styles of enterprise architects? | Develop an architect style indicator for the consistent classification of the enterprise architect styles. | [D1.3] | Questionnaire + model | Enterprise architect style indicator + taxonomy |
| 4 | What are the perspectives and associated enterprise architect profiles of enterprise architects? | Develop architect profile viewpoints for the understanding of the enterprise architect. | [D1.4] | Social cognitive theory | Enterprise architect profiles |
| 5 | What tools can an organisation use to determine enterprise architect profiles? | Develop an instrument allowing organisations to understand enterprise architect profiles. | [D1.4] | Construction research method | Daedalus Instrument |
| 6 | What technology-based solution can an organisation use to determine enterprise architect profiles? | Develop a technology-based solution allowing organisations to determine the profiles of enterprise architects. | [E1] | Focus group | Technology-based Daedalus Instrument |

### 3.3.5.3 Modes of analysis

The modes of analysis are described based on the design science research process steps. The primary cycle incorporates the entire design science research process including awareness [A1], suggestion [S1], development [D1], evaluation [E1] and conclusion [C1], as depicted within Figure 3-K. The modes of analysis in relation to the design science research process steps, and the thesis' research objectives are summarised in Table 3-15. The data collected were analysed using computer aided qualitative data analysis software (CAQDAS).

**Table 3-15: Modes of analysis techniques and research strategy alignment**

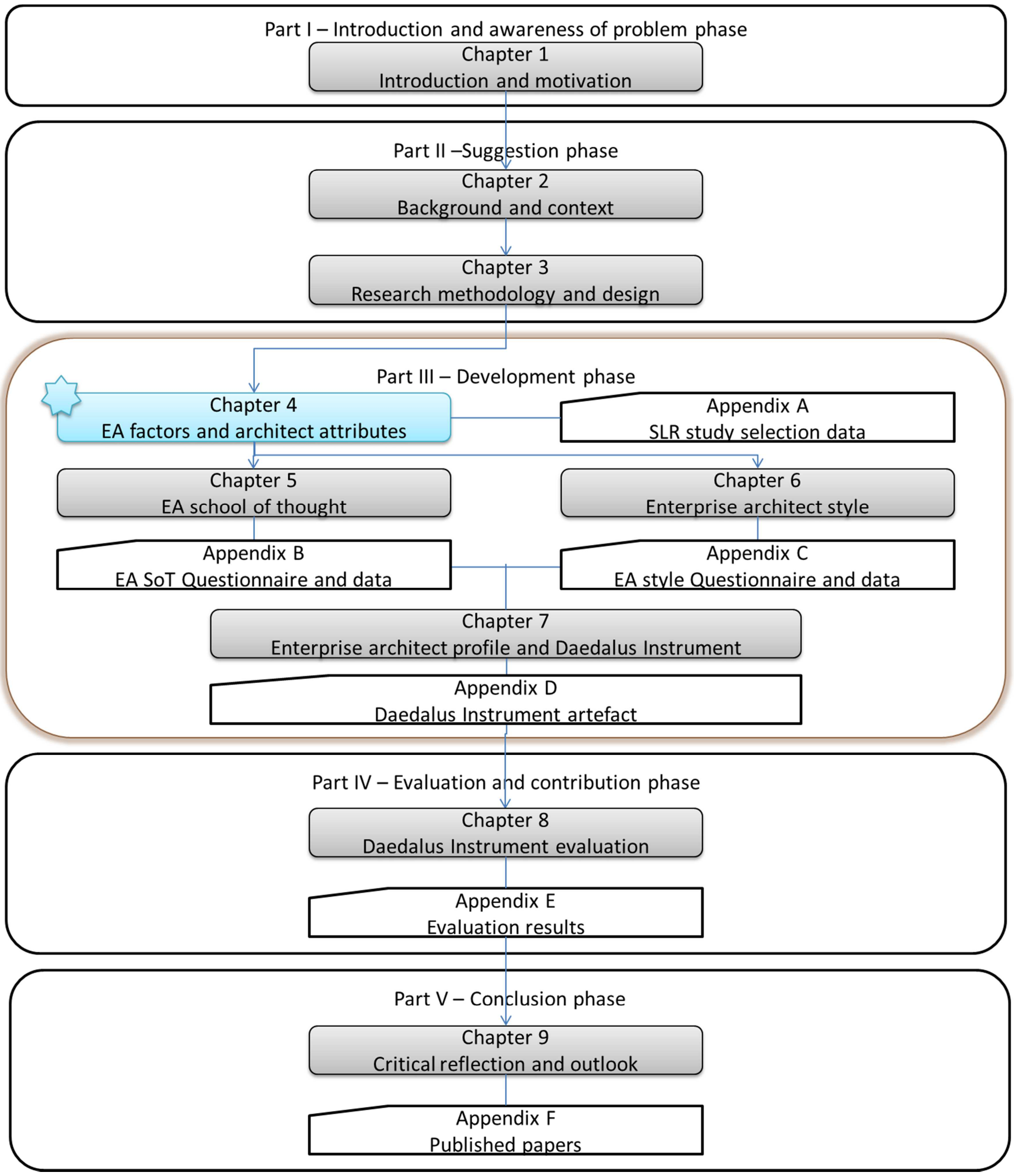
| # | Research question | Research proposition (objectives) | DSR process step | Data preparation | Modes of analysis techniques |
|---|---|---|---|---|---|
| 1 | What are the EA factors and architect attributes, associated with enterprise architects as described within literature? | Determine the enterprise architect associated EA factors and architect attributes described within literature. | [D1.1] | Electronic indexing | Qualitative data display and analysis |
| 2 | What are the core EA belief systems and associated EA schools of thought of enterprise architects? | Develop an EA schools of thought indicator for the consistent classification of EA schools of thought. | [D1.2] | Preparing electronic textual data using coding | Qualitative data display and analysis |
| 3 | What are the core behavioural styles and associated enterprise architect styles of enterprise architects? | Develop an architect style indicator for the consistent classification of the enterprise architect styles. | [D1.3] | Preparing electronic textual data using coding | Qualitative data display and analysis |
| 4 | What are the perspectives and associated enterprise architect profiles of enterprise architects? | Develop architect profile viewpoints for the understanding of the enterprise architect. | [D1.4] | N/A | N/A |
| 5 | What tools can an organisation use to determine enterprise architect profiles? | Develop an instrument allowing organisations to understand enterprise architect profiles. | [D1.4] | N/A | N/A |
| 6 | What technology-based solution can an organisation use to determine enterprise architect profiles? | Develop a technology-based solution allowing organisations to determine the profiles of enterprise architects. | [E1] | Preparing textual data using coding | Qualitative data display and analysis |

## 3.4 Conclusion

This chapter gave background information of available research methodologies as well as the applicable research design to this thesis (i.e. Understanding the architect in enterprise architecture: the Daedalus Instrument for architects) by focusing on "how" the study is conducted to address the research question and objectives.

The next chapter addresses the EA factors and architect attributes, which are associated with the architect. The EA factors and architect attributes are identified through the execution of a systematic literature review. These EA factors and architect attributes served as a precursor for the development of an enterprise architect style.

# 4 EA factors and architect attributes



## 4.1 Introduction

**Chapter 1** gave an introduction and provided the motivation for the thesis. The chapter defined the research questions as well as the research objectives. **Chapter 2** dealt with the awareness of the research problem as well as the suggestion of a tentative design as part of the first two phases of the design science research strategy. **Chapter 3** gave an overview of existing research methodology aspects as well as the design of the research. This chapter, **Chapter 4**, deals with a Systematic Literature Review (SLR) on aspects, enterprise architecture (EA) factors and architect attributes, which are associated with the enterprise architect.

Part III of the thesis is concerned with the development of the design artefact, the Daedalus Instrument for Architects. The EA factors and architect attributes chapter, **Chapter 4,** is divided into five main parts, depicted within Figure 4-A. The introduction of the chapter is covered in section 4.1 with an overview and necessity of the SLR process as well as the introduction of the comprehensive list construct and the EA factors and architect attributes concepts. The SLR process is executed and described within sections 4.2, 4.3 and 4.4 respectively. Section 4.5 summarises the chapter with the conclusion.

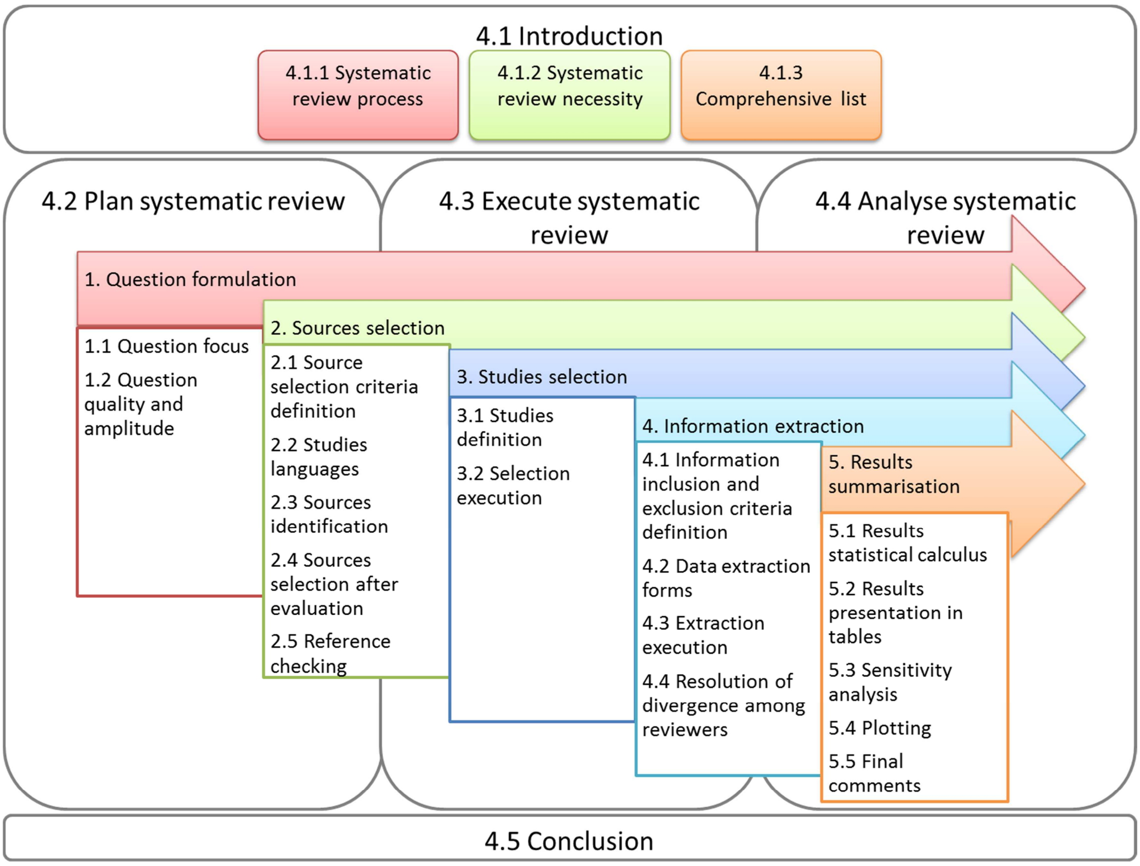



**Figure 4-A: Chapter layout**

**Chapter 4** used the SLR methodology to gather and evaluate available evidence pertaining to the enterprise architect in order to answer a specific research question. The alignment of **Chapter 4** to that of the thesis is depicted within Table 4-1.

This SLR focus on aspects that are associated with the enterprise architect, follows general rules to ensure good quality information was included within the study (Biolchini *et al.*, 2005; Mian *et al.*, 2005). It was executed in this manner to obtain relevant results, which allowed for the identification, selection and production of research evidence.

**Table 4-1: Chapter 4 alignment summary**

| # | Sub-research question | Sub-objective | Challenge | Chapter | DSR Process Step | Deliverable |
|---|---|---|---|---|---|---|
| 1 | What EA factors and architect attributes are associated with the enterprise architect? | To determine which EA factors and architect attributes are associated with the enterprise architect | A systematic study needs to be completed on existing literature concerning the enterprise architect | Chapter 4 – EA factors and architect attributes | [D1.1] | List of EA factors and architect attributes |

## 4.1.1 Research process

This SLR formed part of the development cycle of the Design Science Research (DSR) strategy. The SLR was used in the first iteration of the internal design cycle with the circumscription concerning architect attributes [D1.1] as depicted within Figure 4-B.

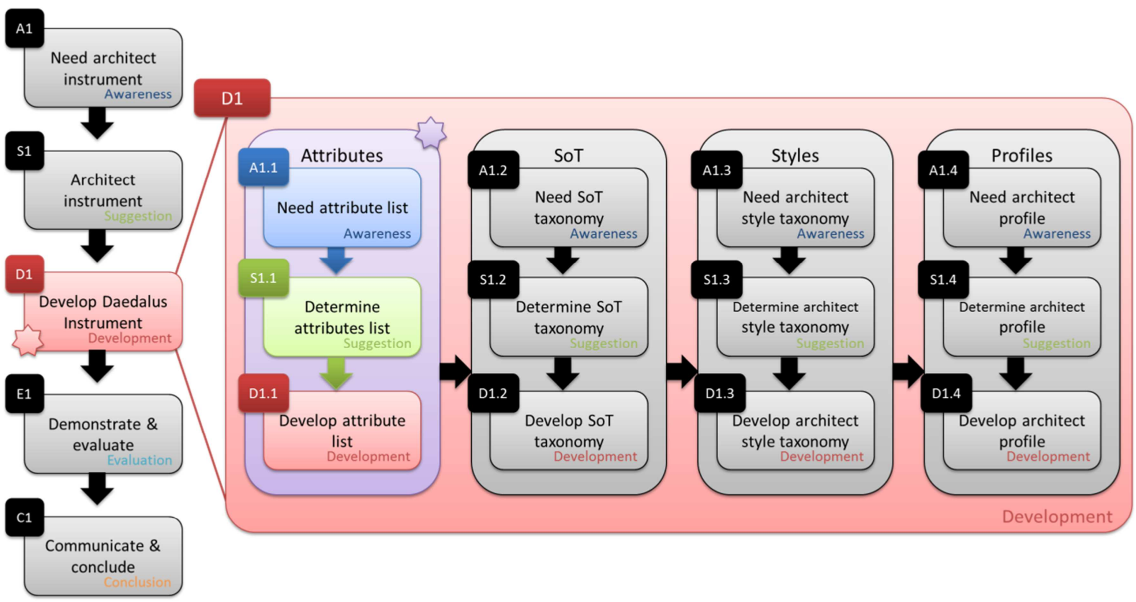



**Figure 4-B: SLR in relation to the DSR development cycle**

The aim of the chapter and the internal development Cycle 1, is to guide researchers in performing systematic reviews (Okoli & Schabram, 2010). EA factors and architect attributes represent the first psychosocial functioning connection of the social cognitive theory, as described within sections 2.3.1 and 2.3.2. Similarly, the motivation and requirement behind following a SLR on aspects associated with the enterprise architect were three-fold and based on the guidelines of Keele (2007):

1. to summarise the existing literature concerning the enterprise architect
2. to identify any gaps within existing enterprise architecture research concerning the architect
3. to provide a foundation for new research on the understanding of the enterprise architect

The three phase SLR approach of plan, execute or conduct, and analyse or report were followed (Biolchini *et al.*, 2005). Although several different SLR processes exist, the plan, execute and analyse phases were consistent across the different systematic review processes (Biolchini *et al.*, 2005; Brereton *et al.*, 2007; Kitchenham, 2004; Mian *et al.*, 2005; Okoli & Schabram, 2010). The three-phase approach followed in the execution of the SLR is depicted within Figure 4-C.

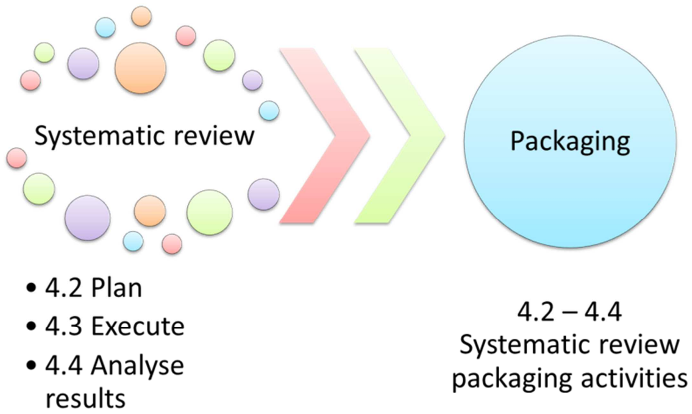



**Figure 4-C: Three-phased approach SLR protocol (Biolchini *et al.*, 2005, p. 10)**

As this study was executed by a single researcher, the scope of the systematic review was limited while following the guidelines for software engineering systematic reviews as depicted within Figure 4-D.

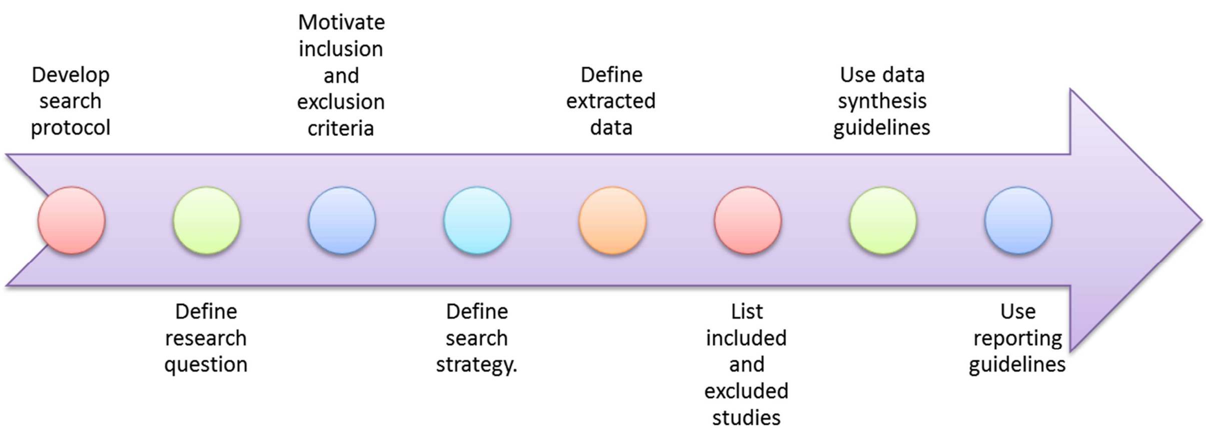



**Figure 4-D: Suggested SLR scope for PhD researcher (Kitchenham, 2004, p. 25)**

Another SLR process specifically developed for information systems research makes use of a four-phase approach with an eight steps process.

### 4.1.2 Research study necessity

Prior to initiating the SLR on aspects associated with the enterprise architect, it was necessary to confirm the need for such a review or the purpose of the review. The need for the SLR was based on and in line with the:

- research questions for the study as defined within **Chapter 1**
- review plan, which defines the basic review procedures
- requirement behind following the SLR as described within section 4.1.2

Although the purpose of the review was specific to the SLR in question, the purpose generally fell within six categories (Okoli & Schabram, 2010):

1. to analyse the progress of a specific stream of research
2. to make recommendations for future research
3. to review the application of one theoretical model in the IS literature
4. to review the application of one methodological approach in the IS literature
5. to develop a model or framework
6. to answer a specific research question

The purpose for this SLR aligned best with the category to answer a specific research question. In addition to the six purpose categories, the Centre for Reviews and Dissemination (CRD) makes use of a set of five questions to determine if a systematic review conforms to the set criteria for inclusion within the Database of Abstracts of Reviews of Effects (CRD, 2014). Although this database focuses primarily on health informatics, the criteria are universal and can be applied to systematic reviews in general and systematic reviews on informatics. The set of CRD criteria, expressed as questions, are listed as follow:

1. Were inclusion / exclusion criteria reported?
2. Was the search adequate?
3. Were the included studies synthesised?
4. Was the quality of the included studies assessed?
5. Are sufficient details about the individual included studies presented?

Section 4.4 describes the systematic literature as per the recommendations of Biolchini *et al.* (2005).

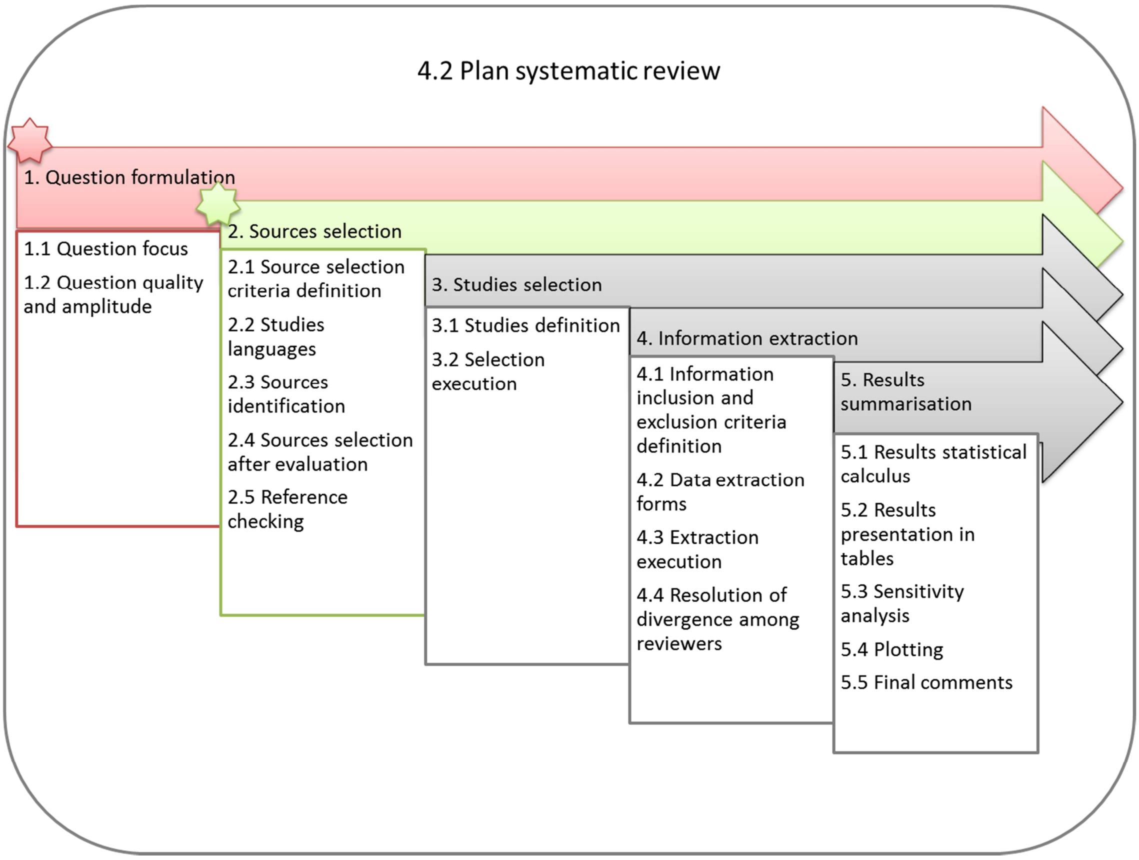
### 4.1.3 Comprehensive list

With the execution of the SLR, a list was formulated of all the EA factors that were found in the literature. These EA factors are concepts that were described in relation to architects within the literature. The EA factor concepts describe what architects do, when they perform their respective functions, where these architects perform their functions and how these architects go about performing their functions. The concept of EA factors thus addressed four of the interrogative pronouns.

Similarly, while executing the SLR, a list was formulated of all the architect attributes that were found in the literature. The architect attributes are concepts that were described in relation to architects within the literature. These architect attribute concepts described who architects are and why they perform their respective functions. The concept of architect attributes thus addressed the remaining two interrogative pronouns.

A combination of the two lists of EA factors and architect attributes created the comprehensive list construct.

## 4.2 Plan systematic review




This SLR made use of the SALSA (Search, AppraisaL, Synthesis, Analysis) framework to ensure the alignment of the SLR criteria as well as to ensure a good quality SLR was delivered. The alignment between the EA SLR and the SALSA framework is listed within Table 4-2.

**Table 4-2: Enterprise Architect SLR SALSA alignment**

| Label | Description | Search | Appraisal | Synthesis | Analysis |
|---|---|---|---|---|---|
| Systematic review | Seeks to systematically search for, appraise and synthesis research evidence, often adhering to guidelines on | Aims for exhaustive, comprehensive searching | Quality assessment may determine inclusion/exclusion | Typically narrative with tabular accompaniment | What is known; recommendations for practice. What remains unknown; uncertainty around findings, recommendations for |

| Label | Description | Search | Appraisal | Synthesis | Analysis |
|---|---|---|---|---|---|
| | the conduct of a review | | | | future research |
| Enterprise architect SLR | Systematic review of EA factors and architect attributes | 12 Databases described within Table 4-5 | Criteria as described within Table 4-7 and Table 4-9 | Narrative and tabular | Descriptive |

Step 1. Question formulation

To ensure consistency and alignment with the thesis research study, the SLR objectives had to be clearly defined. The research objectives were concerned with the research question focus and the research question quality and amplitude. The research question quality and amplitude defined the review context as well as the question the study answers with its range. The SLR can be either a qualitative or quantitative type of review. Where quantitative reviews are concerned with meta-analysis, data aggregation and are descriptive, qualitative SLRs are concerned with meta-synthesis and are narrative or descriptive. For the question formulation (Step 1), the question focus (Step 1.1) and question quality (Step 1.2) were considered.

Step 1.1. Question focus

The question focus defined the systematic review research objectives. On conclusion of the systematic review the objective was realised. The objective of the SLR on aspects associated with the enterprise architect was to determine which EA factors and architect attributes were associated with the enterprise architect.

Step 1.2. Question quality and amplitude

The intention of this step on question quality and amplitude was to define the syntax of the research question. The syntax of the research question was concerned with the systematic review context as well as the research question itself, while taking into account the question range. The question syntax and question range were described by considering attributes such as the problem, question, and keywords are summarised in the following SLR process steps.

Step 1.2.1. Problem

The systematic review target context and the awareness of the problem were described by stating that limited research was available on the understanding of the enterprise architect, whether the enterprise architect was a practitioner, a consultant, an academic or an author. It was necessary to understand what EA factors and architect attributes were associated with the enterprise architect in the context of enterprise architecture.

Step 1.2.2. Question

The systematic review was answered by asking the following research question: What enterprise architect associated EA factors and architect attributes are described in current literature?

Step 1.2.3. Keywords and synonyms

The SLR used keywords for the search of research studies within the online academic research databases. These keywords were expanded using synonyms, concentrated around the enterprise architect (solution architect, business architect, information architect, data architect, application architect, technology architect, integration architect) and enterprise architecture (enterprise architectural, EA).

Step 1.2.4. Intervention

Intervention is concerned with the observed context of the SLR and for this study was to determine specific EA factors or architect attributes that were associated with enterprise architects in the context of enterprise architecture.

Step 1.2.5. Control

The question control is concerned with the baseline or initial dataset that will be used in the systematic review. For the systematic review in this study there is no control as no dataset on aspects associated with the enterprise architect exists.

Step 1.2.6. Effect

The suggestion, effect or type of results expected at the end of the systematic review were for the identification of EA factors and architect attributes that were associated with the enterprise architect.

Step 1.2.7. Outcome measure

The systematic review outcome measure made use of metrics to measure the effect of the systematic review. The outcome measure or development was to create a list of EA factors and architect attributes that were associated with the enterprise architect.

Step 1.2.8. Population

The population group that was observed as part of the systematic review intervention was limited to academic publications regarding enterprise architects and enterprise architecture.

Step 1.2.9. Application

The application areas, roles or professional types that benefited from the SLR results included enterprise architects as practitioners, consultants, authors and academics.

Step 1.2.10. Experimental design

The experimental design described how meta-synthesis was conducted as well as defined which statistical analysis methods were applied on the collected data to interpret the results of the systematic review. The design of the review considered the total number of EA factors and architect attributes mentioned, taking into account both EA factors and architect attributes as a comprehensive list.

A summary of the alignment between the thesis and the SLR is depicted within Table 4-3.

**Table 4-3: Systematic review alignment to thesis**

| Foundation | Research thesis | Systematic literature review |
|---|---|---|
| Objective | To design an instrument that would allow an organisation to understand the architects within the organisation. | To determine which enterprise architect associated EA factors and architect attributes are described within literature. |
| Question | How can an instrument be designed for the understanding of the enterprise architect? | What enterprise architect associated EA factors and architect attributes are described in literature? |

Step 2. Sources selection

The objective of the sources selection step was to select the research sources where searches for primary studies were executed.

Step 2.1. Sources selection criteria definition

The sources selection criteria definition step was concerned with the evaluation criteria for the studies sources. It defined the characteristics which determined the sources to be included in the review execution. The source selection criteria included being accessible online via the Internet, an option to search online databases using keywords, titles and abstracts and the bulk export of reference citations.

Step 2.2. Studies languages

This step defined the languages in which the primary studies had to be written. The studies languages for the review execution are limited to the English language.

Step 2.3. Sources identification

Sources selection was concerned with the selection of study sources for the review execution.

Step 2.3.1. Sources search methods

The sources search methods step was concerned with the process on how the search for primary studies was executed. The source search method for the execution review was limited to online searching through web search engines available to the electronic platform of the University of Pretoria.

Step 2.3.2. Search string

This step was only applicable when the search method was executed via a web search engine. The intention of this step was to define the search string used when executing an online search via a web search engine. The search string used for the review execution was as follows (“enterprise architect” OR “solution architect” OR “business architect” OR "information architect" OR "data architect" OR "application architect" OR "technology architect" OR "integration architect") AND ("enterprise architecture" OR "enterprise architectural" OR EA).

Step 2.3.3. Sources list

The source list step specified the initial source list used for the systematic review execution. The initial sources list of databases for the review execution is depicted within Table 4-4.

**Table 4-4: Sources list – Initial**

| Database | Link |
|---|---|
| ABI/Inform (ProQuest) | http://search.proquest.com/ |
| ACM Portal | http://dl.acm.org/ |
| arXiv | http://arxiv.org/ |
| Compendex Ei Engineering Village | http://www.engineeringvillage.com/ |
| Ebsco Host | http://search.ebscohost.com/ |
| Emerald | http://www.emeraldinsight.com/ |
| Google Scholar | http://scholar.google.com/ |
| IEEE Explore | http://ieeexplore.ieee.org/Xplore/ |
| Gale Databases | http://find.galegroup.com/menu/start |
| Thompson Reuters Web of Science | http://apps.webofknowledge.com/ |
| Science Direct | http://www.sciencedirect.com/ |
| Scopus | http://www.scopus.com/ |
| Springer Link | http://link.springer.com/ |

Step 2.4. Sources selection after evaluation

Sources selection after evaluation was concerned with the elements of the initial source list (Step 2.3.3), which were evaluated according to the sources selection criteria definition (Step 2). The evaluated sources list of databases for the review execution is depicted within Table 4-5.

**Table 4-5: Sources list – Evaluated**

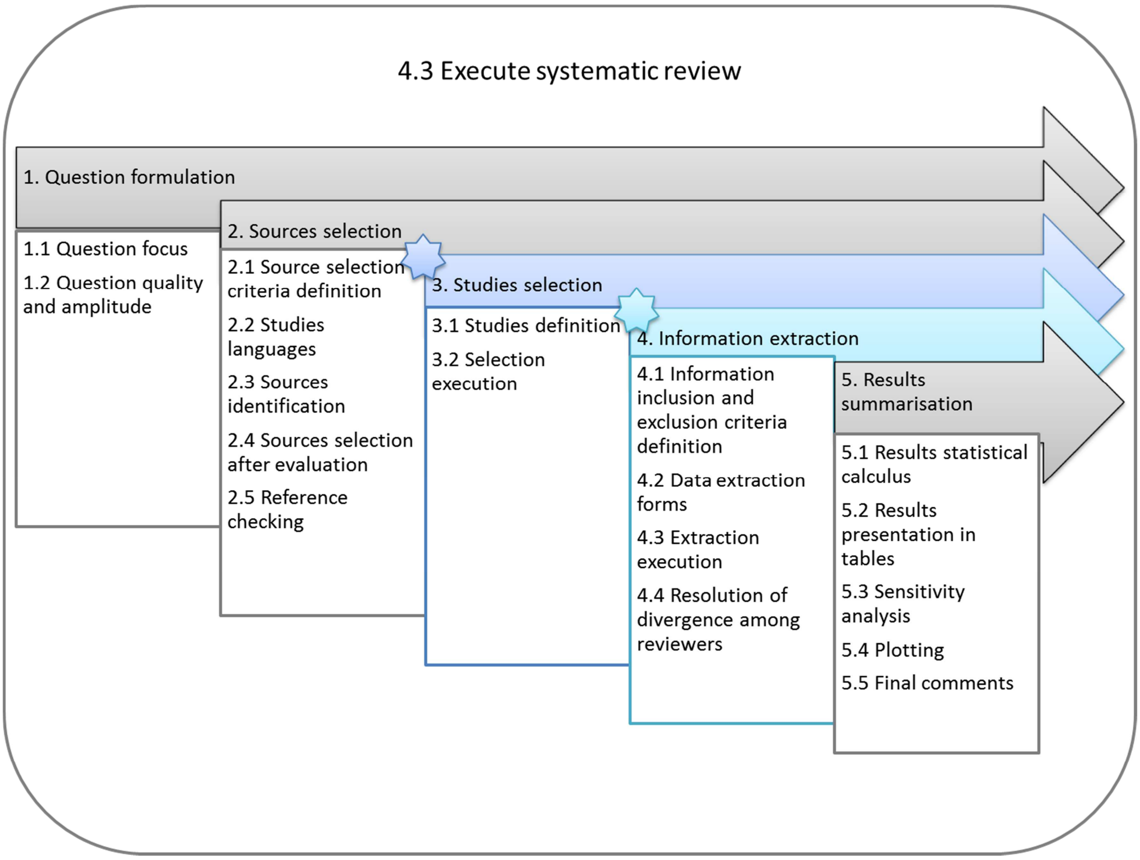
| Database | Link | Satisfied source quality criteria |
|---|---|---|
| ABI/Inform (ProQuest) | http://search.proquest.com/ | Yes |
| ACM Portal | http://dl.acm.org/ | No – No export |
| arXiv | http://arxiv.org/ | No – No complex search terms |
| Compendex Ei Engineering Village | http://www.engineeringvillage.com/ | Yes |
| Ebsco Host | http://search.ebscohost.com/ | Yes |
| Emerald | http://www.emeraldinsight.com/ | Yes |
| Google Scholar | http://scholar.google.com/ | No – No keyword, title, abstract search, fixed search term length |
| IEEE Explore | http://ieeexplore.ieee.org/Xplore/ | Yes |
| Gale Databases | http://find.galegroup.com/menu/start | Yes |
| Thompson Reuters Web of Science | http://apps.webofknowledge.com/ | Yes |
| Science Direct | http://www.sciencedirect.com/ | Yes |
| Scopus | http://www.scopus.com/ | Yes |
| Springer Link | http://link.springer.com/ | Yes |

Step 2.5. Reference checking

The reference checking step was concerned with the expert motivation and reference checking of the initial sources list. The experts evaluated the sources list. Where discrepancies exist with the list, a motivation was provided for the inclusion or exclusion of sources within the list. These motivations included:

- The addition of supplementary sources was required as a result of discrepancies in some citation details for the databases selected. Some of the discrepancies include:
    - No abstract available
    - Incorrect spelling
    - The use of special characters
- The additional citations were included from known EA authors, publishing on the topic of the enterprise architect. These authors include:
    - Lapalme
    - Strano
    - Bredemeyer and Malan
    - Steghuis
    - The Open Group

## 4.3 Execute systematic review




Step 3. Studies selection

The studies selection was executed on the completion of the defined study sources. The process and the criteria for studies selection and evaluation are described within this step. The study selection criteria are listed within Table 4-6.

**Table 4-6: Study selection criteria**

| | Study selection | Systematic literature review on enterprise architects |
|---|---|---|
| Studies definition | Studies inclusion and exclusion criteria definition | Academic publications |
| | Studies types definition | All |
| | Procedures for studies selection | Search of online academic publication databases |
| Selection execution | Initial studies selection | 1305 publications |
| | Studies quality evaluation | N/A |
| | Selection review | N/A |

Step 3.1. Studies definition

The studies definition step defines the way studies are selected.

Step 3.1.1. Studies inclusion and exclusion criteria definition

This step describes the criteria by which studies were evaluated to decide if they were included or not in the context of the SLR. It was fundamental to define these criteria, as a search executed within web search engines may find an excessive number of articles that do not answer the predefined research question. The primary motivation was that a keyword may have several different connotations or be used in studies that are irrelevant to the SLR research topic. It was therefore necessary to define what makes an article a potential candidate to be included or to be excluded from the SLR. Inclusion and exclusion criteria can be found within literature, as in Kitchenham *et al.*, for experiments in the software engineering discipline (2002), or be defined by the researchers. The source inclusion and exclusion criteria are listed within Table 4-7.

**Table 4-7: Source inclusion and exclusion criteria**

| Inclusion criteria | Exclusion criteria |
|---|---|
| Masters and doctoral thesis | World wide web sources (Non-academic) |
| Peer-reviewed academic conference papers | |
| Peer-reviewed academic journal articles | |
| Books | |
| Book chapters | |

Step 3.1.2. Study types definition

Study types definition defined the type of primary studies, which are included during the SLR execution. Study types included qualitative or quantitative studies as observation, feasibility, or characterisation studies. For the execution of the SLR concerning aspects related to the enterprise architect, no specific type of primary study is required, as listed within Table 4-8. This is as a result of the limited number of studies available regarding enterprise architecture and the enterprise architect itself.

**Table 4-8: Study type definition**

| Study type |
|---|
| Any |

Step 3.1.3. Procedures for studies selection

The procedure for studies selection describes the procedure by which the studies will be obtained and evaluated according to exclusion and inclusion criteria. For the SLR concerning aspects related to the enterprise architect; the study is executed using a web browser for the search of online academic databases. The search does not include a hand search for any physical published journals. The initial evaluation will make use of online academic publication databases.

The search string specified is used to execute a search within each database. Where limitations exist within databases as a result of the databases not being developed to cater specifically for SLRs, the search string would be altered to conform to the databases' requirement conditions to result in a successful execution, while still ensuring that the alternations do not affect the results returned from the database as being valid and correct. These limitations can include the length of the search string, or the use of operators, and notation of the search string. The results of each database is recorded separately against the specific database and then combined to provide a total number of retrieved publications.

All duplicates are removed from the list, in addition to all non-English publication being eliminated. The resulting number of publications forms the primary study selection. The next step is to exclude publications based on the defined study criteria using the publication metadata (title, keywords, abstract). All publications where the full text is not available are excluded as part of the study. The SLR primary study is thus executed using a manageable number of publications for full text reading. An additional number of publications are then excluded after full text reading, where the studies are identified as not being relevant to the SLR study. The remaining number of publications is then used for the primary SLR study.

The studies identified as being the primary study selection are each evaluated using a qualitative critical review form. This critical review of each of the studies assists in determining and identifying a comprehensive list of EA factors and architect attributes. A graphical depiction of the study selection procedure is depicted within Figure 4-E.

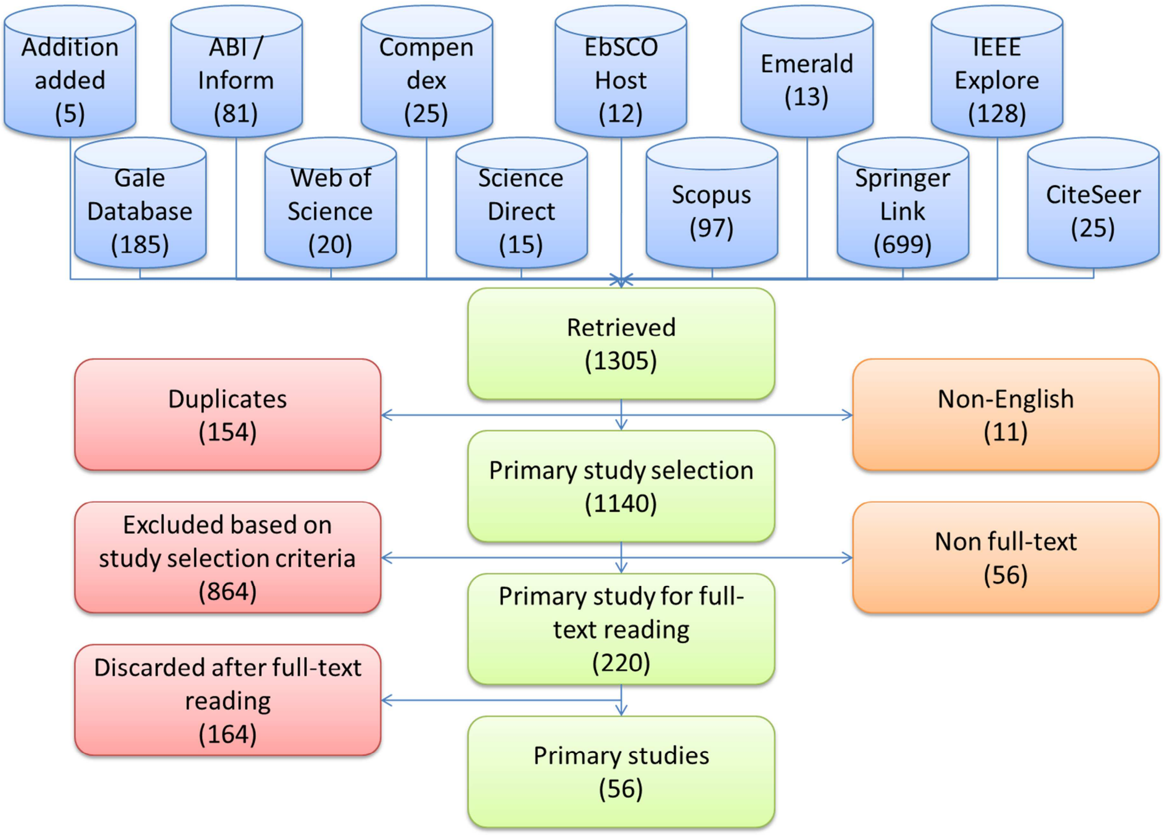



**Figure 4-E: Studies selection process**

Step 3.2. Selection execution

Selection execution aims to register the primary study selection process, reporting the obtained studies and the results of their evaluation. This is done using a standard form to ensure consistency between capturing metadata for each of the searches being executed on the individual databases.

Step 3.2.1. Initial studies selection

The initial study selection included 13 online academic databases and search engines. Three of these were eliminated, which did not conform to the source selection criteria, specified within Step 2.1 and Step 2.4. Additional sources where then added on known work of authors, which was not picked up with the initial search as a result of database search or citation inconsistencies.

An online search is executed for each of the remaining databases and the results are captured and documented. The search results obtained for each of the databases are listed for further evaluation within **Appendix A**.

Step 3.2.2. Study quality evaluation

The procedures for study selection, described within Step 3.1.3, are applied to all obtained articles in order to verify if the studies fit the inclusion and exclusion criteria. Traditionally, the studies are crosschecked against the studies belonging to the types selected during the planning phase. However as a limited amount of enterprise architect studies are available, all studies are included, regardless of study type.

Step 3.2.3. Selection review

Study selection is reviewed to guarantee that the study quality evaluation does not eliminate relevant articles. The study selection procedure is reviewed by the experts listed within Step 2.5 and are approved.

Step 4. Information extraction

Once primary studies are selected, the extraction of relevant information begins. In this step, extraction criteria and results are described.

Step 4.1. Information inclusion and exclusion criteria definition

Information inclusion and exclusion criteria by which the information is obtained from studies must be evaluated. The information inclusion and exclusion criteria are listed within Table 4-9.

**Table 4-9: Information inclusion and exclusion criteria**

| Inclusion criteria | Exclusion criteria |
|---|---|
| Study where a relationship between an architect and EA is described | Study on enterprise architecture, where no reference is made to the enterprise architect |
| Study specifically concerned with various aspects regarding the architect | Author's own publications on the topic |

Step 4.2. Data extraction forms

To ensure a standardised way information is represented, the SLR study makes use of a workbook to collect data from the selected studies as well as the evaluation of studies. The data extraction form includes metadata as provided by the individual search engines as well as information regarding the critical review of the selected studies (critical appraisal tool), which in addition is in alignment with the systematic review's objective and context.

A template of the study selection execution data is listed within Table 4-10, with the complete data source selection execution list, tabled within **Appendix A**.

**Table 4-10: Data source selection execution template**

| Data source | Data source metadata | Data source results |
|---|---|---|
| Online Academic Platform | Name of database | List of databases searched within the platform |
| | Search strategy for each database | Description of search being executed |
| | Date of search | dd/mm/yyyy |
| | Years covered by search | yyyy – yyyy; All dates |
| | Number of publications | # |

A template of the quality critical review form or critical appraisal tool is listed within Table 4-11. The full list of the completed quality critical review evaluation forms are tabled within **Appendix A**.

**Table 4-11: Qualitative critical review form template**

| Criteria | Comment |
|---|---|
| Study identification | Harvard Referencing |
| Study methodology | Outline the study strategy or methodology used within the study. |
| Study scope | Outline the scope of the study or research question. |
| Study limitations | What are the main limitations of the study? |
| EA factors / architect attributes | What are the EA factors or architect attributes identified within the study? |

Step 4.3. Extraction execution

Two kinds of results can be extracted from the selected studies: objective and subjective results. The SLR on aspects related to the enterprise architect makes use of an objective results extraction. This is in line with the data abstraction form, which addresses the below mentioned areas.

Step 4.3.1. Objective results extraction

Objective results are those that can be extracted directly from the selected studies. Such results are organised as follows:

i) Study identification: study identification includes the publication title, its authors, and the source from which it was obtained, described using the Harvard referencing standard
ii) Study methodology: strategy or methods used to conduct the study
iii) Study scope: the scope of the executed study
iv) Study limitations: study limitations found by the article's authors
v) EA factors / architect attributes: The EA factors or architect attributes identified within the study

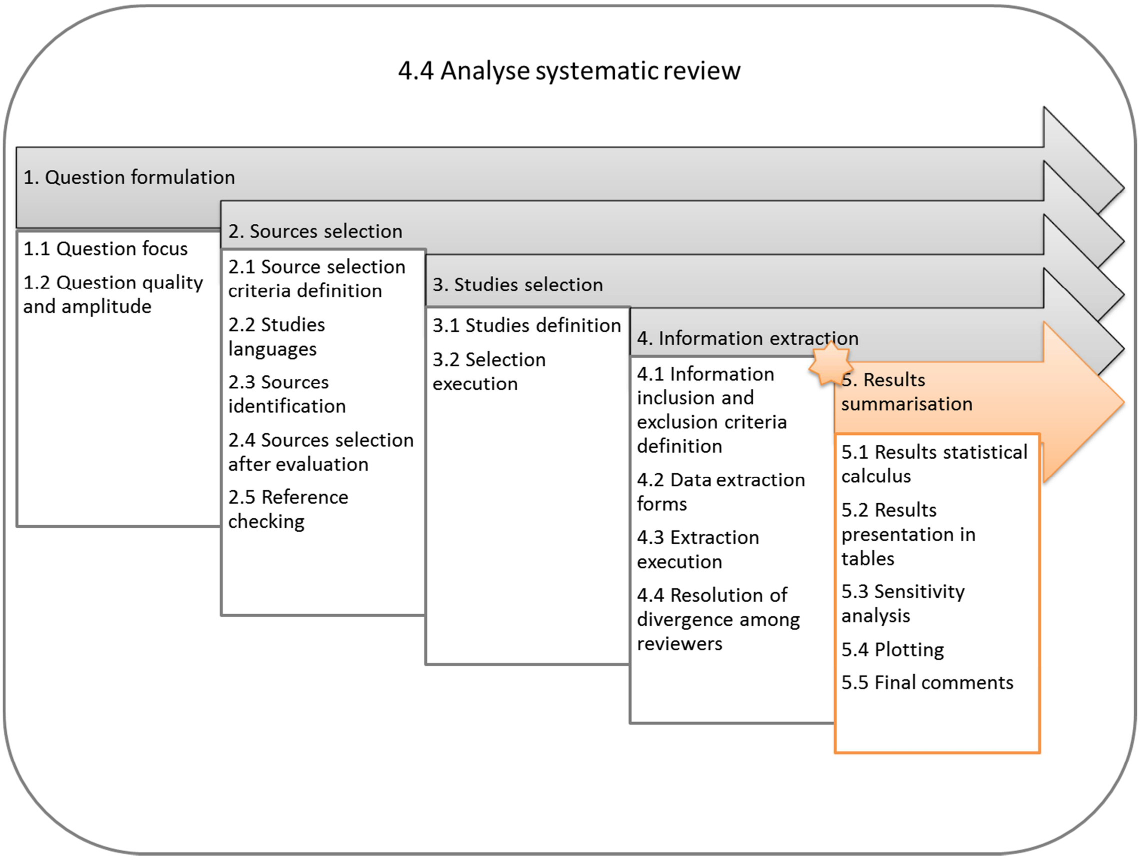
Step 4.4. Resolution of divergences among reviewers

When reviewers do not agree on the information extracted from the studies, the divergences must be recorded. The reviewers must reach a consensus on this matter and register it in this step. No divergences were recorded, as depicted within Table 4-12.

**Table 4-12: Divergence resolution**

| # | Study | Divergence | Consensus |
|---|---|---|---|
| 0 | N/A | N/A | N/A |

## 4.4 Analyse systematic review




Step 5. Results summarisation

This systematic review step aims to present the data resulting from the 56 primary selected studies.

Step 5.1. Results statistical calculus

Statistical methods chosen in Step 1.2.10 were applied to analyse data and to understand the complexity relations between obtained results. The results from the statistical calculus are listed within Table 4-13.

**Table 4-13: Statistical calculus results**

| Topic | # of Studies | Citation |
|---|---|---|
| Framework | 38 studies | (Aier, 2013; Armour *et al.*, 1999; Bauer *et al.*, 2013; Boster *et al.*, 2000; Bubak, 2006; Chuang and Van Loggerenberg, 2010; Chung *et al.*, 2009; Espinosa *et al.*, 2011; Espinosa & Boh, 2009; Farwick *et al.*, 2014; Hämäläinen & Markkula, 2009; Harmon, 2005; Hauder *et al.*, 2014; Hjort-Madsen & Pries-Heje, 2009; Iacob *et al.*, 2014; Lapalme, 2012a; Lindström *et al.*, 2006; Lu & Lin, 2012; Nakakawa *et al.*, 2011, 2009; Naranjo *et al.*, 2014; Niemietz & De Kinderen, 2013; Nikpay *et al.*, 2013; Safari *et al.*, 2014; Sidorova & Kappelman, 2011; Simon *et al.*, 2013b; Solano, 2011; Steen *et al.*, 2004; Steghuis & Proper, 2008; Tambouris *et al.*, 2012; The Open Group, 2009; Van Den Berg & Van Vliet, 2014; Van Der Raadt *et al.*, 2010; Vinoski, 2008; Wegmann, 2003; Woods & Rozanski, 2005; Zimmermann *et al.*, 2011, 2012) |
| Role | 20 studies | (Akenine, 2008; Bredemeyer & Malan, 2004; Chung *et al.*, 2009; Espinosa *et al.*, 2013, 2011; Espinosa & Boh, 2009; Fraga & Llorens, 2007; Gøtze, 2013; Hendrickx *et al.*, 2011; Naranjo *et al.*, 2014; Ouriaghli & Nsubuga, 2012; Solano, 2011; Steghuis & Proper, 2008; Strano & Rehmani, 2007; Tambouris *et al.*, 2012; The Open Group, 2009; Wagter *et al.*, 2012; Walrad *et al.*, 2014; Wegmann, 2003; Woods & Rozanski, 2005) |
| Configuration (Transformation) | 19 studies | (Aier, 2014; Barnes *et al.*, 2014; Bauer *et al.*, 2013; Boster *et al.*, 2000; Bubak, 2006; Chuang & Van Loggerenberg, 2010; Farwick *et al.*, 2014; Gøtze, 2013; Harmon, 2005; Hendrickx *et al.*, 2011; Hjort-Madsen & Pries-Heje, 2009; Lapalme, 2012a; Nakakawa *et al.*, 2011, 2010; Niemietz & De Kinderen, 2013; Simon *et al.*, 2013b; Steen *et al.*, 2004; Strano & Rehmani, 2007; The Open Group, 2009) |
| Stakeholder | 19 studies | (Aier, 2014; Armour *et al.*, 1999; Chuang & Van Loggerenberg, 2010; Espinosa *et al.*, 2011; Espinosa & Boh, 2009; Farwick *et al.*, 2014; Foorthuis *et al.*, 2015, 2010; Hämäläinen & Markkula, 2009; Hendrickx *et al.*, 2011; Nakakawa *et al.*, 2009, 2010; Naranjo *et al.*, 2014; Nikpay *et al.*, 2013; Ouriaghli & Nsubuga, 2012; Tambouris *et al.*, 2012; The Open Group, 2009; Van Der Raadt *et al.*, 2010; Woods & Rozanski, 2005) |
| Position | 18 studies | (Akenine, 2008; Armour *et al.*, 1999; Barnes *et al.*, 2014; Boster *et al.*, 2000; Bredemeyer & Malan, 2004; Espinosa *et al.*, 2013, 2011; Espinosa & Boh, 2009; Gøtze, 2013; Hendrickx *et al.*, 2011; Hjort-Madsen & Pries-Heje, 2009; Lindström *et al.*, 2006; Niemietz & De Kinderen, 2013; Solano, 2011; Strano & Rehmani, 2007; Tambouris *et al.*, 2012; Walrad *et al.*, 2014; Zimmermann *et al.*, 2012) |
| Business objective | 17 studies | (Armour *et al.*, 1999; Boster *et al.*, 2000; Chung *et al.*, 2009; Foorthuis *et al.*, 2015; Hämäläinen & Markkula, 2009; Hendrickx *et al.*, 2011; Lapalme, 2012a; Nakakawa *et al.*, 2009, 2010; Ouriaghli & Nsubuga, 2012; Rehkopf & Wybolt, 2003; Simon *et al.*, 2013b; Tambouris *et al.*, 2012; The Open Group, 2009; Van Den Berg & Van Vliet, 2014; Van Der Raadt *et al.*, 2010; Woods & Rozanski, 2005) |
| Model | 17 studies | (Aier, 2014; Bauer *et al.*, 2013; Espinosa *et al.*, 2013, 2011; Espinosa & Boh, 2009; Farwick *et al.*, 2014; Foorthuis *et al.*, 2015, 2010; Hämäläinen & Markkula, 2009; Hauder *et al.*, 2014; Iacob *et al.*, 2014; Naranjo *et al.*, 2014; Nikpay *et al.*, 2013; Simon *et al.*, 2013b; Steen *et al.*, 2004; The Open Group, 2009; Wegmann, 2003) |
| Domain | 16 studies | (Barnes *et al.*, 2014; Bauer *et al.*, 2013; Bubak, 2006; Chuang & Van Loggerenberg, 2010; Fraga & Llorens, 2007; Gøtze, 2013; Hendrickx *et al.*, 2011; Iacob *et al.*, 2014; Jacobs *et al.*, 2009; Nakakawa *et al.*, 2011, 2009; Tambouris *et al.*, 2012; Vinoski, 2008; Zimmermann *et al.*, 2011, 2012) |
| Organisational culture | 16 studies | (Aier, 2014; Chuang & Van Loggerenberg, 2010; Chung *et al.*, 2009; Farwick *et al.*, 2014; Foorthuis *et al.*, 2015, 2010; Hendrickx *et al.*, 2011; MacLennan & Van Belle, 2014; Niemietz & De Kinderen, 2013; Ouriaghli & Nsubuga, 2012; Safari *et al.*, 2014; Steghuis & Proper, 2008; The Open Group, 2009; Van Den Berg & Van Vliet, 2014; Van Steenbergen *et al.*, 2011; Wagter *et al.*, 2012) |
| Organisational Segment (Business unit) | 16 studies | (Aier, 2014; Armour *et al.*, 1999; Chuang & Van Loggerenberg, 2010; Espinosa *et al.*, 2013, 2011; Espinosa & Boh, 2009; Lindström *et al.*, 2006; MacLennan & Van Belle, 2014; Niemietz & De Kinderen, 2013; Ouriaghli & Nsubuga, 2012; Rehkopf & Wybolt, 2003; Simon *et al.*, 2013b; The Open Group, 2009; Van Der Raadt *et al.*, 2010; Zimmermann *et al.*, 2011, 2012) |
| Politics (Power) | 16 studies | (Armour *et al.*, 1999; Boster *et al.*, 2000; Bredemeyer & Malan, 2004; Chuang & Van Loggerenberg, 2010; Gøtze, 2013; Hjort-Madsen & Pries-Heje, 2009; Lapalme, 2012a; Nakakawa *et al.*, 2010; Ouriaghli & Nsubuga, 2012; Sidorova & Kappelman, 2011; Simon *et al.*, 2013b; Solano, 2011; Strano & Rehmani, 2007; The Open Group, 2009; Van Den Berg & Van Vliet, 2014; Van Der Raadt *et al.*, 2010) |
| Challenge / problem | 15 studies | (Chuang & Van Loggerenberg, 2010; Chung *et al.*, 2009; Espinosa & Boh, 2009; Farwick *et al.*, 2014; Gøtze, 2013; Lapalme, 2012a; Nakakawa *et al.*, 2010; Naranjo *et al.*, 2014; Niemietz & De Kinderen, 2013; Rehkopf & Wybolt, 2003; Sidorova & Kappelman, 2011; Vinoski, 2008; Wegmann, 2003; Woods & Rozanski, 2005; Zimmermann *et al.*, 2012) |
| Position Level | 14 studies | (Akenine, 2008; Barnes *et al.*, 2014; Boster *et al.*, 2000; Espinosa *et al.*, 2013, 2011; Espinosa & Boh, 2009; Gøtze, 2013; Hendrickx *et al.*, 2011; Hjort-Madsen & Pries-Heje, 2009; Lindström *et al.*, 2006; Solano, 2011; Strano & Rehmani, 2007; Walrad *et al.*, 2014; Zimmermann *et al.*, 2012) |
| Critical success factor | 13 studies | (Aier, 2014; Harmon, 2005; Hendrickx *et al.*, 2011; Jacobs *et al.*, 2009; MacLennan & Van Belle, 2014; Nakakawa *et al.*, 2009; Niemietz & De Kinderen, 2013; Nikpay *et al.*, 2013; Ouriaghli & Nsubuga, 2012; Simon *et al.*, 2013b; The Open Group, 2009; Van Der Raadt *et al.*, 2010; Zimmermann *et al.*, 2012) |
| Governance | 13 | (Espinosa *et al.*, 2013; Espinosa & Boh, 2009; Hauder *et al.*, 2014; Nakakawa *et al.*, 2010; Nikpay *et al.*, 2013; Steghuis & Proper, 2008; The Open Group, 2009; |

| Topic | # of Studies | Citation |
|---|---|---|
| | studies | Van Der Raadt *et al.*, 2010; Van Steenbergen *et al.*, 2011; Vinoski, 2008; Woods & Rozanski, 2005; Zimmermann *et al.*, 2011) |
| Standard | 13 studies | (Aier, 2014; Boster *et al.*, 2000; Espinosa *et al.*, 2013, 2011; Espinosa & Boh, 2009; Gøtze, 2013; Hendrickx *et al.*, 2011; Rehkopf & Wybolt, 2003; Strano & Rehmani, 2007; The Open Group, 2009; Vinoski, 2008; Walrad *et al.*, 2014; Woods & Rozanski, 2005) |
| Competency | 11 studies | (Bredemeyer & Malan, 2004; Bubak, 2006; Gøtze, 2013; Hjort-Madsen & Pries-Heje, 2009; Lu & Lin, 2012; Naranjo *et al.*, 2014; Sidorova & Kappelman, 2011; Steghuis & Proper, 2008; Tambouris *et al.*, 2012; Wagter *et al.*, 2012; Walrad *et al.*, 2014) |
| Skill | 11 studies | (Hendrickx *et al.*, 2011; Lapalme, 2012a; Naranjo *et al.*, 2014; Ouriaghli & Nsubuga, 2012; Safari *et al.*, 2014; Sidorova & Kappelman, 2011; Steghuis & Proper, 2008; Tambouris *et al.*, 2012; The Open Group, 2009; Walrad *et al.*, 2014; Woods & Rozanski, 2005) |
| View | 11 studies | (Armour *et al.*, 1999; Bauer *et al.*, 2013; Chuang & Van Loggerenberg, 2010; Espinosa & Boh, 2009; Hämäläinen & Markkula, 2009; Jacobs *et al.*, 2009; Nakakawa *et al.*, 2010; Steen *et al.*, 2004; Steghuis & Proper, 2008; The Open Group, 2009; Woods & Rozanski, 2005) |
| Level of detail | 10 studies | (Bauer *et al.*, 2013; Hämäläinen & Markkula, 2009; Nakakawa *et al.*, 2011; Naranjo *et al.*, 2014; Ouriaghli & Nsubuga, 2012; Simon *et al.*, 2013b; Steen *et al.*, 2004; The Open Group, 2009; Van Der Raadt *et al.*, 2010; Zimmermann *et al.*, 2012) |
| Concern | 09 studies | (Chung *et al.*, 2009; Lapalme, 2012a; Lindström *et al.*, 2006; Nakakawa *et al.*, 2009, 2010; Solano, 2011; The Open Group, 2009; Van Der Raadt *et al.*, 2010; Woods & Rozanski, 2005) |
| Scope | 09 studies | (Bredemeyer & Malan, 2004; Hämäläinen & Markkula, 2009; Lapalme, 2012a; Nakakawa *et al.*, 2011, 2009; Ouriaghli & Nsubuga, 2012; The Open Group, 2009; Walrad *et al.*, 2014; Zimmermann *et al.*, 2012) |
| Benefit | 08 studies | (Chung *et al.*, 2009; Espinosa *et al.*, 2013; Foorthuis *et al.*, 2015, 2010; Sidorova & Kappelman, 2011; Van Steenbergen *et al.*, 2011; Vinoski, 2008; Woods &Rozanski, 2005) |
| Definition | 08 studies | (Armour *et al.*, 1999; Hendrickx *et al.*, 2011; Jacobs *et al.*, 2009; Lapalme, 2012a; The Open Group, 2009; Van Den Berg & Van Vliet, 2014; Vinoski, 2008; Woods & Rozanski, 2005) |
| Discipline | 08 studies | (Bubak, 2006; Fraga & Llorens, 2007; Gøtze, 2013; Harmon, 2005; Lindström *et al.*, 2006; Simon *et al.*, 2013b; Strano & Rehmani, 2007; The Open Group, 2009) |
| Goal | 08 studies | (Aier, 2014; Chung *et al.*, 2009; Espinosa *et al.*, 2013, 2011; Nakakawa *et al.*, 2011; Ouriaghli & Nsubuga, 2012; Van Der Raadt *et al.*, 2010; Woods & Rozanski, 2005) |
| Maturity stage | 07 studies | (Espinosa *et al.*, 2013, 2011; Espinosa & Boh, 2009; Nikpay *et al.*, 2013; Tambouris *et al.*, 2012; The Open Group, 2009; Zimmermann *et al.*, 2011) |
| Methodology | 07 studies | (Bauer *et al.*, 2013; Harmon, 2005; Rehkopf & Wybolt, 2003; Sidorova & Kappelman, 2011; Steen *et al.*, 2004; The Open Group, 2009; Wegmann, 2003) |
| Profile | 06 studies | (Barnes *et al.*, 2014; Bauer *et al.*, 2013; Lu & Lin, 2012; MacLennan & Van Belle, 2014; The Open Group, 2009; Zimmermann *et al.*, 2012) |
| Purpose | 06 studies | (Espinosa *et al.*, 2013; Hämäläinen & Markkula, 2009; Lapalme, 2012a; Nakakawa *et al.*, 2009, 2010; The Open Group, 2009) |
| Experience | 05 studies | (Aier, 2014; Hauder *et al.*, 2014; Ouriaghli & Nsubuga, 2012; Strano & Rehmani, 2007; Woods & Rozanski, 2005) |
| Modelling Notation | 05 studies | (Bauer *et al.*, 2013; Hämäläinen & Markkula, 2009; Steen *et al.*, 2004; The Open Group, 2009; Wegmann, 2003) |
| Technique | 05 studies | (Foorthuis *et al.*, 2010; Niemietz & De Kinderen, 2013; Safari *et al.*, 2014; Van Steenbergen *et al.*, 2011; Woods & Rozanski, 2005) |
| Certification | 04 studies | (Hendrickx *et al.*, 2011; Steghuis & Proper, 2008; Tambouris *et al.*, 2012; Walrad *et al.*, 2014) |
| School of thought | 04 studies | (Foorthuis *et al.*, 2010; Iacob *et al.*, 2014; Lapalme, 2012a; Vinoski, 2008) |
| Architecture Segment | 03 studies | (Espinosa *et al.*, 2011; Espinosa & Boh, 2009; The Open Group, 2009) |
| Deliverable | 03 studies | (MacLennan & Van Belle, 2014; Nakakawa *et al.*, 2009; Van Den Berg & Van Vliet, 2014) |

| Topic | # of Studies | Citation |
|---|---|---|
| Type | 03 studies | (Gøtze, 2013; The Open Group, 2009; Zimmermann *et al.*, 2011) |
| Outcome | 02 studies | (Espinosa & Boh, 2009; Foorthuis *et al.*, 2015) |
| Reporting Line | 02 studies | (The Open Group, 2009; Van Der Raadt *et al.*, 2010) |

## Step 5.2. Results presentation in tables

The results obtained from the systematic review were displayed in a table to facilitate analysis. The tables allow for the hierarchical classification of studies according to different criteria and to organise them under different perspectives. The SLR data presentation template is listed within Table 4-14 and a summary of the SLR data results listed within Table 4-15. The complete list of critical review forms with their data is tabled within **Appendix A**.

**Table 4-14: SLR data presentation template**

| Abstraction | Area | Topic class | Topic |
|---|---|---|---|
| What | Enterprise architecture | EA factor | Certification; Scope (Lapalme, 2012a); Purpose (Lapalme, 2012a); Definition (EARF, 2010; FEA PMO, 2007; Gartner, 2014; ISO/IEC/IEEE JTC1/SC7/WG42, 2011; Lankhorst, 2009; Ross *et al.*, 2006; Schekkerman, 2014; The Open Group, 2009; Zachman, 2008, 2007); Architecture Segment (Strano & Rehmani, 2007); Domain (The Open Group, 2009); Perspectives (Zachman, 2007); Abstractions (Zachman, 2007); Models (Zachman, 2007); Maturity stage (US GAO, 2002); Frameworks (Minoli, 2008); Governance structures (The Open Group, 2009); Modelling notation (Hall & Harmon, 2007). |
| Where | EA practise | EA factor | Organizational segment; Reporting line (Matthee *et al.*, 2007). |
| When | EA cycle | EA factor | PLCM; SDLC; Commercial (Procurement). |
| Who | Enterprise architect | Architect attribute | Stakeholders (Bredemeyer & Malan, 2004); Position (Bredemeyer & Malan, 2004; Ellinger, 2009); Position level; Educational discipline; Education level; Experience; Role (Strano & Rehmani, 2007); Skills category (The Open Group, 2009); Competency (Bredemeyer & Malan, 2004). |
| Why | EA motivation | Architect attribute | Critical success factors (US GAO, 2002); Techniques (Van Steenbergen *et al.*, 2011); Value add (FEA PMO, 2014); Business objectives (Lapalme, 2012a); Desired outcomes (FEA PMO, 2014); Concerns (Jain *et al.*, 2009; Lindström *et al.*, 2006); Challenges (Nakakawa *et al.*, 2010); Organisational culture (Aier, 2013); Benefits (Van Steenbergen *et al.*, 2011); Goals (Boucharas *et al.*, 2010; Buckl *et al.*, 2010b; Lange & Mendling, 2011; Penttinen & Isomäki, 2010). |
| How | EA management | EA factor | Level of detail. |

**Table 4-15: Summary SLR Data results**

| Citation | Study methodology | Study scope | Study limitations | EA factors / architect attribute |
|---|---|---|---|---|
| Aier, S., 2014. The role of organizational culture for grounding, management, guidance and effectiveness of enterprise architecture principles. Information Systems and e-Business Management, 12(1), pp.43–70. | Survey | The role of organizational culture for the mechanisms and effects of EA principles | Not a representative sample. German speaking countries. Reliance on single informants per organisation | framework, standard, model, business unit, organisational culture, CSF, goal, experience, stakeholder, transformation |
| Akenine, D., 2008. A Study of Architect Roles by IASA Sweden. The Architecture Journal, (15). | Case study | IT architecture and architect roles | Presents one way of aligning business to IT by collaboration in distinct and clear architect roles | role, position, position level, challenge |

| Citation | Study methodology | Study scope | Study limitations | EA factors / architect attribute |
|---|---|---|---|---|
| Armour, F.J., Kaisler, S.H. & Liu, S.Y., 1999. Building an Enterprise Architecture Step by Step. IT Professional, 1(4), pp.31–39. | N/A | The article shows how to scope the EA project, set up the development team, and form a target architecture vision | Not an academic study | definition, framework, view, business unit, business objective, position, stakeholder, politics |
| Barnes, J.M., Garlan, D. & Schmerl, B., 2014. Evolution styles: foundations and models for software architecture evolution. Software & Systems Modeling, 13(2), pp.649–678. | Case study | An approach for planning and reasoning about architecture evolution | The software engineering method approach is less appealing for small-scale evolutions | domain, position level, configuration, transformation, profile |
| Bauer, M. *et al.*, 2013. IoT Architectural Reference. In Enabling Things to Talk. Springer, pp. 163–211. | Design science | Definition of an Internet of Things Reference Architecture | The IoT Reference Architecture is rather abstract | framework, methodology, domain, view, modelling notation, level of detail, configuration, profile |
| Boster, M., Liu, S. & Thomas, R., 2000. Getting the most from your enterprise architecture. IT Professional, 2(4), pp.43–51. | A five step process to build an enterprise architecture. | Failure to grasp what makes an architecture valuable can thwart the best of plans | Non Academic study | framework, standard, business objectives, position, position level, configuration, politics, power |
| Bredemeyer, D. & Malan, R., 2004. What it takes to be a great enterprise architect. Enterprise Architecture-Cutter Consortium, 7(8), p.25. | Narrative | The necessary qualities for great enterprise architects | Non-academic study | competency, role, scope, position, politics, power |
| Bubak, O., 2006. Composing a course book for system and enterprise architecture education. In System of Systems Engineering, 2006 IEEE/SMC International Conference on. SMC 2006. Los Angeles, CA, USA: IEEE, pp. 230–235. | Literature review | Outlining an advanced student text for system and enterprise architecting. | Limited in the review of literature | framework, discipline, competency, domain, stage, configuration |
| Chuang, C.-H. & Van Loggerenberg, J., 2010. Challenges Facing Enterprise Architects: A South African Perspective. In Proceedings of the 43rd Hawaii International Conference on System Sciences - 2010. 43rd Hawaii International Conference on System Sciences. Hawaii: IEEE, pp. 1-10. | Interpretive study | The relationship between enterprise architecture and its service delivery process in an organisational context. | issues such as the support and the maintenance of EA have largely been excluded from the study | framework, domain, view, business unit, organisational culture, challenge, stakeholder, configuration, transformation, politics, power |
| Chung, L. *et al.*, 2009. Understanding the Role of Enterprise Architecture towards Better Institutionalization. In 10th ACIS International Conference on Software Engineering, Artificial Intelligences, Networking and Parallel/Distributed Computing. SNPD '09. Daegu: IEEE, pp. 316–320. | Narrative | The role of enterprise architecture from a Requirements Engineering perspective | No metrics to determine the degree of institutionalisation | framework, organisational culture, business objective, benefit, goal, role, challenge, concern |
| Espinosa, J.A. & Boh, W.F., 2009. Coordination and Governance in Geographically Distributed Enterprise Architecting: An Empirical Research Design. In 42nd Hawaii International Conference on System Sciences. HICSS 2009. Hawaii, USA: IEEE, pp. 1–10. | Interpretive | the challenges associated with the "architecting" effort | Limited to 29 participants | framework, standard, maturity, governance, view, model, segment, business unit, outcome, challenge, role, position level, stakeholder |
| Espinosa, J.A. & Boh, W.F., 2009. Coordination and Governance in Geographically Distributed Enterprise Architecting: An Empirical Research Design. In 42nd Hawaii International Conference on System Sciences. HICSS 2009. Hawaii, USA: IEEE, pp. 1–10. | Case study | Team knowledge help to coordinate the architecting effort to achieve this alignment | The study does not comprise a thorough empirical validation | standard, maturity, purpose, governance, model, business unit, benefit, role, position, position level, goal |

| Citation | Study methodology | Study scope | Study limitations | EA factors / architect attribute |
|---|---|---|---|---|
| Espinosa, J.A., Armour, F. & Boh, W.F., 2011. The role of group cognition in enterprise architecting. In System Sciences (HICSS), 2011 44th Hawaii International Conference on. HICSS 2011. Kauai, HI: IEEE, pp. 1–10. | Empirical study | Understanding the coordination challenges and best practices leading to EA success | Unknown | framework, standard, maturity, governance, model, segment, business unit, goal, role, position, position level, stakeholder |
| Farwick, M. *et al.*, 2014. A situational method for semi-automated Enterprise Architecture Documentation. Software & Systems Modeling, pp.1–30. | Systematic literature review | EAM documentation automation | Limited number of techniques identified to automate EAM documentation | framework, model, organisational culture, challenge, stakeholder, configuration, transformation |
| Foorthuis, R. *et al.*, 2010. On course, but not there yet: Enterprise architecture conformance and benefits in systems development. In ICIS 2010 Proceedings – Thirty First International Conference on Information Systems. | Survey | Benefits that Enterprise Architecture (EA) deliver | Measuring perceptions of respondents instead of objective results. Usual limitations of causal analysis based on observational rather than experimental data. | model, organisational culture, benefit, stakeholder, technique, schools of thought |
| Foorthuis, R. *et al.*, 2015. A theory building study of enterprise architecture practices and benefits. Information Systems Frontiers, pp.1–24. | Theory-building survey study | EAM benefits | measured perceptions of individual respondents instead of objective facts; objective measures were not feasible in our study because of their fundamental shortcomings | model, organisational culture, outcome, business objective, benefit, stakeholder |
| Fraga, A. & Llorens, J., 2007. Training initiative for new Software/Enterprise architects: an ontological approach. In The Working IEEE/IFIP Conference on Software Architecture. WICSA '07. Mumbai, India: IEEE, pp. 19–22. | Literature review | A methodology based on ontological structures and reinforcement learning for enterprise architects | Unknown | domain, role, discipline, certification |
| Gøtze, J., 2013. The changing role of the enterprise architect. In 17th IEEE International Enterprise Distributed Object Computing Conference Workshops, EDOCW 2013. Proceedings - IEEE International Enterprise Distributed Object Computing Workshop, EDOCW. EDOCW 2013. Vancouver, BC: IEEE, pp. 319–326. | Literature review | The role of enterprise architects and the importance of the enterprise architects' understanding of boundary issues in their practice. | Unknown | standard, domain, competency, discipline, role, challenge, position, position level, type, transformation, politics |
| Hämäläinen, N. & Markkula, J., 2009. Question framework for architectural description quality evaluation. Software Quality Journal, 17(2), pp.215–228. | Field study | A question framework for architecture design quality evaluation | A limited number of replies by the focus group members may have affected the reliability of the results. | framework, view, modelling notation, level of detail, business objective, stakeholder, purpose, scope |
| Harmon, K., 2005. The systems nature of enterprise architecture. In IEEE Systems, Man and Cybernetics Society, Proceedings - 2005 International Conference on Systems, Man and Cybernetics, October 10, 2005 - October 12, 2005. Conference Proceedings - IEEE International Conference on Systems, Man and Cybernetics. SMC 2005. Waikoloa, HI, USA: IEEE, pp. 78–85. | Unknown | Enterprise as a system and the "systems" nature of Enterprise architecture | unknown | framework, CSF, methodology, discipline, configuration |
| Hauder, M. *et al.*, 2014. Examining adaptive case management to support processes for enterprise architecture management. In Proceedings - IEEE | Design science | Adaptive Case Management (ACM) as an emerging paradigm to support agile, lean, and | A larger empirical basis and further case studies in organisations are necessary to | framework, governance, model, stage, experience |

| Citation | Study methodology | Study scope | Study limitations | EA factors / architect attribute |
|---|---|---|---|---|
| International Enterprise Distributed Object Computing Workshop, EDOC. pp. 23–32. | | collaborative processes for EA management (EAM). | validate the approach. | |
| Hendrickx, H.H.M. *et al.*, 2011. Defining the Business Architecture profession. In 13th IEEE International Conference on Commerce and Enterprise Computing. CEC 2011. Kirchberg, Luxembourg: IEEE Computer Society, pp. 325–332. | Field study | A need for a new role, the Business Architect | The paper is a preliminary result | definition, methodology, standard, domain, certification, organisational culture, CSF, business objective, role, position, position level, skills, stakeholder, transformation |
| Hjort-Madsen, K. & Pries-Heje, J., 2009. Enterprise Architecture in Government: Fad or Future? In System Sciences, 2009. HICSS'09. 42nd Hawaii International Conference on. Hawaii International Conference on System Sciences. Hawaii: IEEE, pp. 1–10. | Field study | The use and adoption of the EA concept in the Danish central government. | Unknown how long a fashion like EA will stay fashionable in government or even how long it will take to become unfashionable again. | framework, competency, position, position level, transformation, politics |
| Iacob, M.E. *et al.*, 2014. From enterprise architecture to business models and back. Software & Systems Modeling, 13(3), pp.1059–1083. | Case study | Important IT change processes affecting an organization's enterprise architecture are also mirrored by a change in the organisation's business model | Relating the ArchiMate and BMC concepts and not their relationships. | framework, domain, model, schools of thought |
| Jacobs, D., Kotze, P. & Van Der Merwe, A., 2009. Towards an enterprise repository framework. In Joint Proceedings of the 4th International Workshop on Technologies for Context-Aware Business Process Management, TCoB 2009. AT4WS 2009. AER 2009. MDMD 2009. In Conjunction with ICEIS 2009. ICEIS 2009. Milan, Italy: Inst. for Syst. and Technol. of Inf. Control and Commun., pp. 77–89. | Analogical reasoning | The theoretical foundation of the data warehouse domain to contribute to the definition of an enterprise repository framework | Unknown | definition, domain, view, CSF |
| Lapalme, J., 2012. Three Schools of Thought on Enterprise Architecture. IT Professional, 14(6), pp.37–43. | Literature review | EA definitions and EA schools of thought | Limited literature review | definition, framework, schools of thought, scope, purpose, skill, concern, challenge, objective, transformation, politics |
| Lindström, Å. *et al.*, 2006. A survey on CIO concerns-do enterprise architecture frameworks support them? Information Systems Frontiers, 8(2), pp.81–90. | Survey | The issues and constraints of the CIO role in Swedish companies | Limited geographic scope | Framework, Business units, Position, Position level, Discipline, Concern |
| Lu, H.K. & Lin, P.C., 2012. A study of competence of enterprise architects in higher education. In ICSESS 2012 - Proceedings of 2012 IEEE 3rd International Conference on Software Engineering and Service Science. pp. 551–554. | Field research | Identify the core competences of enterprise architects in higher education | | Framework, [competency (Personal traits, general skills, Professional skills, industrial knowledge, Project management skills, Communication & negotiation skills, Team management skills)], profile |
| MacLennan, E. & Van Belle, J.-P., 2014. Factors affecting the organizational adoption of service-oriented architecture (SOA). Information Systems and e-Business Management, 12(1), pp.71–100. | Survey | Organisational SOA adoption in South Africa | Limited to enterprise architects in South Africa | business unit, organisational culture, CSF, profile |
| Nakakawa, A., Van Bommel, P. & Erik Proper, H.A., 2011. Applying soft systems methodology in enterprise architecture creation workshops. In Proceedings of the 4th International Workshop on Enterprise Modelling and Information Systems Architectures, EMISA 2011. | Field study | An SSM adaptation to supplement the design of the collaboration process with support for triggering discussions and creating a shared understanding | The repeatability and predictability of the script is yet to be determined | framework, domain, scope, purpose, level of detail, goal, transformation |

| Citation | Study methodology | Study scope | Study limitations | EA factors / architect attribute |
|---|---|---|---|---|
| pp. 37–50. | | and vision among EA stakeholders. | | |
| Nakakawa, A., Van Bommel, P. & Proper, H.A.E., 2009. Quality enhancement in creating enterprise architecture: Relevance of academic models in practice. In Advances in Enterprise Engineering II. Lecture Notes in Business Information Processing. pp. 109–133. | Design science | Development of a collaboration process to facilitate the steps in the formulated approach | The theoretical underpinnings of CEEADA, an approach focusing on quality enhancement in creating enterprise architecture. | framework, domain, scope, purpose, business objective, CSF, deliverable, concern, stakeholder |
| Nakakawa, A.A., van Bommel, P.P. & Proper, H.A.E., 2010. Challenges of involving stakeholders when creating enterprise architecture. In 5th SIKS/BENAIS Conference on Enterprise Information Systems. pp. 43–55. | Exploratory survey | Investigating challenges that enterprise architects face when they involve organizational stakeholders during enterprise architecture creation. | No theory or method exists to address the challenges in collaborative architecture creation. | governance, view, business objective, concern, stakeholder, challenge, transformation, politics |
| Naranjo, D., Sanchez, M. & Villalobos, J., 2014. Towards a unified and modular approach for visual analysis of enterprise models. In Proceedings - IEEE International Enterprise Distributed Object Computing Workshop, EDOC. EDOCW 2014. Ulm, Germany: IEEE, pp. 77–86. | Case study | Automated structural and domain-specific analysis methods of an Enterprise Model | The development of the EA analysis approach is based on a fictional case study | framework, model, level of detail, skill, role, stakeholder, competency, challenge |
| Niemietz, H. & De Kinderen, S., 2013. Communication breakdowns in architecture driven transformations: The result of cultural diversity? A theoretical grounding of findings from qualitative interviews. In Proceedings - 2013 IEEE International Conference on Business Informatics, IEEE CBI 2013. pp. 298–305. | Literature review | How cultural differences within an organisation contribute to the struggling/failure of EA guided enterprise transformations. | The focus on the enterprise architects' perspective is a limitation for our study. | framework, business unit, organisational culture, technique, CSF, challenge, position, transformation |
| Nikpay, F. *et al.*, 2013. A review of critical success factors of enterprise architecture implementation. In Proceedings - 2013 International Conference on Informatics and Creative Multimedia, ICICM 2013. pp. 38–42. | Literature review | A review of the Critical Success Factors (CSF) which influence successful EA implementation | Each EA project has particular characteristics which need to find specific factors | Governance, Cognition, Management, Planning, Documentation, Programing, Communication & Support, Stakeholder Participation, Process, Scope, Economic Pressure, Culture, Skill of Architect, Tools / Methodology, Coverage, Rules & EA process, EA model / Artefact, Business Driven Approach, Assessment / Evaluation, Training / Education |
| Ouriaghli, A. & Nsubuga, W.M., 2012. Enterprise Architect's Roles in a Proactive Enterprise Development Context - PED model for understanding the role of an Enterprise Architect in a Proactive Enterprise Development context. Masters: IT Management. Gothenburg, Sweden: University of Gothenburg | Empirical study | The Enterprise Architect's role in a proactive enterprise development context | The role and responsibilities of an Enterprise Architect in the context of a proactive enterprise development | level of detail, business unit, stage, organisational culture, CSF, business objective, goal, role, skills, stakeholder, scope, experience, politics, power |
| Rehkopf, T.W. & Wybolt, N., 2003. Top 10 Architecture Land Mines. IT Professional, 5(6), pp.36–43. | Unknown | Contribution of enterprise architecture to business organisation success. EA anti-patterns | Non-academic study | methodology, standard, business unit, business objective, challenge |
| Safari, H., Faraji, Z. & Majidian, S., 2014. Identifying and evaluating enterprise architecture risks using FMEA and fuzzy VIKOR. Journal of Intelligent Manufacturing, | Case study | Using failure mode and effect analysis (FMEA) for evaluating EA risks | Limited to a single Iranian company. Risks based on literature review and experts within said | framework, organisational culture, technique, skills |

| Citation | Study methodology | Study scope | Study limitations | EA factors / architect attribute |
|---|---|---|---|---|
| pp.1–12. | | | company. | |
| Sidorova, A. & Kappelman, L., 2011. Realizing the benefits of enterprise architecture: An actor-network theory perspective. In Proceedings of the 2nd International Conference on Complex Systems Design and Management. CSDM 2011. Paris, France: Springer Verlag, pp. 317–333. | ANT | The socio-political and socio-technical aspects of EA work in the context of complex organization situations. | The degree of accessibility to different parts of the EA repository in terms of appropriate practices regarding | framework, methodology, challenge, competency, skill, benefit, politics |
| Simon, D., Fischbach, K. & Schoder, D., 2013. Enterprise architecture management and its role in corporate strategic management. Information Systems and e-Business Management, pp.1–38. | Design science | Relatively small sample of interviewees and limited time in the interviews to achieve a full understanding of EA. | Few interview statements that reveal difficulties in grasping the concept of EA or initial perceptions of an architectural approach to corporate strategic management being too model-based | framework, model, level of detail, business unit, CSF, business objective, discipline, transformation, politics, power |
| Solano, M.A., 2011. SoSE architecture principles for net-centric multi-int fusion systems. In System of Systems Engineering (SoSE), 2011 6th International Conference on. SoSE 2011. Albuquerque, NM: IEEE, pp. 61–66. | Design science | Key issues innate to Net-Centric Multi-Int Fusion Systems, and offers SoSE principles for a top-down analysis of functional requirements and guidelines for reconciling design trade-offs. | Building a one-of-a-kind (specialised) SoS is fiscally untenable | framework, abstraction, position, position level, role, concern, politics |
| Steen, M.W.A. *et al.*, 2004. Supporting viewpoint-oriented enterprise architecture. In Enterprise Distributed Object Computing Conference, 2004. EDOC 2004. Proceedings. Eighth IEEE International. EDOC 2004. Monterey, California, USA: IEEE, pp. 201–211. | Design science | Design of a tool environment for viewpoint-oriented enterprise architecture | The tool environment caters for two un-integrated prototypes | framework, methodology, view, modelling notation, level of detail, transformation |
| Steghuis, C. & Proper, E., 2008. Competencies and responsibilities of enterprise architects: A jack-of-all-trades? In 4th International Workshop CIAO, and 4th International Workshop EOMAS, held at CAiSE 2008, June 16, 2008 - June 17, 2008. Lecture Notes in Business Information Processing. Springer Verlag, pp. 93–107. | Survey | The study is concerned with the professionals who are responsible for the creation of the products and the execution of the associated processes: the enterprise architects. | Only Capgemini's architects were surveyed. | framework, governance, view, certifications, organisational culture, role, competency, skills |
| Strano, C. & Rehmani, Q., 2007. The role of the enterprise architect. Information Systems and eBusiness Management, 5(4), pp.379-396. | Interpretive study | The role of the enterprise architect as viewed by subject matter experts within the executive branch of the US Federal Government. | Addresses only the executive branch of the US Federal Government. Criteria that were used for selecting the data. Data was based on self-reporting. | standard, role, position, position level, experience, discipline, configuration, politics |
| Tambouris, E. *et al.*, 2012. Fostering enterprise architecture education and training with the enterprise architecture competence framework. International Journal of Training and Development, 16(2), pp.128–136. | Literature review | Training uses of the Enterprise Architecture Competence Framework (EA-CF). | EA-CF implementation in real-world conditions and their evaluation with established assessment models | framework, domain, maturity, business objective, competency, stakeholder, skill, certification, role, stage, position. |
| The Open Group, 2009. TOGAF Version 9.1: A Manual 9.1 ed., Van Haren Publishing. | Narrative | Enterprise Architecture Framework | Limited information on EA tools and enterprise architects | definition, framework, methodology, standard, domain, maturity, scope, purpose, governance, view, modelling notation, segment, deliverable, type, level of detail, reporting line, segment, business unit, organisational culture, |

| Citation | Study methodology | Study scope | Study limitations | EA factors / architect attribute |
|---|---|---|---|---|
| | | | | CSF, business objective, concern, role, discipline, skills category, stakeholder, configuration, politics, power, profile |
| Van den Berg, M. & Van Vliet, H., 2014. Enterprise architects should follow the money. In Proceedings - 16th IEEE Conference on Business Informatics. CBI 2014. Geneva, Switzerland: IEEE, pp. 135–142. | Systematic literature review | Insights into how IT decision-making actually takes place and what that means for them. | Exclude grey literature (web logs, white papers). Bias in the selection of studies to include and exclude, bias of | definition, framework, deliverable, organisational culture, business objective, politics |
| Van der Raadt, B. *et al.*, 2010. The relation between EA effectiveness and stakeholder satisfaction. Journal of Systems and Software, 83(10), pp.1954–1969. | Case study | EA stakeholder satisfaction and EA effectiveness relationship | Limited number of respondents in single organisation. Untested the construct and discriminant validity of the measurement model. Incompatible data collection comparison. | framework, governance, level of detail, reporting line, business unit, CSF, business objective, stakeholder, concern, goal, power |
| Van Steenbergen, M. *et al.*, 2011. Achieving Enterprise Architecture Benefits: What Makes the Difference? In Enterprise Distributed Object Computing Conference Workshops (EDOCW), 2011 15th IEEE International. IEEE, pp. 350–359. | Survey | The relations between EA techniques used and EA benefits perceived, as well as the influence of contextual factors. | Perceptions of the use of EA techniques and the benefits EA engenders | governance, organisational culture, technique, benefit |
| Vinoski, S., 2008. Serendipitous reuse. IEEE Internet Computing, 12(1), pp.84–87. | N/A | EA application integration | Non-academic study | definition, framework, standard, domain, governance, benefit, schools of thought, challenge, domain |
| Wagter, R., Proper, H.A. & Witte, D., 2012. Enterprise architecture: A strategic specialism. In Proceedings of the 2012 IEEE 14th International Conference on Commerce and Enterprise Computing, CEC 2012. pp. 1–8. | Survey | The competencies of the professionals who are responsible for the creation of an enterprise architecture, i.e. the enterprise architects themselves. | Surveys at Dutch speaking consulting companies in Netherland and Belgium | organisational culture, role, competency |
| Walrad, C.C. *et al.*, 2014. Architecting a Profession. IT Professional, 16(1), pp.42–49. | Case study | An EA roadmap as a baseline of knowledge or standards to ensure consistent service. | Not an academic study | scope, skill, competency, position, certification, position level, role, standard |
| Wegmann, A., 2003. On the Systemic Enterprise Architecture Methodology (SEAM). In Published at the International Conference on Enterprise Information Systems. SEAM. Citeseer, pp. 483 – 490. | Case study | Design of an original methodology for Enterprise Architecture | Limitations on the applicability of using the SEAM | framework, methodology, modelling notation, challenge, role |
| Woods, E. & Rozanski, N., 2005. Using architectural perspectives. In Software Architecture, 2005. WICSA 2005. 5th Working IEEE/IFIP Conference on. WICSA 2005. Pittsburgh, PA, USA: IEEE, pp. 25–35. | Design | Using the architectural perspective to provide an architect with practical guidance as to how to ensure that their system exhibits the right set of quality properties | Limited number of architectural perspectives is listed | definition, framework, standard, governance, view, stage, objective, concern, challenge, goal, technique, benefit, role, experience, skill, stakeholder |
| Zimmermann, A. *et al.*, 2011. Capability Diagnostics of Enterprise Service Architectures using a dedicated Software Architecture Reference Model. In Services Computing (SCC), 2011 IEEE International Conference on. IEEE, pp. 592–599. | Case study | Extend existing enterprise and software architecture reference models and maturity frameworks to accord with a sound meta-model approach. | The results of these assessments need to be interpreted in the context of company specific strategies and use cases. As a consequence they cannot provide vendor rankings of any kind. | framework, domain, maturity, governance, type, business unit |

| Citation | Study methodology | Study scope | Study limitations | EA factors / architect attribute |
|---|---|---|---|---|
| Zimmermann, O., Miksovic, C. & Küster, J.M., 2012. Reference architecture, metamodel, and modelling principles for architectural knowledge management in information technology services. Selected papers from the 2011 Joint Working IEEE/IFIP Conference on Software Architecture (WICSA 2011), 85(9), pp.2014–2033. | Field study | Capturing and sharing design knowledge such as architectural decisions | Applying the approach to business domains outside IT services | framework, level of detail, business unit, CSF, position, position level, domain, challenge, scope, profile |

Step 5.3. Sensitivity analysis

Result robustness is verified by investigating if there are uncertainties about including or excluding certain studies. This is the case as sensitivity analysis is more important when a complete meta-analysis is performed. For the SLR study on the enterprise architect, sensitivity analysis was not applied.

Step 5.4. Plotting

A data plotting strategy may be defined to present the results. Similarly to sensitivity analysis, plotting is indicated when meta-analysis is performed. As the SLR was concerned with obtaining a comprehensive list of EA factors and architect attributes, no plotting strategy was applied.

Step 5.5. Final comments

This item presents reviewers' final comments about the systematic review results.

Step 5.5.1. Number of studies

1305 number of studies were found, with 56 number of studies selected as the primary study list.

Step 5.5.2. Search, selection and extraction bias

Any search, selection or information extraction biases that could invalidate the systematic review results were identified by the reviewers. No search selection and extraction bias were identified.

Step 5.5.3. Publication bias

Publication bias refers to the problem that positive results are more likely to be published than negative results since the concept of positive or negative results sometimes depends on the viewpoint of the researcher. The SLR was published and no such publication bias was recorded.

Step 5.5.4. Inter-reviewers variation

Conflict resolution between reviewers regarding the systematic review results. No inter-reviewer variation was recorded.

Step 5.5.5. Results application

The comprehensive list of EA factors and architect attributes was used within the next DSR internal development cycle. The second internal development cycle used the comprehensive list in the execution of a questionnaire to determine and validate the findings of the SLR. By validating the results, the EA factors and architect attributes were used to determine the impact on the architect's school of thought.

Step 5.5.6. Recommendations

The results from the SLR was used as input into new research, forming the critical foundation of what was required to perform a study, which was concerned about aspects of the enterprise architect.

## *4.5 Conclusion*

The chapter concludes with the suggestion, awareness and development of a comprehensive number of EA factors and architect attributes found within current literature. These EA factors and architect attributes were identified using a systematic literature review, which was concerned with aspects as they relate to the enterprise architect. This resulted in a comprehensive list of 40 EA factors and architect attributes, depicted within Figure 4-F and Table 4-16.

**Table 4-16: EA factors and architect attributes classifications**

| | | | |
|---|---|---|---|
| Architecture Segment | Modelling Notation | Competencies | Benefits |
| Certification | Models | Discipline | Business objectives |
| Configuration | Profile (Organisation, UML) | Experience | Challenges and problems |
| Definitions | Purpose | Position Levels | Concerns |
| Deliverables | Scope | Positions | Critical success factors |
| Domains | Standards | Roles | Goals |
| Frameworks | Views | School of thought | Organisational culture |
| Governance | Organisational Segment (Business unit) | Skills Category | Outcomes |
| Maturity stage | Reporting Line | Stakeholders | Politics (Power) |
| Level of detail | Methodologies | Type | Techniques |


**Figure 4-F: EA factors and architect attributes classifications**

Figure 4-G depicts the relationships between EA factors, architect attributes and enterprise architects.

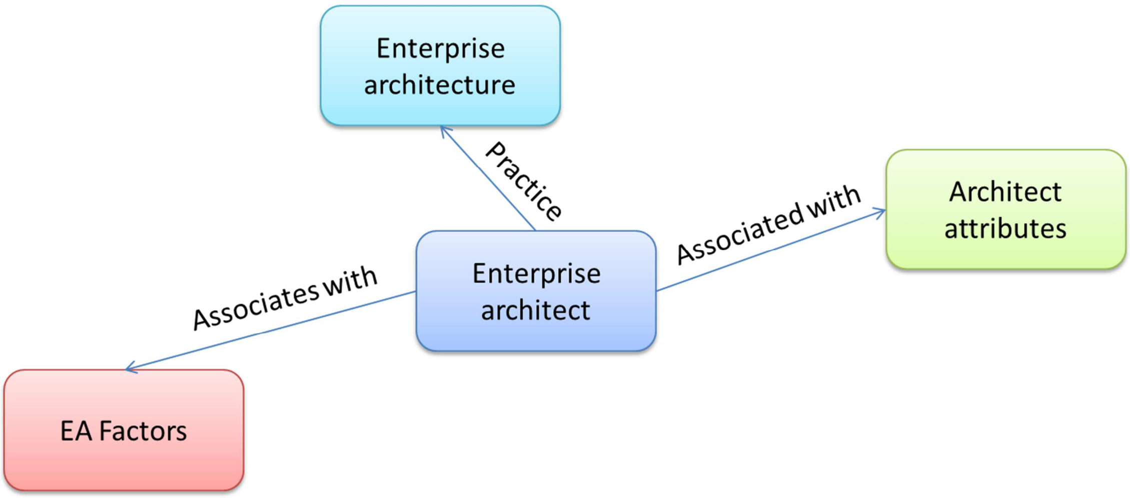



**Figure 4-G: Enterprise architect, EA factors and architect attributes relationships**

The EA factors and architect attributes list formed the first component of the Daedalus Instrument as depicted within Figure 4-H, which is also used as input into the next internal development DSR cycle.

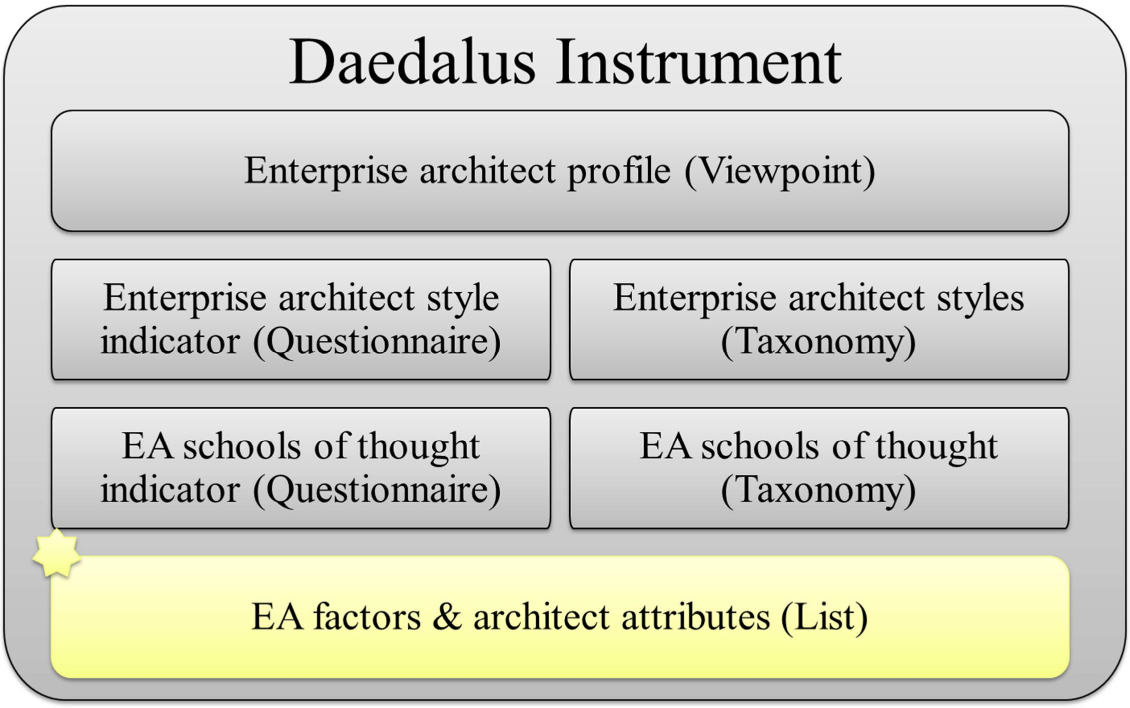


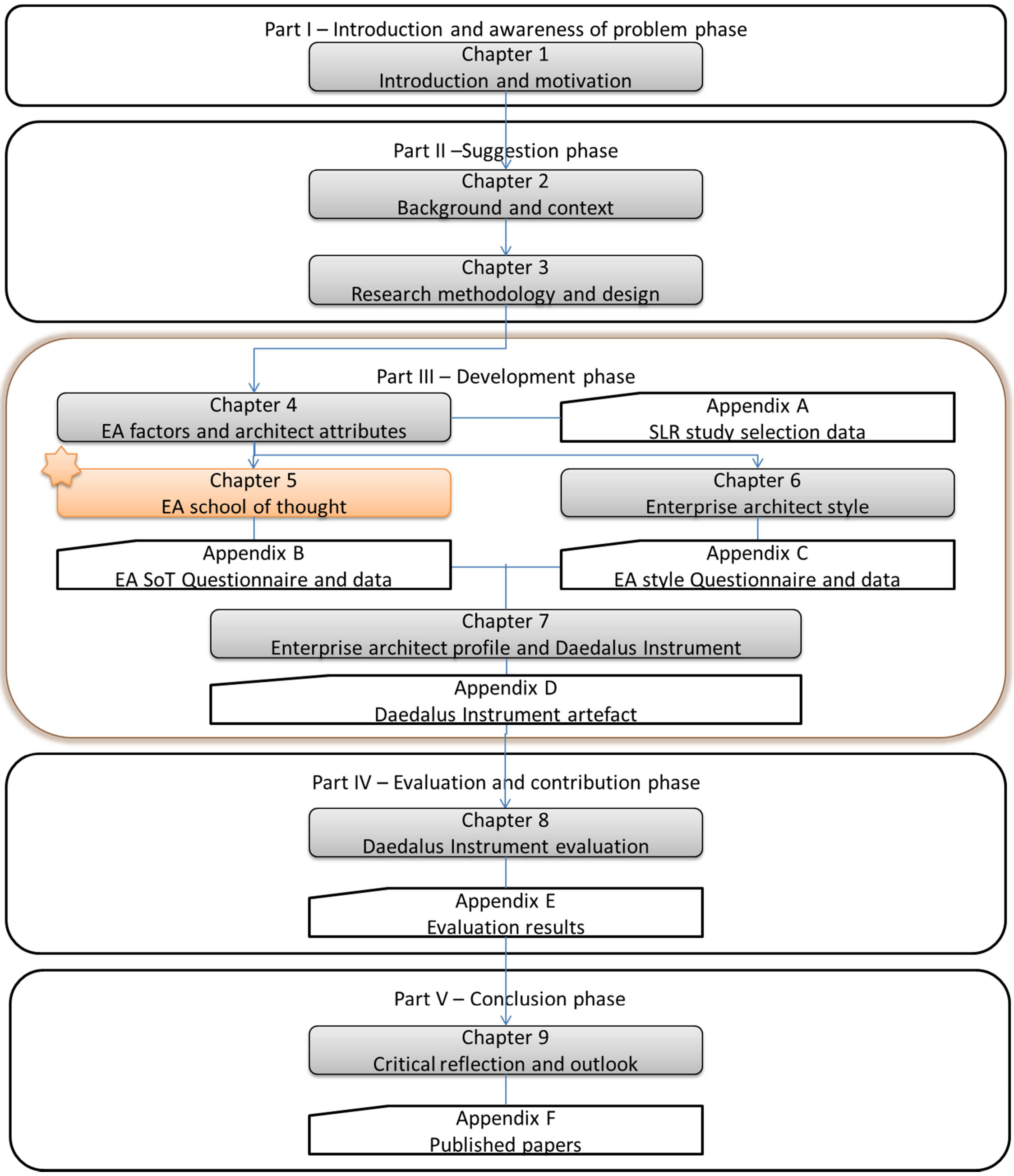

**Figure 4-H: Daedalus Instrument for Architects – EA factors and architect attributes list**

A summary of the motivation behind the systematic review is depicted within Table 4-17.

**Table 4-17: Systematic review motivation based on CRD (2014)**

| Systematic literature review criteria | Systematic literature review on enterprise architecture |
|---|---|
| Were inclusion / exclusion criteria reported? | Yes |
| Was the search adequate? | Yes |
| Were the included studies synthesised? | Yes |
| Was the quality of the included studies assessed? | Yes |
| Are sufficient details about the individual included studies presented? | Yes |

# 5 EA schools of thought



## *5.1 Introduction*

**Chapter 4** detailed the systematic literature review, as the first internal development cycle of the design science research (DSR) strategy. The chapter concluded with a comprehensive list of enterprise architecture (EA) factors and architect attributes, which formed the first component of the Daedalus Instrument for Architects (DIA), as well as the input into the next internal development cycle of the design science research strategy. In this chapter, **Chapter 5**, the second internal development cycle is described, which is concerned with the process of understanding enterprise architects' belief systems. **Chapter 5** describes the execution of a study to collect and analyse data on different aspects as it relates to enterprise architects' belief systems and their EA schools of thought (SoT), with the design artefacts developed being an EA SoT indicator and taxonomy. This chapter makes use of a questionnaire to explore and evaluate information pertaining to the enterprise architect in order to answer a specific research question. The thesis is divided into sections, with Part III of the thesis concerned with the development of the design artefact.

The EA SoT chapter, **Chapter 5,** is divided in five main parts, as depicted within Figure 5-A. Section 5.1 introduces the research process and necessity as well as explaining the concepts of EA scope and EA purpose used for the EA SoT construct. Sections 5.2, 5.3 and 5.4 describe the research process for collecting and analysing data as well as the formulation of the classification around EA SoT and the enterprise architect respectively. The chapter is then summarised and concluded in section 5.5.

EA SoT are concerned with the belief systems of enterprise architects on what they believe EA is. The EA schools of thought group enterprise architects sharing the same belief system on EA, into the same schools. This is similar to people viewing themselves as either "new school" or "old school", where they share the same opinions and beliefs about fashion, music or even motor vehicles with other people in their school of thought. To understand enterprise architects' belief systems, there needs to be a way to consistently determine and classify the belief systems and schools of thought of enterprise architects. This chapter deals with determining the classification by developing the EA schools of thought taxonomy and by developing a questionnaire as an indicator to allow enterprise architects and EA stakeholders to consistently determine to which EA school of thought an architect belongs.

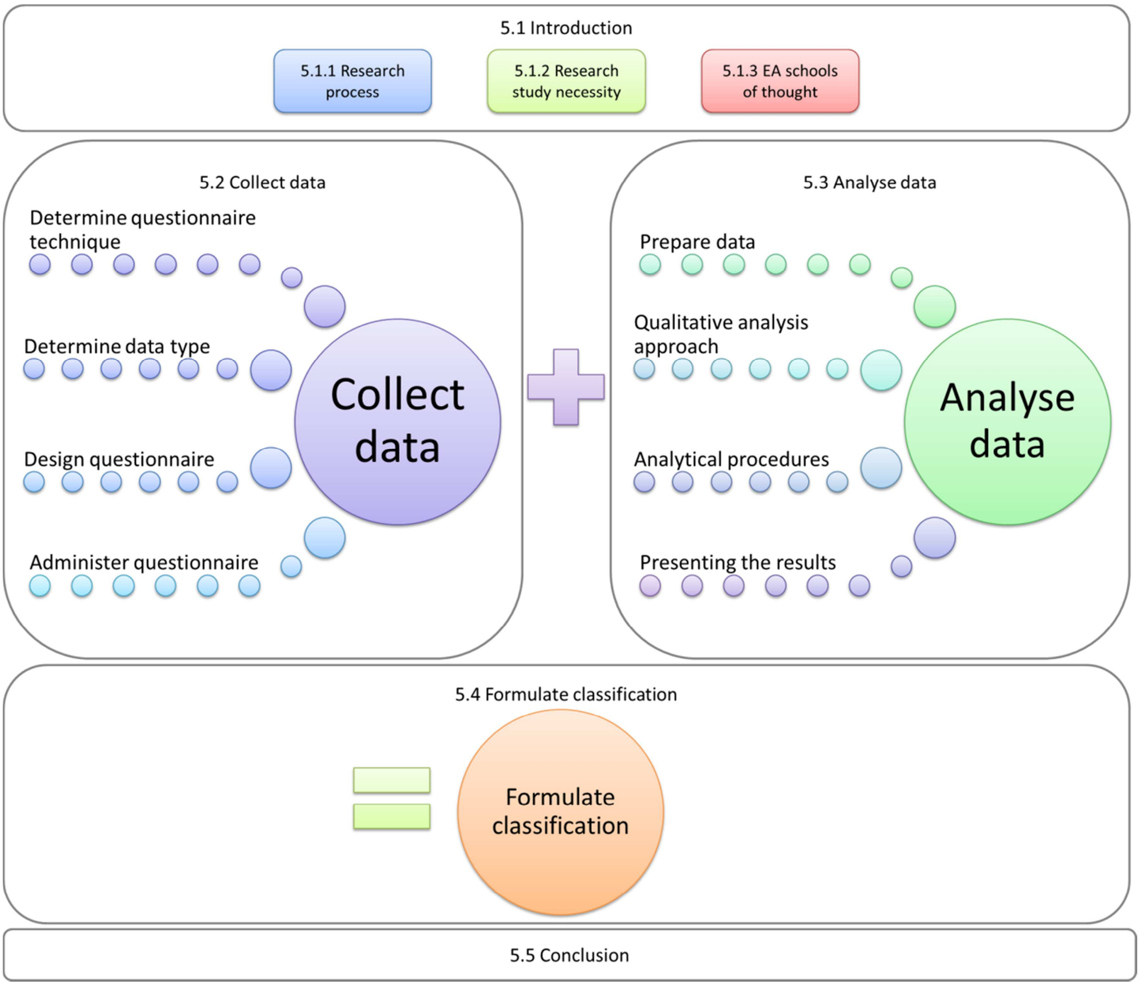



**Figure 5-A: Chapter layout**

This chapter explores and evaluates information pertaining to the enterprise architect belief systems in order to answer a specific research question. The alignment of **Chapter 5** to that of the thesis is depicted within Table 5-1.

**Table 5-1: Chapter 5 alignment summary**

| # | Sub-research question | Sub-objective | Challenge | Chapter | DSR Process Step | Deliverable |
|---|---|---|---|---|---|---|
| 2 | How can an EA schools of thought indicator be developed for the consistent classification of EA schools of thought? | To develop an EA schools of thought indicator for the consistent classification of EA schools of thought. | An instrument and classification needs to be created to allow an organisation to determine the specific EA school of thought an architect would align to. | Chapter 5 – EA school of thought | [D1.2] | EA school of thought indicator + classification |

## 5.1.1 Research process

The development of the EA schools of thought indicator as well as the EA schools of thought taxonomy is completed as part of the second internal development cycle of the design science research strategy as depicted within Figure 5-B.

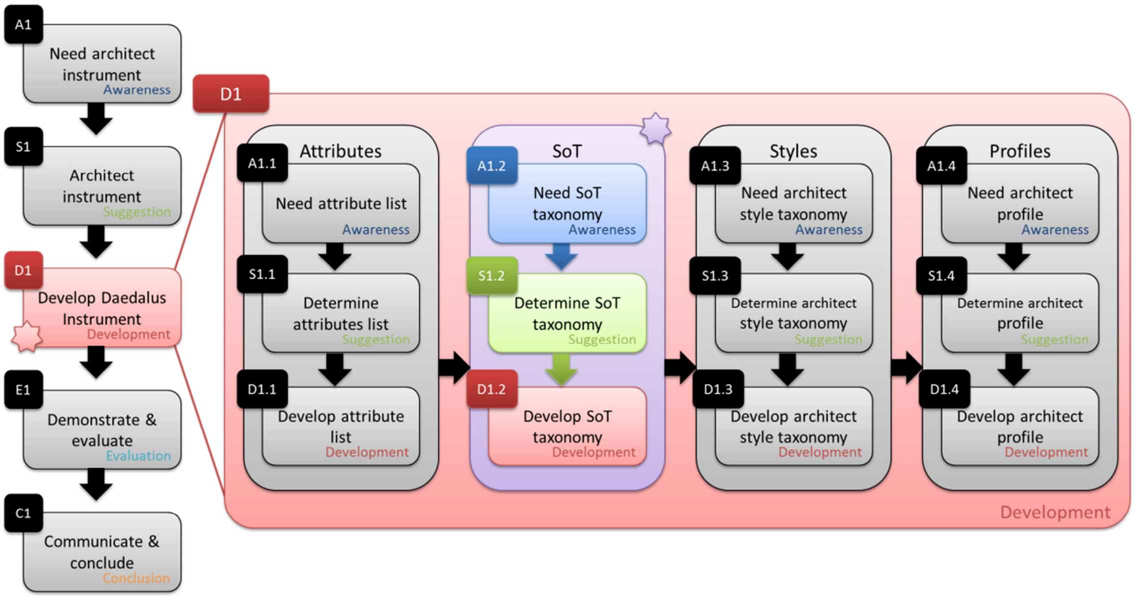



**Figure 5-B: EA SoT in relation to the DSR development cycle**

This research study forms part of the development cycle of the Design Science Research (DSR) strategy. It is the second iteration of the internal design cycle with the circumscription concerning architect attributes [D1.2] as depicted within Figure 5-B.

The aim of this chapter and the internal development Cycle 2 was to determine if any of the EA factors and architect attributes identified within the systematic literature review (SLR), are relevant to the understanding of enterprise architect's belief system. The EA SoT represents the second psychosocial functioning connection of the social cognitive theory, as described within sections 2.3.1 and 2.3.3. A questionnaire was used to question architects around the world, where each question within the questionnaire was aligned to a specific EA factor or architect attribute to explore any relevance to architects' belief systems.

The systematic literature review led to the creation of a comprehensive list of EA factors and architect attributes, defined within **Chapter 4**, which were used to determine if they were of any significance in influencing the EA beliefs.

The study was executed in three phases, depicted within Figure 5-C:

1. Collect data
2. Analyse data
3. Formulate classification

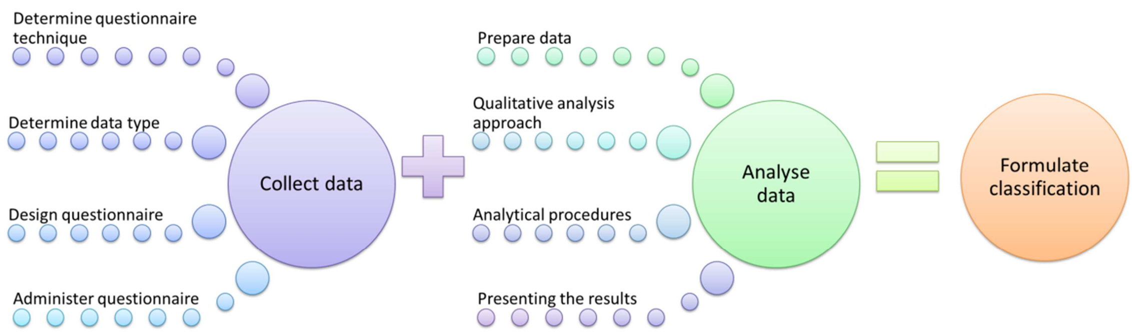



**Figure 5-C: Questionnaire design**

### 5.1.2 Research study necessity

In the systematic literature review, described in **Chapter 4**, a comprehensive list of EA factors and architect attributes was identified. With so many EA factors and architect attributes being associated with the architect, an approach was needed to better understand specific concepts as they relate to the enterprise architect as well as a classification scheme to enhance the understanding of the enterprise architect. Considering the comprehensive list of EA factors and architect attributes as well as the list of primary studies identified within the SLR, a single study from the list of studies represented within the SLR, described within section 4.4, was selected to understand the relation among EA scope, EA purpose and the enterprise architect. This study represents Lapalme's understanding and definition of architects' belief systems (Lapalme, 2012a).

In the study on the three schools of thought on enterprise architecture, Lapalme investigated several EA authors' definition of enterprise architecture. He noted that similarities existed in their beliefs around the planning scope and purpose of an EA initiative. This led to the realisation that three of a possible nine EA schools of thought exist, describing EA authors' beliefs on enterprise architecture (Lapalme, 2012a).

EA authors' definitions that were used consisted of two EA factors for the understanding of the belief systems of enterprise architects. These two factors, EA scope and EA purpose, form the foundation for the EA schools of thought, which were also identified within the SLR in **Chapter 4**. The EA schools of thought represent the different architect worldviews and opinions of architects who share the same EA school. The worldviews and opinions of architects are fundamental to understanding the enterprise architects, as architects make sense of EA by imposing their own meanings and understandings of EA, their beliefs regarding EA, and are fundamental to their motivation behind performing EAM.

Understanding the EA schools of thought, allows for the understanding of enterprise architects and their EA belief systems.

### 5.1.3 EA schools of thought

The three EA schools of thought were first introduced in a 2012 IEEE article by Lapalme (2012a). In the article Lapalme considered the views of EA authors on what enterprise architecture was to them, how they went about defining enterprise architecture, and ultimately stated why he, Lapalme, believed they defined enterprise architecture in the way they did. These belief systems were based on their understanding of EA scope and EA purpose expressed as an EA definition. The study, however, had its limitations as it was based on a literature review of the belief systems of EA authors, which described their own definitions and did not include any other architects who were not authors or had their own EA definition.

#### 5.1.3.1 EA scope & purpose

Lapalme noticed that all the referenced architect authors' definitions were constructed in a similar manner (2012a). The referenced authors referred directly or indirectly to the concepts of EA scope and EA purpose. In the article Lapalme identified three common positions related to EA scope and three common positions related to EA purpose, depicted within Table 5-2.

**Table 5-2: EA definitions range in scope and purpose (Lapalme, 2012a, p. 38)**

| EA Scope | EA Purpose |
|---|---|
| The enterprise-wide IT platform, including all components (software, hardware, and so on) of the enterprise IT assets | Effectively execute and operate the overall enterprise strategy for maintaining a competitive advantage by aligning the business and IT strategies such that the proper IT capabilities are developed to support current and future business needs |
| The enterprise as a sociocultural, techno-economic system, including all facets of the enterprise (where enterprise IT is just one facet) | Effectively implement the overall enterprise strategy by designing the various enterprise facets (governance structures, IT capabilities, remuneration policies, work design, and so on) to maximize coherency between them and minimize contradictions |
| The enterprise in its environment, including not only the enterprise but also its environment and the bidirectional relationship and transactions between the enterprise and its environment | Help the organisation innovate and adapt by designing the various enterprise facets to maximize organisational learning throughout the enterprise |

The understanding of scope and purpose is directly related to the motivation behind decisions, and is concerned with the architect and not EA or EAM. Lapalme emphasised that "EA scope" represents the scope of planning the EA initiative, or the scope of EA which is under consideration to be changed. "EA purpose" represents the purpose for planning an EA initiative, rather than the purpose of executing the EA initiative. These two concepts form the foundation of the EA belief system and ultimately allowed Lapalme to define which EA school of thought an architect belongs to, depicted in Figure 5-D.

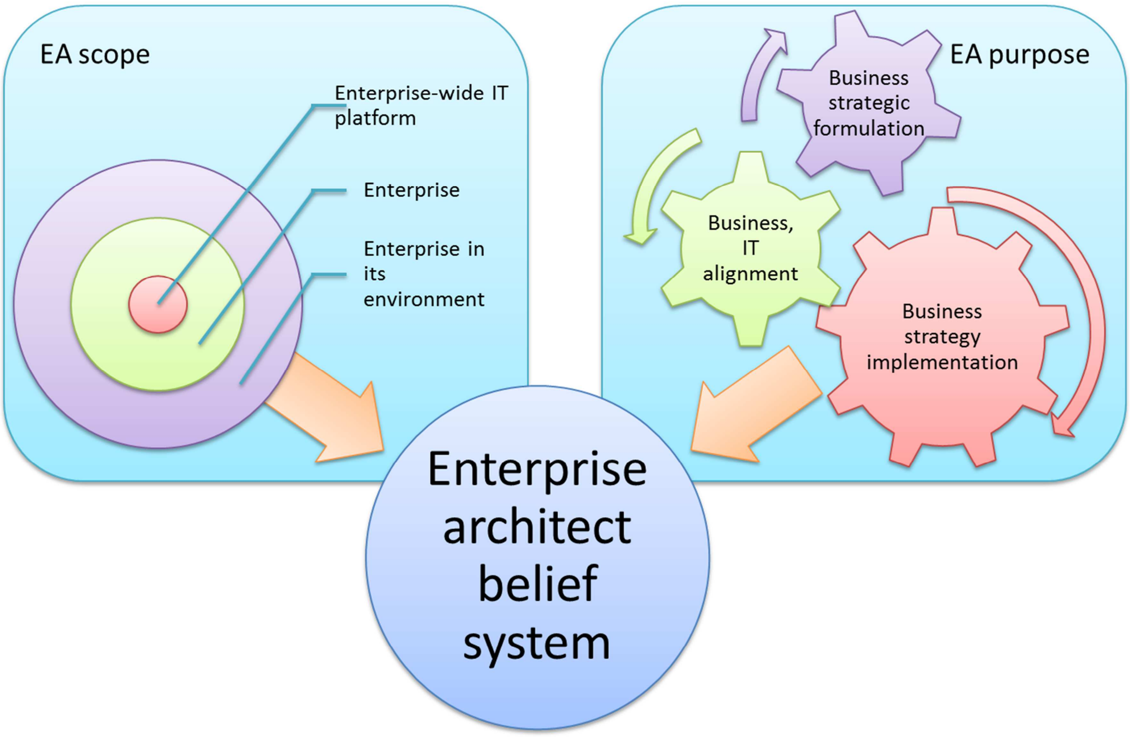



**Figure 5-D: Enterprise architect belief system**

Lapalme admits that these two concepts are not the only concepts that could be used as the foundation for the enterprise architect belief system. The enterprise architect belief system could be based on the concept of system boundary (open system vs. closed system) and the concept of system dynamics (mechanistic vs. systemic), depicted within Figure 5-E (2012b). The enterprise architect belief system could also be based on strategy reach, IT strategy reach vs. non-IT strategy reach (Lapalme, 2012b).

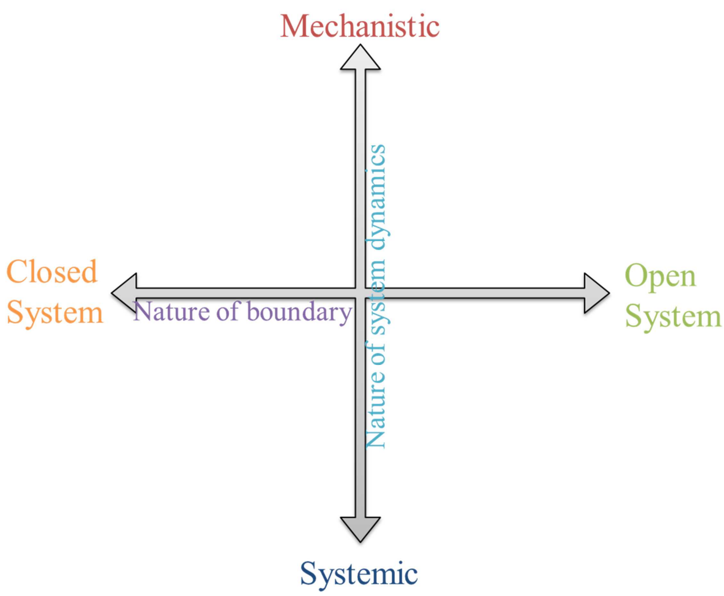



**Figure 5-E: EA SoT alternative view**

For the purpose of this research study, the enterprise architect belief system is based on the concepts of scope and purpose, as described within the published article (Lapalme, 2012a). The alternative perspectives were not considered as the perspectives were not field tested and did not have a foundation in existing literature.

The EA scope and EA purpose concepts relate to architects' understanding of the breadth, depth or reach of EA and their intentions behind planning an EA initiative. From this perspective (using scope and purpose), enterprise architects sharing the same belief system regarding enterprise architecture also belong to the same EA school of thought.

### 5.1.3.2 EA schools of thought matrix

Aligning to the identified three distinct positions on EA scope and the three distinct positions on EA purpose, as depicted within Table 5-2, allowed for the identification of nine possible EA schools of thought (Lapalme, 2012a, 2012b). Lapalme proposed a novel 3X3 matrix classification, which could be used to represent the different EA schools of thought from the perspective of shared understanding of EA scope and EA purpose, as depicted in Figure 5-F. Lapalme identified the three ideal EA schools of thought by reviewing existing literature where EA authors defined their own definitions on what they believe EA to be.

By understanding the perspectives on EA scope and EA purpose, Lapalme identified specific belief perspectives from which to understand each of the EA schools of thought. These identified belief perspectives as well as their definitions are depicted within Table 5-3.

**Table 5-3: EA belief perspectives (Lapalme, 2012a, 2012b)**

| Beliefs | Description | | Source |
|---|---|---|---|
| Motto | Motto – "a short sentence or phrase that expresses a rule guiding the behaviour of a particular person or group" | | (Merriam-Webster, 2014) |
| Objectives and concerns | Objective - "based on facts rather than feelings or opinions : not influenced by feelings" | Concern – "to relate to something : to be about something" | (Merriam-Webster, 2014) |
| Principles and assumptions | Principle – "a moral rule or belief that helps you know what is right and wrong and that influences your actions" | Assumption – "an assuming that something is true" | (Merriam-Webster, 2014) |
| Skills | Skills – "to make a difference" | | (Merriam-Webster, 2014) |
| Belief concepts | Belief – "a feeling of being sure that someone or something exists or that something is true" | Concept – "something conceived in the mind" | (Merriam-Webster, 2014) |
| Perceived challenges | Perceive – "to think of something as being something stated" | Challenge – "something that requires thought and skill for resolution" | (Merriam-Webster, 2014) |
| Insights | Insight – "an understanding of the true nature of something" | | (Merriam-Webster, 2014) |
| Limitations | Limitation – "something (such as a lack of ability or strength) that controls what a person is able to do" | | (Merriam-Webster, 2014) |

As previously described, from the combination of the three distinct positions on EA scope and the three distinct positions of EA purpose, nine EA schools can be identified, depicted within Figure 5-F. Although theoretically nine EA schools of thought could exist, Lapalme only identified three ideal EA schools of thought based on his literature review by stating:

"There are nine possible scope and purpose combinations, but most of the literature falls within three combinations" (Lapalme, 2012a, p. 38).

Lapalme continues to describe that:

"These schools of thought should be viewed as "ideal" types insofar as authors typically don't fit perfectly in one school, but rather gravitate toward one over another" (Lapalme, 2012a, 2012b).

The three ideal EA schools of thought, depicted within Figure 5-F, identified by Lapalme are:

1. Enterprise IT architecting (EITA) school of thought (see section 5.3.4.1)
2. Enterprise integration (EI) school of thought (see section 5.3.4.2)
3. Enterprise ecological adaption (EEA) school of thought (see section 5.3.4.3)

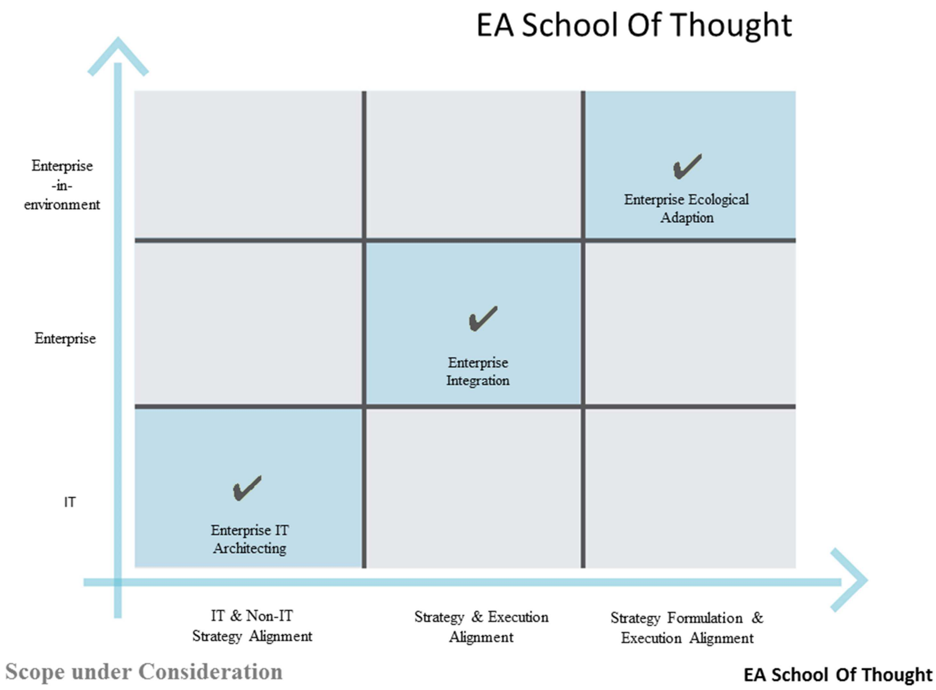



**Figure 5-F: EA schools of thought matrix**

This section dealt with the research process used for the study, the necessity for the study and an introduction to the EA schools of thought. The next section describes the first step in the research process, dealing with collecting data.

## *5.2 Collect data*

A four-step process was followed for the collection of data for the research study. The study was executed using an online self-mediated questionnaire, where participants were requested to complete the questionnaire based on their understandings of the EA factors and architect attributes. The data collection process is depicted within Figure 5-G.

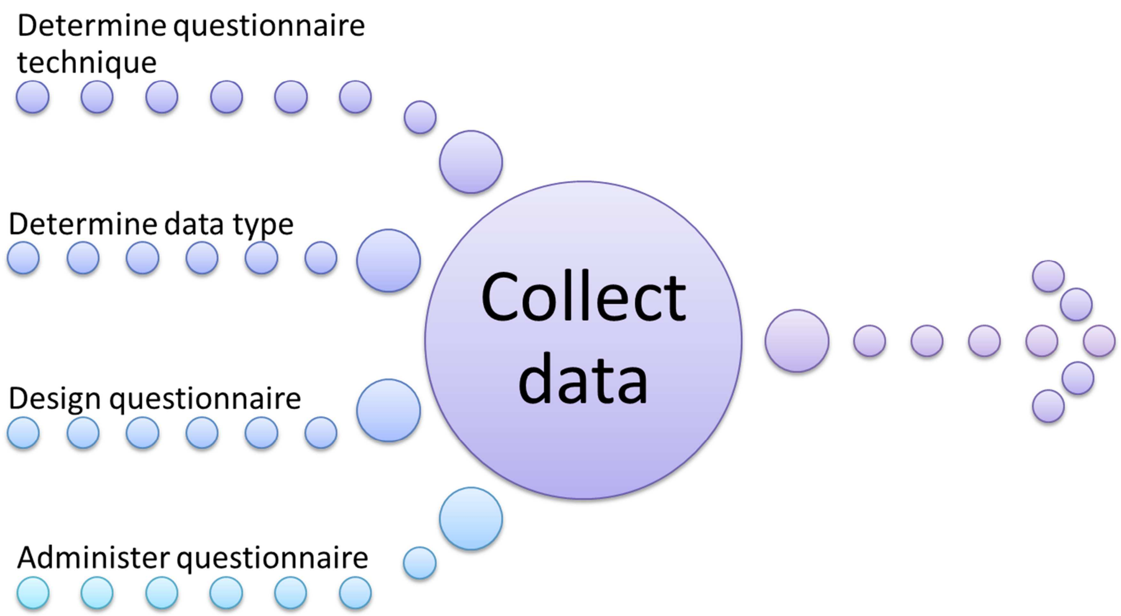



**Figure 5-G: Collect data process**

The "ideal" EA schools of thought as defined by Lapalme are solely based on an initial literature review of published EA authors, which formulated their own definitions on what they believed EA to be. The same approach cannot be used to determine the EA schools of thought of the "everyday" enterprise architects, as not all enterprise architects have their own developed definition on what they believe enterprise architecture to be. Therefore, to determine the beliefs of enterprise architects and in which EA school of thought they might belong to, the research study takes an alternative approach.

This study determined architects' school of thought by questioning architects, using a questionnaire, which was guided by factors and attributes determined in **Chapter 4**. The questionnaire also questioned architects on their understanding of scope and purpose of EAM. Similarly to Lapalme (2012a), scope and purpose are used to determine SoT.

### 5.2.1 Determine questionnaire technique

The main data collection method used was that of a questionnaire. The construction of the questionnaire was based on the EA factors and architect attributes identified within the SLR in **Chapter 4** that guided the construction of the questionnaire.

In addition to the collection of primary data from the questionnaire, secondary source data was used. This secondary data represented the data collected during the execution of the SLR as the comprehensive list of EA factors and architect attributes, as well as the list of primary studies identified.

The purpose of the study was to determine the EA belief systems and determine if EA factors and architect attributes were related to the architects' EA belief systems. As a result an exploratory questionnaire was constructed. Each question was aligned to a specific EA factor or architect attribute using specific predefined options from secondary sources such as the SLR. Each question had an additional option, “other”, to determine alternatives options which were not specified.

The questionnaire was executed as an intranet-mediated questionnaire using an online academic questionnaire tool, of which a part is depicted within Figure 5-H. The complete questionnaire is listed within **Appendix B.2**.

1.

**What architecture position do you currently hold?***

- Analyst
- System engineer / architect
- Systems / solution architect
- Enterprise architect / chief enterprise architect
- Other (Please specify)

2.

**What number of years experience do you have in enterprise architecture?***

- Less than 1 year EA experience
- Between 1 year and 5 years EA experience
- Between 5 years and 10 years EA experience
- Between 10 years and 15 years EA experience
- More than 15 years EA experience

**Figure 5-H: Internet mediated questionnaire**

### 5.2.2 Determine data type

As the study was concerned with the architect and their beliefs as they relate to the EA factors and architect attributes, the relationships that exist between the EA factors and architect attributes are independent of the EA schools of thought. This was due to the architects’ belief systems, which are based on their understanding of EA scope and EA purpose. The questionnaire was designed to collect the architects’ background as well as their opinions on the EA factors and architect attributes.

The design of the questionnaire was in line with the research study’s purpose to accurately determine the EA schools of thought and determine the relation of EA factors and architect attributes to their architectural choices and worldviews. From the systematic literature review, a set of questions was designed to do an exploratory qualitative study using an open-ended questionnaire. The exploratory study ensured the effective collection and analysis of the necessary data. The complete questionnaire is listed within **Appendix B.2**, with an example of the question mapping and data requirements listed within Table 5-4.

**Table 5-4: Example questions mapping and data requirements table**

| | | | | | |
|---|---|---|---|---|---|
| Research type | Exploratory | | | | |
| Research question | How can the EA school of thought of an enterprise architect be determined in a consistent manner? | | | | |
| Research objective | To determine in which EA school of thought an enterprise architect would belong. | | | | |
| Question # | Investigative questions | Variable(s) required | Detail in which data is measured | Data variables (opinion, behaviour, attribute) | Source |
| 1 | What architecture position do you most associate with? | Participant attribute as architecture position | Analyst<br>System engineer / architect<br>Systems / solutions architect<br>Enterprise architect / Chief EA<br>Other (Specify) | Attribute | (Bredemeyer & Malan, 2004; Ellinger, 2009) |

## 5.2.3 Design questionnaire

The research study design took five perspectives into account to ensure the results were in line with the research objectives. The research study design is depicted within Figure 5-I.


**Figure 5-I: Qualitative research design**

The research design is primarily concerned with and aligned to the objective and research question of the research study. In order to explain an alternative approach to determine architects' EA schools of thought, the study made use of a questionnaire where the EA factors and architect attributes determined within the systematic literature review, are aligned to questions specifically formulated to determine the EA schools of thought, as well as to determine if relationships exist between the identified EA factors or architect attributes and enterprise architects residing within a specific EA school of thought.

The research study methodology is depicted in Figure 5-J. The questionnaire was targeted towards enterprise architects around the globe. These architects included EA practitioners, authors, academics or consultants. The selection of the sample was based on the two-stage heterogeneous sampling process, depicted within Figure 5-K.

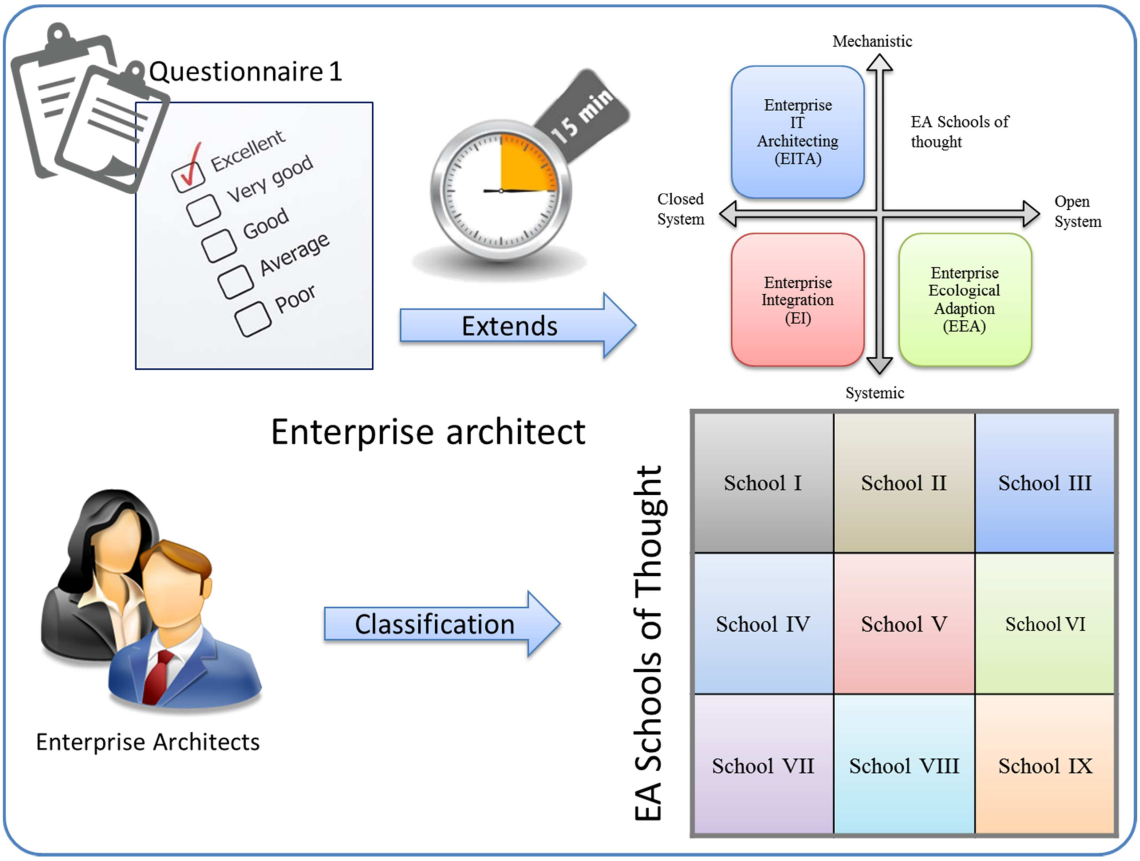



**Figure 5-J: Research study methodology**

The answers to these questions were then viewed in relation to the suggested understanding of the EA schools of thought as defined by Lapalme (2012a). This was done to validate the existing "ideal" EA schools of thought as well as to identify any possible new EA schools of thought. The taxonomy was then formulated based on the newly identified EA schools of thought.

Heterogeneous purposeful sampling was selected as a non-probability sampling method for selecting the required sample of architects, as a typical case. A non-probability method was selected as it was difficult to obtain the list of the study population (Salant & Dillman, 1994). This sampling technique allowed for collected data to describe key themes that were observed. Additionally, it allowed for understanding the patterns that emerged and how they contributed to the key themes of the research results, which enabled the identification of uniqueness. To ensure maximum variation from the population sample, the population sample selection criteria were based on enterprise architects only in their capacity as either practitioner, consultant, author or academic.

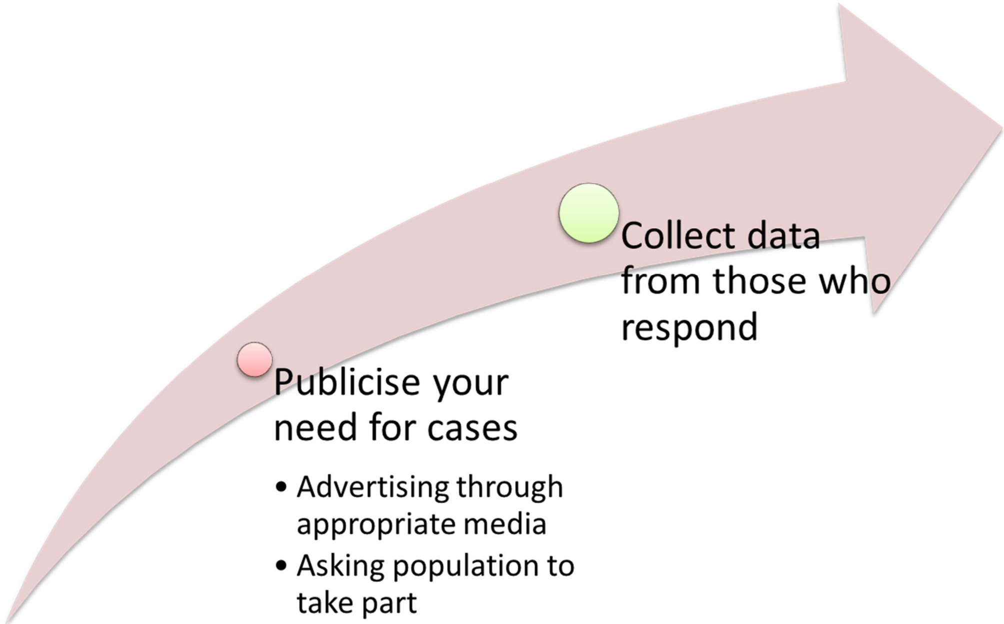



**Figure 5-K: Heterogeneous sampling process (Saunders *et al.*, 2009, p. 233)**

During Stage I of the heterogeneous sampling process, a dual approach was taken to publicise the need for participation in the study. This was done by requesting enterprise architects directly via email as well as posting requests for participation on enterprise architecture specific discussion forums on a well-known professional social media network. Members of the various EA groups were then requested to participate in the research study and complete the anonymous questionnaire. Anonymity and privacy of the study was in accordance with required ethic conditions.

As part of Stage II and to ensure simple, accurate and effective collection of the research study data, the questionnaire was hosted by a site dedicated to academic research and was available online at www.thesistools.com. Willing participants (112) self-completed the online questionnaire, allowing for data to be collected in a consistent manner.

As part of the mixed method methodology and in addition to collecting primary data from the online questionnaire, the study made use of journal publications as written documentary materials from the systematic literature review to assist in answering the research study question and meet the research study objective. The suitability of the secondary data was evaluated in terms of coverage, validity, reliability and measurement bias (Saunders *et al.*, 2009). This was done to ensure knowledge, skill and understanding gained from the secondary data could be applied to the research study.

Questionnaires are well-suited for an exploratory study using a limited number of open-ended questions, the sampling population demographic, the alignment to the research question, and research objective allowed for the selection and use of a self-administered internet mediated questionnaire. The intent and design of the questionnaire were to ensure maximum response rates, validity and reliability of the data being collected. The motivation on the selection of the Internet-mediated questionnaire is depicted within **Appendix B**.

Each EA factor or architect attribute was used within a single question, where the question questioned the participating architect on their specific belief with regards to the specific EA factor or architect attribute. This was done to determine if there was a link between the specific EA factor or architect attribute and their understanding of EA scope and EA purpose (which was used, similarly to Lapalme, to identify EA SoT). The exact details on the analysis and methodology are described within **Section 5.3.3**.

### 5.2.4 Administer questionnaire

While taking into account the design of the questionnaire, key factors such as the relationship between variables and variable types was considered, as well as the understanding of the organisational context.

Content validity was ensured through the systematic literature review that formed the basis of the initial options for the measurement of each question.

Pre-testing was used to confirm the reliability of the questionnaire by ensuring participants consistently interpreted the questions within the questionnaire in the same manner as what the study intended. This was done to produce consistent findings regardless of research sample, time or condition. In addition, each of the questions within the questionnaire was newly developed and not adopted or adapted from previous questionnaires. The questionnaire makes use of open questions in the form of lists, which is in line with an exploratory research strategy. The list questions provide a comprehensive list of options taken from the systematic literature review and other online sources, while adding the option of “other” to catch any alternative answers to the question.

The requirements for data collection specific to this study are depicted within **Appendix B**.

## *5.3 Analyse data*

The data collected from the questionnaires was used to create the EA SoT taxonomy. A detailed definition and description of each of the EA schools of thought is given in Section 5.3.4. This taxonomy has its foundation based on the initial work on EA schools of thought (Lapalme, 2012a) as well as the aspects as they relate to enterprise architecture as defined within the systematic literature review completed within **Chapter 4**. The process of data analysis is depicted within Figure 5-L.

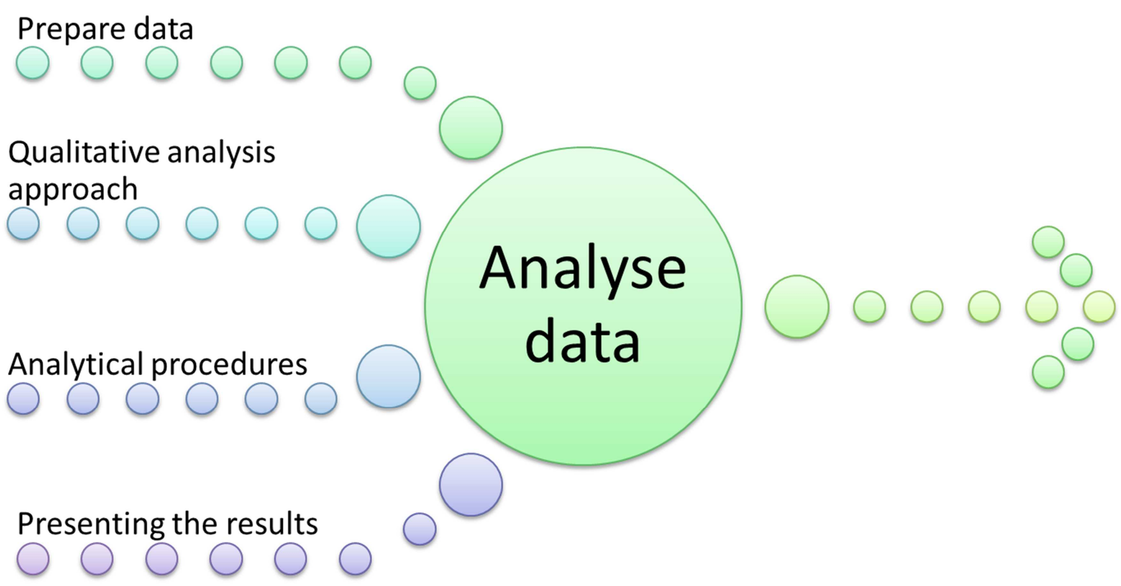



Figure 5-L: Analyse data

### 5.3.1 Prepare data

Limited preparation was needed as the data were electronically available. A number of participants' entries had to be discarded as they did not complete the questionnaire adequately to use their input as part of the analysis. Where participants used the "other" field to answer the questions, the answers were interpreted with the objective of the question in mind. If the answer was similar in nature to an existing option, it was included as the identified option; otherwise it was recorded as an alternative answer.

The required sample size was calculated based on an acceptable sampling error, the preferred accuracy or confidence level, available budget, and the preferred statistical value (Salant & Dillman, 1994). For this study, an acceptable sampling error of 10% was selected with desired level of accuracy with at least a 95% confidence interval. The statistical values required from the study were percentages of the selected target population. These values were then used to calculate the desired sample size, as described by Salant and Dillman(1994) as follows:

$$s = \frac{z^2(p(1-p))}{e^2}$$

Equation 5-1: Study sampling size calculation

Where **s** represents the required sample size, **z** represents the fraction corresponding to the preferred level of confidence, **p** represents the population target respondent proportion and **e** represents the acceptable sampling error. The values used within the Equation 5-1 to calculate the required sampling size were the following:

- **z** = 1.96 as a statistical lookup value based on a 95% confidence level
- **p** = 90% with a decimal value of 0.9

- **e** = 10% with a decimal value of 0.1

This resulted in a suggested minimum sample **s** as 35 participants. The study managed to obtain 112 responses from the enterprise architecture community of which 107 responses were useful. This ensured a favourable reduction of the required sampling error rate from an initial 10% to an actual sampling error rate of less than 6%, which ensured a 94% certainty in the study results.

### 5.3.2 Qualitative analysis approach

The comprehensive list of existing EA factors and architect attributes obtained within **Chapter 4**, allowed for the classification of the EA factors and architect attributes into category areas.

The category areas clarified the alignment and understanding of the different EA beliefs depicted within **Appendix B**. Pre-coding was done on the different EA factors and architect attribute options to understand if there could be any significant relation of these EA factors and architect attributes to the beliefs of the enterprise architects. The classification of the EA factors and architect attributes was done to align to five different EA related categories, each category aligning to a specific interrogative pronoun. These interrogative pronouns are "What" representing "enterprise architecture"; "How" representing "enterprise architecture management"; "Why" representing "enterprise architecture motivation", "Who" representing the "enterprise architect", and "Where" representing "enterprise architecture practice", while the "When" interrogative pronoun was found to be not relevant and was subsequently excluded. The classification of the different EA factors and architect attributes is depicted within **Appendix B.3**, with an extract depicted within Table 5-5.

**Table 5-5: Example coding classification**

| Abstraction | Area | Topic class | Topic | Option |
|---|---|---|---|---|
| What | Enterprise Architecture | EA Factor | Definitions | MIT |
| What | Enterprise Architecture | EA Factor | Definitions | EARF |
| What | Enterprise Architecture | EA Factor | Definitions | FEAF |
| What | Enterprise Architecture | EA Factor | Definitions | The Open Group |

Considering the 35 EA factors and architect attribute aligned questions, a qualitative rating system was used for the grading of EA factors and architect attributes related to a specific EA school of thought, depicted within Table 5-6.

**Table 5-6: Relevance qualitative rating system**

| Indication | Percentage | Value |
|---|---|---|
| Strong | >= 50% | >= ½ |
| Weak | < 50% | < ½ |

The rating system in Table 5-6 can be explained as follows: if more than 50% of participants belonging to a school of thought chose a certain option, say "hierarchical culture" as answer to question 32) then that option was considered related to that specific SOT. Thus, a relevance rating was given based on participants' answers to the EA factor and architect attributes aligned questions. EA factors and architect attributes were only considered when there was a strong indication that it explains the different EA schools of thought. Where there was no strong indication, or a weak indication, the modes of analysis classification depict the EA factor or architect attributes as not being applicable or "N/A".

### 5.3.3 Analytical procedures

With a comprehensive list of 35 EA factors and architect attributes used within the study, several different steps were taken on the understanding of architects' belief systems. The research study followed three different steps on the data analysed:

1. The first modes of analysis step was to determine the possible number of EA schools of thought and which schools of thought could exist, based on the architect participants' understanding of EA scope (Question 6) and EA purpose (Question 7). The percentage of participants belonging to the different schools of thought is given in Figure 5-U.
2. Understanding the number of EA schools of thought, the second modes of analysis step was to determine which of EA factors and architect attributes aligned questions could further explain the EA schools of thought, identified within the first analysis step.
3. The final modes of analysis step was to determine for each EA factor or architect attribute aligned question, the answer to the question which showed a strong indication of relevance to the description of the EA schools of thought. The relevancy was determined according to the qualitative rating system as listed within Table 5-6.

As the study was based on the initial work by Lapalme (2012a), the foundation and selection for the modes of analysis steps were based on the participants' understanding of the scope and purpose of EA; where EA scope represented the scope under consideration to be changed as part of the EA initiative, and EA purpose represented the purpose for planning an EA initiative, rather than executing the EA initiative.

Aligning to the three different positions on EA scope and the three different positions on EA purpose as depicted within Table 5-2, allowed for nine theoretical EA schools of thought. A 3X3 matrix, depicted within Figure 5-F, was used to represent the different EA schools of thought. These schools of thought were identified through the execution of the study and defined based on the answers from the participating architects.

Using the electronic data collected from the participants of the study, each participant was then placed in a specific EA school of thought based on their understanding of EA scope and EA purpose. The results from the study clearly indicated and reaffirmed the three "ideal" EA schools of thought as identified by Lapalme (2012a), with an additional four newly identified EA schools of thought.

The data collected as part of the study and specifically the architects' answers on EA scope and EA purpose are used as the foundation for the understanding of EA schools of thought. This perspective provided a possible nine EA schools of thought, based on the three views on EA scope and the three views of EA purpose. These perspectives on the classification of EA schools of thought can then be depicted as a 3X3 cell matrix, as depicted within Figure 5-F.

The answers of all the questions (except question 6 & 7, which deal with the EA scope and EA purpose) of each of the participants were viewed from the perspective of their specific EA school of thought (which was determined by the answers to question 6 & 7). These answers on the EA factors and architect attribute aligned questions provided insight into the understanding of the EA schools of thought.

### 5.3.4 Presenting results

With the execution, collection and analysis of the data from the research study, there was evidence that more EA SoTs exist, based on the understanding of EA scope and EA purpose; seven distinct EA schools of thought exist. Not a single participant considered the scope of EA to be confined to IT, while they considered the purpose of planning an EA initiative to be about strategy and execution alignment, or strategy formulation and execution alignment, as depicted within Figure 5-M. This eliminated two of the theoretical nine EA schools of thought, resulting in the seven EA schools of thought found.

Each EA school of thought was characterised according to beliefs centred around EA as per the original description of the EA schools of thought (2012a), and described within Table 5-7.

**Table 5-7: Alignment of EA beliefs to topics, based on Lapalme (Lapalme, 2012a, p. 39)**

| Beliefs | Topic |
|---|---|
| EA school of thought | School of thought, Types, Scope, Purpose, Definitions |
| Motto | Philosophy, Organisational culture, Competencies |
| Objectives and concerns | Deliverables, Outcomes, Business objectives, Concerns, Goals, Benefits, Innovation |
| Principles and assumptions | Domains, Governance, Architecture segment, Phases |
| EA skills | Frameworks, Methodologies, Standards, Modelling notation, Certification, Patterns, Building blocks, Techniques, Experience, Positions, Position Levels, Skills category, |
| Belief concepts | Responsibilities, Influence, Creativity, Critical success factors, Benefits, Roles, Personality, Temperament |
| Perceived challenges | Maturity stage, Reporting line, Organisational segment, Discipline, Education |
| Insights | Views, Level of detail, Stakeholders |
| Limitations | Trends, Impacts, Challenges and problems |

These EA schools of thought included the initial three and "ideal" EA schools of thought as identified by Lapalme (2012a), as well as four newly identified EA schools of thought as a result of the study. The EA schools of thought taxonomy is depicted within Figure 5-M.

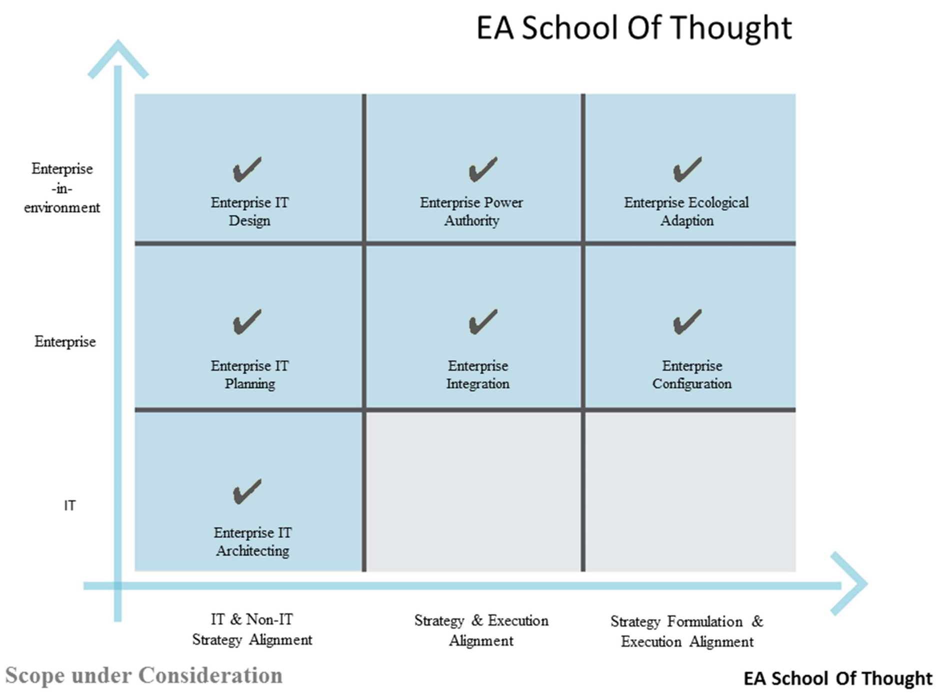



**Figure 5-M: EA schools of thought taxonomy, based on Lapalme (2012a, p. 39)**

As the three "ideal" EA schools of thought had already been described and defined by Lapalme (2012a), the focus of the development was based on the four newly identified EA schools of thought. A summary of the "ideal" EA schools of thought is provided as defined by Lapalme, to provide context and completeness. Additionally the findings from the study of the "ideal" EA schools of thought are included with a summary of the EA school of thought definition. The four newly identified EA schools of thought make reference in name and classification to the work done by Mintzberg *et al.* on the ten strategy formation schools of thought (Mintzberg *et al.*, 2005).

### 5.3.4.1 Enterprise IT Architecting (EITA)

In the Enterprise IT Architecting (EITA) school of thought, EA is about alignment between an organisation's IT assets (through strategy, design, and management). This is done to effectively execute the business strategy and various business operations using proper IT capabilities (Lapalme, 2012a, 2012a).

The position of the EITA school of thought in relation to the other EA schools of thought is depicted within Figure 5-N. The EITA school of thought was one of the initial EA schools of thought identified by Lapalme (2012a).

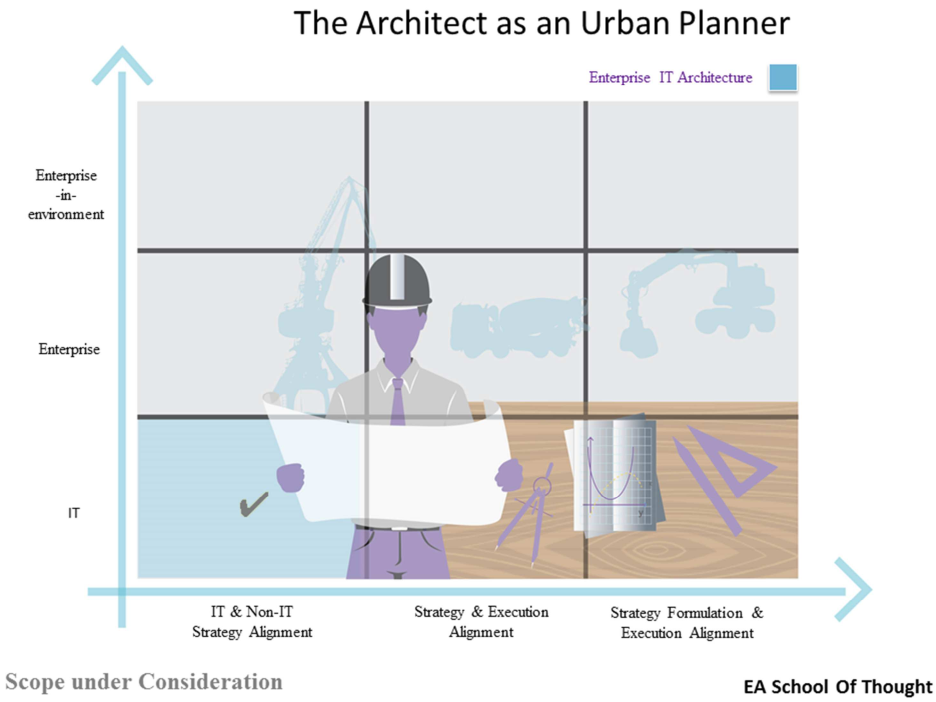



**Figure 5-N: EITA school of thought**

From this research study 9% of participating architects fell within the EITA School having 5 – 10 years of experience, being employed in a senior position and having obtained a master's degree in a formal sciences educational discipline. These architects have TOGAF or Zachman certification and see their architect role as being a leader. Their function is confined to the domain or system level affecting the business segment of the organisation, while the architecture effort is focused on a logical perspective with an inventory abstraction. Using the Zachman Framework for Enterprise Architecture, these architects concentrate their efforts within the inventory representation intersection of the ontology while creating composite or viewpoint models to create awareness of EA within the organisation. As architects, they believe that their EA effort is demonstrating commitment in order to achieve success. They interact with project managers and analysts on a daily basis. Their modelling notation of choice is UML while using their IT general skills as an architect. These architects believe their EA competency to be that of a consultant while adding value by defining future EA models or roadmaps. Their outcomes are centred on improving organisational efficiency or quality of business information. As architects, their concerns are with meeting quality requirements or providing IT direction while experiencing challenges with effective collaboration. The EITA architects' goals are confined to business-IT alignment, while their business objectives are centred on supporting IT planning and reducing costs. They make use of initial project architecture as an EA technique to perform their duties. Architects within the EITA school of thought describe their organisations' culture as being a rational or hierarchical organisational culture and describes the EA function as reporting to the CIO. A good analogy for architects within the EITA school of thought is that of urban planner.

A summary of the beliefs that form part of the EITA school of thought belief system is depicted with Table 5-8.

**Table 5-8: EITA school of thought beliefs (Lapalme, 2012a, p. 39)**

| Belief | Enterprise IT Architecture (EITA) |
|---|---|
| Motto | • EA as the glue between business and IT |
| Objectives & concerns | • Effective enterprise strategy execution and operations<br>• IT Planning & Cost reduction<br>• Business Enablement |
| Principles and assumptions | • Reductionism<br>• Business strategies and objectives are provided by the business and are correct<br>• Independent design of organisational dimensions<br>• Disinterest in no IT dimensions |
| Skills | • Technical competence |
| Challenges | • Organisational understanding and acceptance of designed plans |
| Insights | • Permits the design of robust and complex technological solutions<br>• Fosters the creation of high quality models and planning scenarios |
| Limitations | • Susceptible to producing inadequate or unfeasible solutions for the larger organisational context<br>• Susceptible to considerable solution acceptance and implementation barriers<br>• Susceptible to "perfect" designs for unsustainable strategies syndrome |

A summary of the results from the study as it applies to the EITA school of thought is depicted with Table 5-9.

**Table 5-9: EITA study results**

| # | Investigative questions | Results |
|---|---|---|
| 1 | What architecture position do you most associate with? | EA |
| 2 | What experience do you have in enterprise architecture? | 5-10 |
| 3 | In what educational discipline are you formally trained? | Formal sciences |
| 4 | What is your highest level of education obtained? | Master's degree |
| 5 | What enterprise architecture certification have you obtained to date? | Zachman + TOGAF |
| 6 | What is the scope of EAM? | IT |
| 7 | What is the purpose of EAM? | IT & business strategy alignment |
| 8 | What architecture definition would you most associate with? | N/A |
| 9 | What EA role do you most associate with? | Leader |
| 10 | What enterprise architect position level do you currently hold? | Senior level |
| 11 | What enterprise architecture segment do you work on? | System + system segment |
| 12 | What enterprise architecture domain do you associate with? | N/A |
| 13 | What organisational segment is most affected by the architecture effort you work on? | Business |
| 14 | What level of detail do you perform in the architecture effort? | N/A |
| 15 | What stakeholder perspectives do you focus on for the architecture function? | Logical |
| 16 | What architecture abstractions do you focus on? | Inventory |
| 17 | What architecture models do you create? | Composite |
| 18 | What stage of maturity do you believe the architecture effort has obtained? | Create |
| 19 | What CSF or success attributes have the architecture effort realised? | Demo |
| 20 | What EAM frameworks do you align most with? | N/A |
| 21 | Which stakeholders do you interact with? | PM + Analyst |
| 22 | What governance structure do you interact with? | N/A |
| 23 | What modelling notations do you most often use in your current role? | UML |
| 24 | What skills category do you most often use as an architect? | IT general skills |
| 25 | What enterprise architecture competency do you most associate with? | Consulting |
| 26 | What value do you add to the enterprise architecture effort? | Future state + roadmap |
| 27 | What outcomes do you try to achieve by delivering on the EAM effort? | Efficient + quality |

| # | Investigative questions | Results |
|---|---|---|
| 28 | What enterprise architecture concerns do you have in your current role? | Quality + ICT direction |
| 29 | What enterprise architecture challenges do you have in your current role? | Collaborate |
| 30 | What enterprise architecture goals do you try to achieve in your current role? | IT alignment |
| 31 | What enterprise architecture techniques do you use within your current role? | Project start-up |
| 32 | What organisational culture best describes the enterprise architecture function within your organisation? | Rational + hierarchical |
| 33 | To whom does the enterprise architecture function report to? | CIO |
| 34 | What enterprise architecture benefits do you believe you bring in your current role? | N/A |
| 35 | What business objectives do you try to achieve in your current role? | Costs |

### 5.3.4.2 Enterprise Integrating (EI)

For the EI school of thought, EA focuses on designing all facets of the organisation. The architect's goal is to execute the enterprise's strategy by maximising the overall coherency between all of its facets, including IT (Lapalme, 2012a, 2012b).

The position of the EI school of thought in relation to the other EA schools of thought is depicted with Figure 5-O. The EI school of thought was one of the initial EA schools of thought identified by Lapalme (2012a).

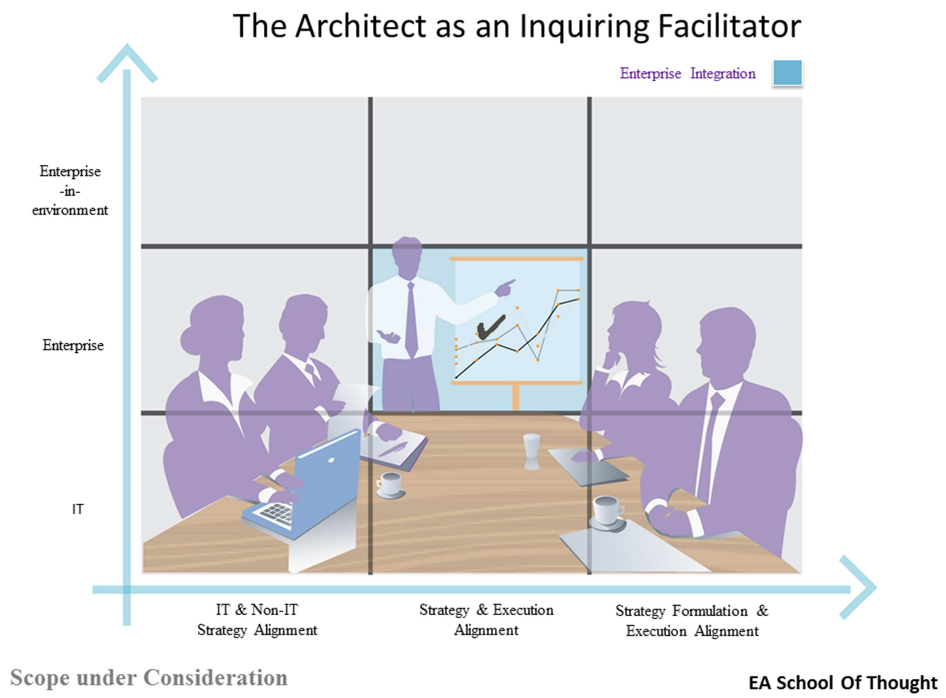



**Figure 5-O: EI school of thought**

From this research study 18% of participating architects who fell within the EI School are senior business architects, having 10 – 15 years of experience with a master's degree in a professional and applied sciences discipline. They use TOGAF and are certified as TOGAF architects, while making use of Gartner's definition to explain EA and see themselves as having a change agent's role. The architects' work is focused on the enterprise level and affects the business function of the organisation, while the architecture effort is focused on a conceptual or logical perspective with a process abstraction. Using the Zachman Framework for Enterprise Architecture, these architects concentrate their efforts within the process definition intersection of the ontology while creating composite or viewpoint models to develop the EA function within the organisation. Architects within the EI school of thought have provided EA as a capability to meet their commitments. They also interact with other architects and executives and interact with governance boards. The EI architects make use of UML or BPMN to document their EA effort. This is in line with the business EA domain and the process abstraction. As EI architects, their skills are concentrated around EA skills while having a strategist's competency, delivering value by creating future architecture state models and roadmap models. These architects' outcomes are centred on improving efficiency in the organisation, while experiencing challenges around factors hindering effective collaboration. Their primary EA technique used is that of getting EA deliverables formally approved. The EI architects find themselves within an organisation with a rational culture and the EA function reporting to the CIO. They believe they provide insight into the complexity of the organisation while integrating or standardising processes and systems within the organisation. Their main objective is that of implementing the business strategy, which is in line with their beliefs around EA purpose. A good analogy for architects within the EI school of thought is that of an inquiring facilitator.

A summary of the beliefs that form part of the EI school of thought belief system is depicted with Table 5-10.

**Table 5-10: EI school of thought beliefs (Lapalme, 2012a, p. 39)**

| Belief | Enterprise Integration (EI) |
|---|---|
| Motto | • EA as the link between strategy and execution |
| Objectives & concerns | • Effective enterprise strategy implementation<br>• Organizational coherence |
| Principles and assumptions | • Holism<br>• Business strategies and objectives are provided by the business and are correct<br>• Environment as something to manage<br>• Joint design of all organizational dimensions |
| Skills | • Small group facilitation<br>• Systems thinking |
| Challenges | • Understanding of organisational systemic dynamics<br>• Organisational collaboration<br>• System thinking paradigm shift |
| Insights | • Permits the design of comprehensive solutions<br>• Enables significant organisational efficiency by eliminating unnecessary contradictions and paradoxes |
| Limitations | • Susceptible to "perfect" designs for unsustainable strategies syndrome<br>• Requires a paradigm shift from reductionism to holism |

A summary of the results from the study as it applies to the EI school of thought is depicted with Table 5-11.

**Table 5-11: EI study results**

| # | Investigative questions | Results |
|---|---|---|
| 1 | What architecture position do you most associate with? | EA |
| 2 | What experience do you have in enterprise architecture? | 10 – 15 |

| # | Investigative questions | Results |
|---|---|---|
| 3 | In what educational discipline are you formally trained? | Professional applied sciences |
| 4 | What is your highest level of education obtained? | Master's degree |
| 5 | What enterprise architecture certification have you obtained to date? | TOGAF |
| 6 | What is the scope of EAM? | Enterprise |
| 7 | What is the purpose of EAM? | Strategy & execution alignment |
| 8 | What architecture definition would you most associate with? | Gartner |
| 9 | What EA role do you most associate with? | Change agent |
| 10 | What enterprise architect position level do you currently hold? | Senior level |
| 11 | What enterprise architecture segment do you work on? | Enterprise level |
| 12 | What enterprise architecture domain do you associate with? | Business |
| 13 | What organisational segment is most affected by the architecture effort you work on? | Business |
| 14 | What level of detail do you perform in the architecture effort? | N/A |
| 15 | What stakeholder perspectives do you focus on for the architecture function? | Logical + conceptual |
| 16 | What architecture abstractions do you focus on? | Process |
| 17 | What architecture models do you create? | Composite |
| 18 | What stage of maturity do you believe the architecture effort has obtained? | Development |
| 19 | What CSF or success attributes has the architecture effort realised? | Provide |
| 20 | What EAM frameworks do you align most with? | TOGAF |
| 21 | Which stakeholders do you interact with? | Executive + architect |
| 22 | What governance structure do you interact with? | Boards |
| 23 | What modelling notations do you most often use in your current role? | UML + BPMN |
| 24 | What skills category do you most often use as an architect? | EA skills |
| 25 | What enterprise architecture competency do you most associate with? | Strategy |
| 26 | What value do you add to the enterprise architecture effort? | Future state + roadmap |
| 27 | What outcomes do you try to achieve by delivering on the EAM effort? | Efficiency |
| 28 | What enterprise architecture concerns do you have in your current role? | N/A |
| 29 | What enterprise architecture challenges do you have in your current role? | Collaborate |
| 30 | What enterprise architecture goals do you try to achieve in your current role? | N/A |
| 31 | What enterprise architecture techniques do you use within your current role? | Approve EA |
| 32 | What organisational culture best describes the enterprise architecture function within your organisation? | Rational |
| 33 | To whom does the enterprise architecture function report to? | CIO |
| 34 | What enterprise architecture benefits do you believe you bring in your current role? | Integrate + complexity |
| 35 | What business objectives do you try to achieve in your current role? | Implement strategy |

### 5.3.4.3 Enterprise Ecological Adaptation (EEA)

For the EEA school of thought, EA is concerned with fostering organisational learning by designing all facets of the organisation, including the organisation's relationship to its environment, to foster innovation and system-in-environment adaptation. For architects within the EEA school of thought, creating the enterprise strategy and designing the organisation are top priorities (Lapalme, 2012a, 2012b).

The position of the EEA school of thought in relation to the other EA schools of thought is depicted within Figure 5-P. The EEA school of thought was one of the initial EA schools of thought identified by Lapalme (2012a).

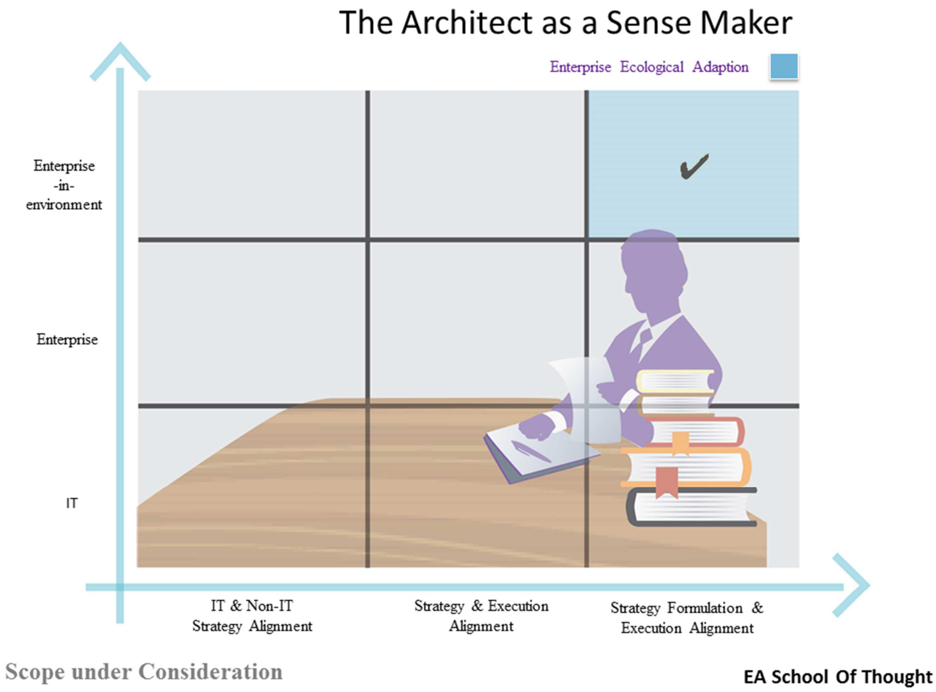



**Figure 5-P: EEA school of thought**

From this research study 11% of participating architects fell within the EEA are senior architects, have 5 – 10 years of experience and are educated within a formal sciences discipline. They have TOGAF certification or have no EA certification whatsoever and describe EA using the Archimate Foundation definition to describe EA. These architects make use of the Zachman framework for enterprise architecture, while interacting with other architects on a day-to-day basis. The EEA architects see themselves as fulfilling the role of an EA leader affecting the business function within the organisation. Their architecture modelling effort is defined on a medium level of detail, focusing on the process abstraction. Using the Zachman Framework for Enterprise Architecture, these architects concentrate their efforts within the process definition intersection of the ontology while creating composite or viewpoint models to create awareness of EA within the organisation. These architects' EA efforts have provided a capability to meet their commitments. The EEA architects interact with governance committees while documenting their architecture effort using custom modelling notations. They use EA skills to model the future EA state of the organisation and see their primary EA competency as a consultant or strategist. The EI architects try to improve efficiency within the organisation and are concerned with realising business value while facing challenges around effective collaboration. The EEA architects reside within an organisation with a rational culture with the EA function reporting to the CIO. These architects believe they bring benefit to the organisation by integrating and standardising systems and processes or by depicting a clear image of the desired future situation by enabling the organisation's strategy. A good analogy for architects within the EEA school of thought is that of a sense maker.

A summary of the beliefs that form part of the EEA school of thought belief system is depicted with Table 5-12.

**Table 5-12: EEA school of thought beliefs (Lapalme, 2012a, p. 39)**

| Belief | Enterprise Ecological Adaption (EEA) |
|---|---|
| Motto | • EA as a means for organisation innovation and sustainability |
| Objectives & concerns | • Innovation & adaption<br>• Organisational coherence<br>• System-in-environment coevolution |
| Principles and assumptions | • Holism<br>• System-in-environment coevolution<br>• Environment can be changed<br>• Joint design of all organisational dimensions |
| Skills | • Dialogue fostering<br>• System & System-in- environment thinking<br>• Larger group facilitation |
| Challenges | • Fostering sense-making<br>• Organisational collaboration<br>• System-in-environment paradigm shift |
| Insights | • Fosters enterprise-in environment coevolution and enterprise coherency<br>• Fosters organisational innovation and sustainability |
| Limitations | • Requires many organisational pre-conditions with regards to management and strategy creation |

A summary of the results from the study as it applies to the EEA school of thought is depicted with Table 5-13.

**Table 5-13: EEA study results**

| # | Investigative questions | Results |
|---|---|---|
| 1 | What architecture position do you most associate with? | EA |
| 2 | What experience do you have in enterprise architecture? | 5-10 |
| 3 | In what educational discipline are you formally trained? | Formal sciences |
| 4 | What is your highest level of education obtained? | N/A |
| 5 | What enterprise architecture certification have you obtained to date? | TOGAF + None |
| 6 | What is the scope of EAM? | Enterprise environment |
| 7 | What is the purpose of EAM? | Strategy formulation & execution alignment |
| 8 | What architecture definition would you most associate with? | Archi foundation |
| 9 | What EA role do you most associate with? | Leader |
| 10 | What enterprise architect position level do you currently hold? | Senior level |
| 11 | What enterprise architecture segment do you work on? | N/A |
| 12 | What enterprise architecture domain do you associate with? | N/A |
| 13 | What organisational segment is most affected by the architecture effort you work on? | Business |
| 14 | What level of detail do you perform in the architecture effort? | Medium |
| 15 | What stakeholder perspectives do you focus on for the architecture function? | N/A |
| 16 | What architecture abstractions do you focus on? | Process |
| 17 | What architecture models do you create? | Composite |
| 18 | What stage of maturity do you believe the architecture effort has obtained? | Aware |
| 19 | What CSF or success attributes has the architecture effort realised? | Provide |
| 20 | What EAM frameworks do you align most with? | Zachman |
| 21 | Which stakeholders do you interact with? | Architect |
| 22 | What governance structure do you interact with? | Committee |
| 23 | What modelling notations do you most often use in your current role? | Custom |
| 24 | What skills category do you most often use as an architect? | EA skills |
| 25 | What enterprise architecture competency do you most associate with? | Consult + strategy |
| 26 | What value do you add to the enterprise architecture effort? | Future state |
| 27 | What outcomes do you try to achieve by delivering on the EAM effort? | Efficiency |
| 28 | What enterprise architecture concerns do you have in your current role? | Business value |

| # | Investigative questions | Results |
|---|---|---|
| 29 | What enterprise architecture challenges do you have in your current role? | Collaboration |
| 30 | What enterprise architecture goals do you try to achieve in your current role? | IT alignment + standardisation + complexity |
| 31 | What enterprise architecture techniques do you use within your current role? | N/A |
| 32 | What organisational culture best describes the enterprise architecture function within your organisation? | Rational |
| 33 | To whom does the enterprise architecture function report to? | CIO |
| 34 | What enterprise architecture benefits do you believe you bring in your current role? | Integrate + future state |
| 35 | What business objectives do you try to achieve in your current role? | Enable strategy |

### 5.3.4.4 Enterprise Configuration (EC)

The position of the EC school of thought in relation to the other EA schools of thought is depicted within Figure 5-Q. The EC school of thought is one of the four new EA schools of thought as identified and confirmed by this research study.

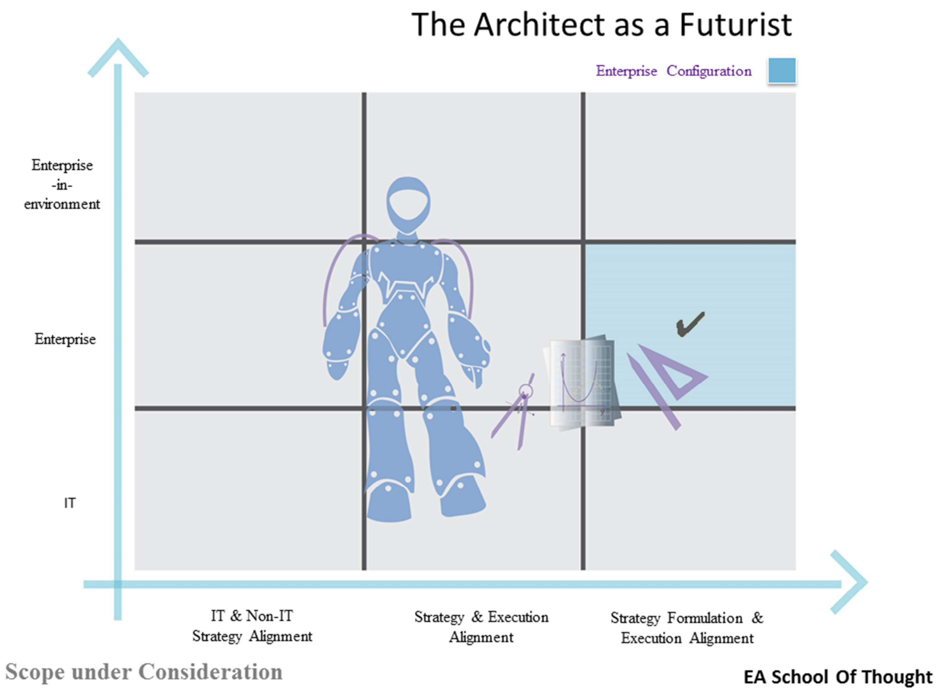



**Figure 5-Q: EC school of thought**

From this research study 8% of participating architects who fell within the EC School are senior-level domain-specific solutions architects with 1 – 5 years of experience. These architects are trained in formal sciences and are TOGAF certified, using TOGAF and defining EA as per the Open Group EA definition. Their work affects the business segment of the organisation while the architecture effort is focused on a logical perspective with a distribution abstraction. Using the Zachman Framework for Enterprise Architecture, these architects concentrate their efforts within the distribution representation intersection of the ontology while creating composite or viewpoint models focusing on the future state of the architecture. These architects' efforts have realised enterprise architecture as a capability to meet commitment within their organisations. They interact with other architects as well as project managers and have a core competency of a consultant. Their concerns are concentrated around realising business value. These architects face challenges around the strength and weaknesses of the methods being used as well as the evaluation of EA design alternatives. These architects' goals are to realise business-IT alignment, standardisation and to reduce complexity. They exchange knowledge with other architects and employees working on their projects. They believe their efforts will integrate and standardise processes and systems, while depicting a clear image of the future situation.

Enterprise architects within the EC school of thought consider EA to be about the transformation of decisions (Aier, 2014; The Open Group, 2009), specifically with regard to the transformation and realisation of business decisions (Hendrickx *et al.*, 2011) considering how internal factors influence business decisions. The EC school of thought has its foundation in transformation theory (Barnes *et al.*, 2014; Chuang & Van Loggerenberg, 2010; Niemietz & De Kinderen, 2013), where EA is can be seen as using business decisions to realise the business strategy (Akenine, 2008; Bredemeyer & Malan, 2004; Gøtze, 2013; Hendrickx *et al.*, 2011; Nakakawa *et al.*, 2009, 2010; Ouriaghli & Nsubuga, 2012; Simon *et al.*, 2013b; Van Der Raadt & Van Vliet, 2008). The lifecycle of strategic change in the organisation can be seen as a series of interlocking growth curves (Aier, 2014; Espinosa *et al.*, 2011) indicating significant change in the direction and execution of the business strategy (Hendrickx *et al.*, 2011; Ouriaghli & Nsubuga, 2012).

The objectives of the EC school of thought are to consider the internal environment in their decision making and transformation methodology (Chuang & Van Loggerenberg, 2010; Hendrickx *et al.*, 2011; Nakakawa *et al.*, 2010), ensuring effective strategy transformation.

The aim is to ensure that a significant impact is made on the strategic direction of the business strategy and ultimately the organisation (Bredemeyer & Malan, 2004), ensuring the future growth of the organisation as soon as the growth starts to decline. The goal is to ensure successful business strategy execution in each of these cycles by considering the various different decision configurations and selecting the best configuration for the next business growth cycle (The Open Group, 2009).

The priorities of the enterprise architects in the EC school of thought are on the decision transformation methodology (Chuang & Van Loggerenberg, 2010; Hendrickx *et al.*, 2011; Nakakawa *et al.*, 2009, 2010). The school of thought is guided by an improvement approach to problem solving (Nakakawa *et al.*, 2010) where EA is concerned with the planning and executing of the business strategy.

The organisation is seen as operating independently from its environment and seen as a closed system (Lapalme, 2012b). Other components include the various different aspects and dimensions of the organisation.

With organisational change being the order of the day (Chuang & Van Loggerenberg, 2010; Hjort-Madsen & Pries-Heje, 2009; Nakakawa *et al.*, 2009; Van Der Raadt *et al.*, 2010), as a result of decision transformation, careful attention needs to be given to ensure effective organisational collaboration (Espinosa *et al.*, 2013, 2011; Nakakawa *et al.*, 2009; Van Der Raadt *et al.*, 2010). The organisation needs to be transformed from one significant growth cycle to the next (The Open Group, 2009), making this paradigm shift from one growth cycle to the next problematic.

Enterprise architects within the EC school of thought make the organisation susceptible to the continual change in design decision configurations (Iacob *et al.*, 2014; Nakakawa *et al.*, 2009; Ouriaghli & Nsubuga, 2012; The Open Group, 2009; Van Der Raadt *et al.*, 2010). This continual change in configuration could impact on the realisation of the business strategy. The EC school of thought also requires and environment that is open and comfortable with the continual rate of change (Aier, 2014; Boster *et al.*, 2000). Enterprise architects within the EC school of thought understand that a significant change in strategic direction is vital to the organization's survival (Hendrickx *et al.*, 2011; The Open Group, 2009) and that the strategic direction is guided by the decision methodology (Bredemeyer & Malan, 2004; Ouriaghli & Nsubuga, 2012; Strano & Rehmani, 2007), which permits itself to design transformational solutions. In this case the enterprise architect's role is to define this decision transformational methodology (Chuang & Van Loggerenberg, 2010; Hendrickx *et al.*, 2011; Nakakawa *et al.*, 2009, 2010) ensuring effective and successful strategy formulation and execution alignment.

The enterprise architect can be seen as a "futurist", trying to understand the organisation and considering the various configurations on how decisions today will impact the organisation in the future. A good analogy for architects within the EC school of thought is that of a futurist.

A summary of the beliefs that form part of the EC school of thought belief system is depicted with Table 5-14.

**Table 5-14: EC school of thought beliefs**

| Belief | Enterprise Configuration (EC) |
|---|---|
| Motto | • EA as a decision transformation methodology |
| Objectives & concerns | • System-in-environment coevolution<br>• Organisational coherence<br>• Effective enterprise strategy transformation |
| Principles and assumptions | • Holism<br>• System-in-environment coevolution<br>• Environment as something to transform.<br>• Joint design of all organisational dimensions. |
| Skills | • System & System - in - environment thinking<br>• Larger group facilitation |
| Belief concepts | • Holism<br>• Open System<br>• Determinism<br>• Contextualism |

| Belief | Enterprise Configuration (EC) |
|---|---|
| Challenges | • Organisational collaboration<br>• System-in-environment paradigm shift |
| Insights | • Permits the design of transformational solutions<br>• Fosters enterprise coevolution and enterprise coherency |
| Limitations | • Susceptible to continual design changes and unrealized strategy<br>• Requires environments that may be influenced |

A summary of the results from the study as it applies to the EC school of thought is depicted with Table 5-15.

**Table 5-15: EC study results**

| # | Investigative questions | Results |
|---|---|---|
| 1 | What architecture position do you most associate with? | SA |
| 2 | What experience do you have in enterprise architecture? | 1-5 |
| 3 | In what educational discipline are you formally trained? | N/A |
| 4 | What is your highest level of education obtained? | N/A |
| 5 | What enterprise architecture certification have you obtained to date? | TOGAF |
| 6 | What is the scope of EAM? | Enterprise in environment |
| 7 | What is the purpose of EAM? | Strategy & execution alignment |
| 8 | What architecture definition would you most associate with? | Open Group |
| 9 | What EA role do you most associate with? | N/A |
| 10 | What enterprise architect position level do you currently hold? | Senior level |
| 11 | What enterprise architecture segment do you work on? | Segment |
| 12 | What enterprise architecture domain do you associate with? | N/A |
| 13 | What organisational segment is most affected by the architecture effort you work on? | Business |
| 14 | What level of detail do you perform in the architecture effort? | Various levels |
| 15 | What stakeholder perspectives do you focus on for the architecture function? | Logical |
| 16 | What architecture abstractions do you focus on? | Distribution |
| 17 | What architecture models do you create? | Composite |
| 18 | What stage of maturity do you believe the architecture effort has obtained? | N/A |
| 19 | What CSF or success attributes have the architecture effort realised? | Provide |
| 20 | What EAM frameworks do you align most with? | TOGAF |
| 21 | Which stakeholders do you interact with? | PM + architects |
| 22 | What governance structure do you interact with? | N/A |
| 23 | What modelling notations do you most often use in your current role? | N/A |
| 24 | What skills category do you most often use as an architect? | N/A |
| 25 | What enterprise architecture competency do you most associate with? | Consulting |
| 26 | What value do you add to the enterprise architecture effort? | Future state |
| 27 | What outcomes do you try to achieve by delivering on the EAM effort? | N/A |
| 28 | What enterprise architecture concerns do you have in your current role? | Business value |
| 29 | What enterprise architecture challenges do you have in your current role? | Strength & weaknesses + evaluate |
| 30 | What enterprise architecture goals do you try to achieve in your current role? | IT alignment + standardisation + complexity |
| 31 | What enterprise architecture techniques do you use within your current role? | Knowledge exchange |
| 32 | What organisational culture best describes the enterprise architecture function within your organisation? | N/A |
| 33 | To whom does the enterprise architecture function report to? | N/A |
| 34 | What enterprise architecture benefits do you believe you bring in your current role? | Integrate + future state |
| 35 | What business objectives do you try to achieve in your current role? | N/A |

### 5.3.4.5 Enterprise Power Authority (EPA)

The position of the EPA school of thought in relation to the other EA schools of thought is depicted within Figure 5-R. The EPA school of thought is one of the four new EA schools of thought as identified and confirmed by this research study.

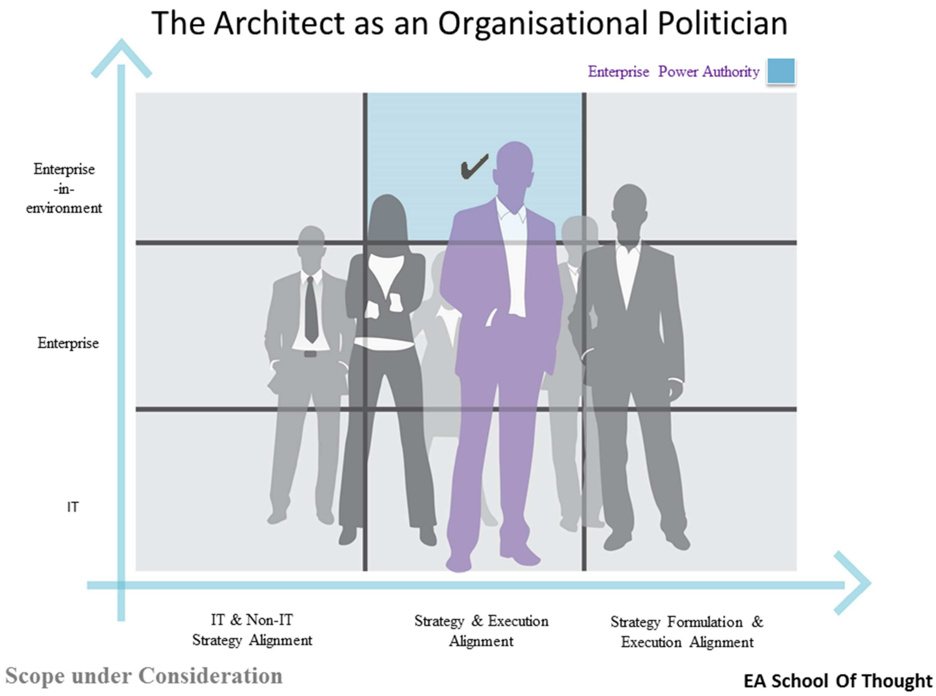



**Figure 5-R: EPA school of thought**

From this research study 23% of participating architects who fell within the EPA School are senior business architects with 10 – 15 years' experience while being educated within a formal sciences discipline. They have master's degrees and are certified TOGAF architects and using TOGAF for their architecture effort, although they describe EA using the Gartner definition for EA. The architects also see themselves as change agents. Their EA effort is concerned with the enterprise level affecting the business function of the organisation and is not concerned with specific domains. As these architects are business architects, affecting the business function of the organisation, they also take a conceptual or business management perspective when they focus on the process abstraction when performing the EA function by building composite models. Using the Zachman Framework for Enterprise Architecture, these architects concentrate their efforts within the process definition intersection of the ontology while creating composite or viewpoint models to create awareness of EA within the organisation. These architects also believe that their architecture effort has provided a capability to meet their commitment. In line with the EPA architects' business perspective, they interact with executives and line managers while interacting with governance committees in the execution of their day-to-day function. These architects also use BPMN to document their architecture landscape. This is again in line with their business perspective and their focus on the process abstraction. The EPA architects lists their skills most often used as business and EA skills. They also list their competency as being that of a consultant. These architect believe they add value by creating models of the future state, which illustrate what the enterprise should look like across all EA viewpoints in support of the business strategy. The architects within the EPA school of thought believe they improve the effectiveness and agility of the enterprise while being concerned about realising business value. These architects face challenges with regards to effective collaboration, which include organisation politics, and social complexity of organisation. The EPA architects listed their goals they are trying to achieve as realising business-IT alignment, while stating that their EA technique choices are explicitly linked to the business goals. These architects function in an organisation with a hierarchical organisational culture where the EA function reports to the CIO of the organisation. They believe they bring benefit to the organisation by integrating, standardising or de-duplicating related processes and systems by enabling business.

Enterprise architects within the EPA school of thought consider EA as a power and negotiation tool (Chuang & Van Loggerenberg, 2010; Ouriaghli & Nsubuga, 2012; Sidorova & Kappelman, 2011). As enterprise architecture is seen by many as defining the future state of the organisation, the roadmap and the implementation plan for the organisation's transition (Hauder *et al.*, 2014; Nikpay *et al.*, 2013; Steghuis & Proper, 2008; The Open Group, 2009), the architects within this school of thought see EA as a tool of control allowing advancements of interests by controlling the strategy execution of the organisation (Chuang & Van Loggerenberg, 2010; Ouriaghli & Nsubuga, 2012; Van Den Berg & Van Vliet, 2014).This perspective is not confined to the architects but may also apply to any stakeholders in EA (The Open Group, 2009). The EPA school of thought has its foundation in political science (Bredemeyer & Malan, 2004; Hjort-Madsen & Pries-Heje, 2009; Nakakawa *et al.*, 2009; Van Den Berg & Van Vliet, 2014).

The aim of the enterprise architect within the EPA school of thought is to use the EA function for control and to influence the organisation's strategic execution (Bredemeyer & Malan, 2004; Chuang & Van Loggerenberg, 2010). With the power to describe, and control over the future organisational environment, architects within this school of thought can become susceptible to self-interest and deception (Nakakawa *et al.*, 2010). Much focus is spent on gaining approval of the EA effort (Boster *et al.*, 2000; Nakakawa *et al.*, 2009). All external dimensions are considered as part of the system (Aier, 2014; Gøtze, 2013; Harmon, 2005; Nakakawa *et al.*, 2011; Ouriaghli & Nsubuga, 2012; Van Der Raadt *et al.*, 2010) and as a result are open to negotiation (Sidorova & Kappelman, 2011; Van Den Berg & Van Vliet, 2014). However, as business strategies and objectives are provided by the business, their understanding can still be open to interpretation (Nakakawa *et al.*, 2009). The view of the architect within the EPA school of thought is that of an ever changing environment (Hartmann, 2011; Hjort-Madsen & Pries-Heje, 2009; Lapalme, 2012a; Ouriaghli & Nsubuga, 2012). Architects within the EPA school of thought often have a systems thinking approach to describing the organisation system (Gøtze, 2013; Lapalme, 2012a; Simon *et al.*, 2013b). These enterprise architects, however often define the system only on conceptual levels of abstraction (Foorthuis *et al.*, 2015).

Although the organisation is seen as operating within a greater environment (Harmon, 2005; MacLennan & Van Belle, 2014; The Open Group, 2009), facilitation and collaboration is confined to a small group (Nakakawa *et al.*, 2010; Van Der Raadt *et al.*, 2010). The EPA school of thought is guided by a negotiation approach to problem solving (Gøtze, 2013). Belief concepts such as authority and open systems are core to the beliefs to the architect within the EPA school of thought (Bredemeyer & Malan, 2004; Espinosa *et al.*, 2013; Espinosa & Boh, 2009; Lapalme, 2012a). The school of thought lends itself to the design of superficial solutions (Nakakawa *et al.*, 2011; Simon *et al.*, 2013b), ensuring much of the organisation within the high-level system is defined and documented.

Enterprise architects superficially consider organisational efficiency (Aier, 2014; Lapalme, 2012a; Ouriaghli & Nsubuga, 2012; Van Der Raadt *et al.*, 2010) by eliminating conflicting scenarios (Ouriaghli & Nsubuga, 2012), which leads the organisation to be susceptible to politically motivated solutions (Ouriaghli & Nsubuga, 2012) that could adversely affect the desired business strategy.

The EPA school of thought requires many organisational pre-conditions with regards to power structure and strategic execution (Bredemeyer & Malan, 2004; Chuang & Van Loggerenberg, 2010; Ouriaghli & Nsubuga, 2012) in order to be effective in defining the strategic alignment. Enterprise architects within the EPA school of thought require the understanding of organisational system dynamics (Lapalme, 2012b). Architects are faced with concerns regarding organisational coherence (Gøtze, 2013; Niemietz & De Kinderen, 2013; Wagter *et al.*, 2012), and often struggle with organisational collaboration specifically outside their power and control base (Van Der Raadt *et al.*, 2010).

The enterprise architect's role in the EPA school of thought is to negotiate the strategic alignment of the organisation (Gøtze, 2013; Ouriaghli & Nsubuga, 2012; Van Den Berg & Van Vliet, 2014) using enterprise architecture as a tool. In this case the enterprise architect can be seen as a "politician", trying to negotiate and alter the future state of the organisation (Gøtze, 2013; Ouriaghli & Nsubuga, 2012; Van Den Berg & Van Vliet, 2014). A good analogy for architects within the EPA school of thought is that of an organisational politician.

A summary of the beliefs that form part of the EPA school of thought belief system is depicted with Table 5-16.

**Table 5-16: EPA school of thought beliefs**

| Belief | Enterprise Power Authority (EPA) |
|---|---|
| Motto | • EA as a tool for power and negotiation |
| Objectives & concerns | • Influence enterprise strategy direction<br>• Organisational power |

| Belief | Enterprise Power Authority (EPA) |
|---|---|
| Principles and assumptions | • Realism<br>• Business strategies and objectives are provided by the business and are open to negotiation.<br>• Environment can be changed.<br>• Joint design of all organisational dimensions. |
| Skills | • Small group facilitation<br>• Systems thinking |
| Belief concepts | • Realism<br>• Closed System<br>• Indeterminism<br>• Authority |
| Challenges | • Understanding of organisational systemic dynamics<br>• Organisational collaboration<br>• Organisational coherence |
| Insights | • Permits the design of comprehensive solutions<br>• Ignores organisational efficiency by eliminating alternative scenarios |
| Limitations | • Susceptible to “political” motivated designs for unsustainable strategies syndrome<br>• Requires many organisational pre-conditions with regards to power structure and strategy creation |

A summary of the results from the study as it applies to the EPA school of thought is depicted with Table 5-17.

**Table 5-17: EPA study results**

| # | Investigative questions | Results |
|---|---|---|
| 1 | What architecture position do you most associate with? | EA |
| 2 | What experience do you have in enterprise architecture? | 10-15 |
| 3 | In what educational discipline are you formally trained? | Formal sciences |
| 4 | What is your highest level of education obtained? | Master’s degree |
| 5 | What enterprise architecture certification have you obtained to date? | TOGAF |
| 6 | What is the scope of EAM? | Enterprise |
| 7 | What is the purpose of EAM? | Strategy formulation & execution alignment |
| 8 | What architecture definition would you most associate with? | Gartner |
| 9 | What EA role do you most associate with? | Change agent |
| 10 | What enterprise architect position level do you currently hold? | Senior level |
| 11 | What enterprise architecture segment do you work on? | Enterprise level |
| 12 | What enterprise architecture domain do you associate with? | Business |
| 13 | What organisational segment is most affected by the architecture effort you work on? | Business |
| 14 | What level of detail do you perform in the architecture effort? | N/A |
| 15 | What stakeholder perspectives do you focus on for the architecture function? | Conceptual |
| 16 | What architecture abstractions do you focus on? | Process |
| 17 | What architecture models do you create? | Composite |
| 18 | What stage of maturity do you believe the architecture effort has obtained? | N/A |
| 19 | What CSF or success attributes have the architecture effort realised? | Provide |
| 20 | What EAM frameworks do you align most with? | TOGAF |
| 21 | Which stakeholders do you interact with? | Executives + line management |
| 22 | What governance structure do you interact with? | Committee |
| 23 | What modelling notations do you most often use in your current role? | BPMN |
| 24 | What skills category do you most often use as an architect? | EA skills + business skills |
| 25 | What enterprise architecture competency do you most associate with? | Consulting |
| 26 | What value do you add to the enterprise architecture effort? | Future state |
| 27 | What outcomes do you try to achieve by delivering on the EAM effort? | Efficiency |
| 28 | What enterprise architecture concerns do you have in your current role? | Business value |
| 29 | What enterprise architecture challenges do you have in your current role? | Collaboration |
| 30 | What enterprise architecture goals do you try to achieve in your current role? | IT alignment |
| 31 | What enterprise architecture techniques do you use within your current | Business goals |

| # | Investigative questions | Results |
|---|---|---|
| | role? | |
| 32 | What organisational culture best describes the enterprise architecture function within your organisation? | Hierarchical |
| 33 | To whom does the enterprise architecture function report to? | CIO |
| 34 | What enterprise architecture benefits do you believe you bring in your current role? | Integrate |
| 35 | What business objectives do you try to achieve in your current role? | Enable business |

### 5.3.4.6 Enterprise IT Design (EITD)

The position of the EITD school of thought in relation to the other EA schools of thought is depicted within Figure 5-S. The EITD school of thought is one of the four new EA schools of thought as identified and confirmed by this research study.

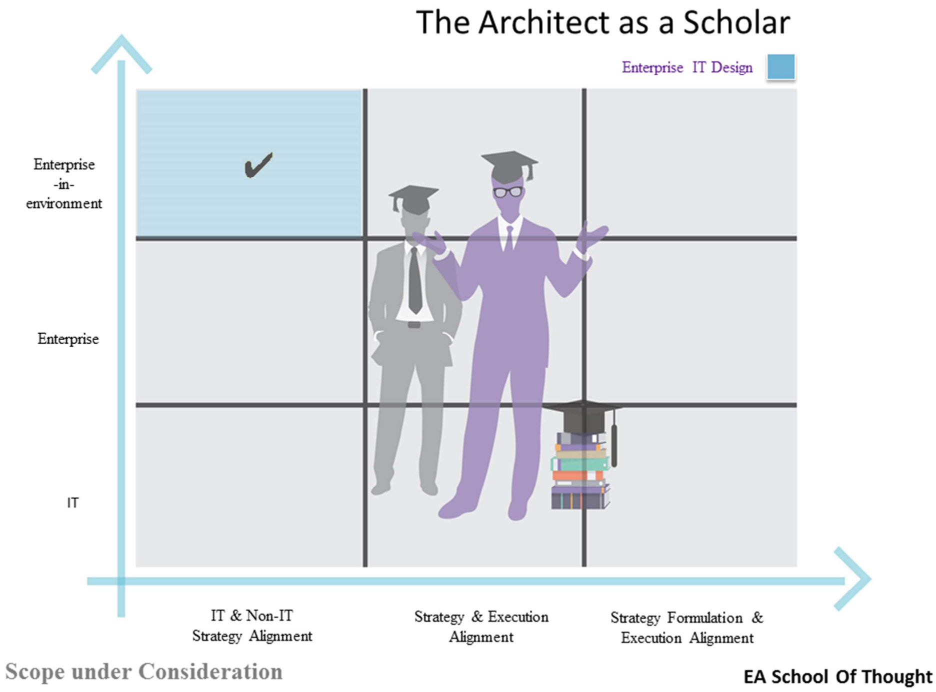



**Figure 5-S: EITD school of thought**

From this research study 8% of participating architects fell within the EITD School having between 5 – 10 years of EA experience, being positioned at an executive level and having obtained a master's degree in a professional and applied sciences discipline. These architects often have TOGAF certification or another unspecified EA certification. As EITD architects, they make use of the Gartner definition to explain EA. These architects see themselves as fulfilling the role of change agent. As EITD architects their EA focus is on the process abstraction. Using the Zachman Framework for Enterprise Architecture, these architects concentrate their efforts on process alignment transformation while creating composite or viewpoint models to create awareness of EA within the organisation. In line with the process abstraction and alignment transformation, the modelling notation of choice is the BPMN modelling notation. The EITD architects list their EA skills as the skills most often used and their competency as being that of a consultant. As EITD architects, they focus their attention of developing future state models, which illustrate what the enterprise should look like across all EA viewpoints. These architects try to improve the effectiveness and agility of the enterprise, while being concerned with providing future ICT and business strategic direction as well as having challenges on factors hindering effective collaboration. In line with the EA purpose specified, the EITD architects' goals are centred on business-IT alignment. They specify that they function within an organisation with a group culture and report to either the CEO or the CIO in their executive position level. Similarly, these architects believe the benefits they bring to the organisation are that of integration, standardisation or de-duplication of related processes and systems, while their primary business objective is that of effectively enabling the organisation's strategy.

Enterprise architects within the EITD school of thought consider EA as a change agent to focus on the design of the IT strategy in order to be in line with external IT environments (Ouriaghli & Nsubuga, 2012; Simon *et al.*, 2013b; Van Der Raadt *et al.*, 2010). Techniques such as SWOT analysis are used to understand the external environment (Ouriaghli & Nsubuga, 2012; Simon *et al.*, 2013b) and how it will impact on the IT and non-IT strategies. The EITD school of thought has its roots in the belief of open systems (Lapalme, 2012b). The organisational system is considered in context of its environment and often the organisational system within its environment is described in various levels of abstraction.

The aim of the school of thought is to develop and define the IT & non-IT strategy alignment (Bredemeyer & Malan, 2004; Chung *et al.*, 2009; Farwick *et al.*, 2014; Foorthuis *et al.*, 2015, 2010; Gøtze, 2013; Hendrickx *et al.*, 2011; Niemietz & De Kinderen, 2013). The EITD school of thought is concerned with simplifying the organisation in its environment (Foorthuis *et al.*, 2015, 2010; Wegmann, 2003). Architects describe EA as a design methodology to simplify, optimise and standardise ensuring IT & non-IT strategy alignment (Espinosa *et al.*, 2011; Foorthuis *et al.*, 2015; Rehkopf & Wybolt, 2003). The EITD school of thought is guided by a unique external alignment approach to problem solving (Farwick *et al.*, 2014; Gøtze, 2013).

The EA process within the EITD school of thought involves aligning IT & non-IT strategies (Akenine, 2008; Bredemeyer & Malan, 2004; Chung *et al.*, 2009; Tambouris *et al.*, 2012) to match that of external environment best practices (The Open Group, 2009). Concerns central to the EITD school of thought are directly related to the future strategic IT direction to match external best practice environments. Core to the EITD school of thought is the influence the external environment has on IT & non-IT strategies (Harmon, 2005; MacLennan & Van Belle, 2014; Van Den Berg & Van Vliet, 2014; Van Der Raadt *et al.*, 2010).

Architects within the EITD school of thought are often highly technically competent and have great technical knowledge (Akenine, 2008; Lu & Lin, 2012; Tambouris *et al.*, 2012; Van Der Raadt *et al.*, 2010). However, architects in the school of thought sometimes struggle with getting organisational understanding and acceptance of IT environment best practices (Chuang & Van Loggerenberg, 2010; Walrad *et al.*, 2014), which is influenced by the external environment. Making sense of the complexity of the IT & non-IT strategy within the environment is then also a challenge (Nakakawa *et al.*, 2010). As a result of this complexity and misalignment on the understanding of the IT & non-IT strategies within its greater environment, organisational collaboration is also a challenge (Hendrickx *et al.*, 2011; Nakakawa *et al.*, 2010).

As a result of these challenges mentioned, the EITD school of thought is susceptible to extensive solution acceptance and implementation barriers (Nakakawa *et al.*, 2010; Rehkopf & Wybolt, 2003; Van Der Raadt *et al.*, 2010) and the concept that the design should be "perfect". Enterprise architects are then seen as perfectionists and can be easily caught in an “analysis paralysis” mode of work (Chuang & Van Loggerenberg, 2010).

The strengths of the EITD school of thought lies in its understanding of the external environment (Harmon, 2005; Ouriaghli & Nsubuga, 2012; Sidorova & Kappelman, 2011) and trying to match the IT & non-IT strategies to that of external best practices (The Open Group, 2009). However, oversimplification of the organisation in its environment may lead to unrealised IT & non-IT strategy alignment and the school of thought may be susceptible to resistance from other organisational divisions due to their understanding of the organisation being part of a larger system (Aier, 2014; Bredemeyer & Malan, 2004; Espinosa *et al.*, 2013; Ouriaghli & Nsubuga, 2012). Enterprise architects within the EITD school of thought often see themselves as “scholars” or learners, constantly learning from the external environment and how to apply the external best practices to align the IT & non-IT strategies. A good analogy for architects within the EITD school of thought is that of a scholar.

A summary of the beliefs that form part of the EITD school of thought belief system is depicted with Table 5-18.

**Table 5-18: Enterprise IT design school of thought beliefs**

| Belief | Enterprise IT Design (EITD) |
|---|---|
| Motto | • EA as a change agent considering external IT environment |
| Objectives & concerns | • Enterprise IT strategy execution matching external environment<br>• Innovation & adaption |
| Principles and assumptions | • Reductionism<br>• Design of IT organisational dimensions on external environment<br>• IT strategies and objectives are influenced by the external environment |
| Skills | • Engineering knowledge<br>• Technical competence<br>• Larger group facilitation |
| Belief concepts | • Reductionism<br>• Closed System<br>• Environmental determinism<br>• Contextualism |
| Challenges | • Organisational understanding and acceptance of external IT environment influence<br>• Fostering sense-making |

| Belief | Enterprise IT Design (EITD) |
|---|---|
| Insights | • Permits the design of externally influenced technological solutions<br>• Influence IT strategy innovation by studying external environment |
| Limitations | • Susceptible to considerable solution acceptance and implementation barriers<br>• Susceptible to "perfect" designs for unsustainable strategies syndrome<br>• Fosters IT organisational innovation and sustainability |

A summary of the results from the study as it applies to the EITD school of thought is depicted with Table 5-19.

**Table 5-19: EITD study results**

| # | Investigative questions | Results |
|---|---|---|
| 1 | What architecture position do you most associate with? | EA |
| 2 | What experience do you have in enterprise architecture? | 5-10 |
| 3 | In what educational discipline are you formally trained? | Professional & applied sciences |
| 4 | What is your highest level of education obtained? | Master's degree |
| 5 | What enterprise architecture certification have you obtained to date? | TOGAF + Other |
| 6 | What is the scope of EAM? | IT |
| 7 | What is the purpose of EAM? | Strategy formulation & execution alignment |
| 8 | What architecture definition would you most associate with? | Gartner |
| 9 | What EA role do you most associate with? | Change agent |
| 10 | What enterprise architect position level do you currently hold? | N/A |
| 11 | What enterprise architecture segment do you work on? | Enterprise level |
| 12 | What enterprise architecture domain do you associate with? | N/A |
| 13 | What organisational segment is most affected by the architecture effort you work on? | N/A |
| 14 | What level of detail do you perform in the architecture effort? | N/A |
| 15 | What stakeholder perspectives do you focus on for the architecture function? | N/A |
| 16 | What architecture abstractions do you focus on? | Process |
| 17 | What architecture models do you create? | Composite |
| 18 | What stage of maturity do you believe the architecture effort has obtained? | N/A |
| 19 | What CSF or success attributes have the architecture effort realised? | N/A |
| 20 | What EAM frameworks do you align most with? | N/A |
| 21 | Which stakeholders do you interact with? | N/A |
| 22 | What governance structure do you interact with? | N/A |
| 23 | What modelling notations do you most often use in your current role? | BPMN |
| 24 | What skills category do you most often use as an architect? | EA skills |
| 25 | What enterprise architecture competency do you most associate with? | Consulting |
| 26 | What value do you add to the enterprise architecture effort? | Future state |
| 27 | What outcomes do you try to achieve by delivering on the EAM effort? | Efficiency |
| 28 | What enterprise architecture concerns do you have in your current role? | ICT + Business direction |
| 29 | What enterprise architecture challenges do you have in your current role? | Collaboration |
| 30 | What enterprise architecture goals do you try to achieve in your current role? | IT alignment |
| 31 | What enterprise architecture techniques do you use within your current role? | N/A |
| 32 | What organisational culture best describes the enterprise architecture function within your organisation? | Group |
| 33 | To whom does the enterprise architecture function report to? | CEO + CIO |
| 34 | What enterprise architecture benefits do you believe you bring in your current role? | Integrate |
| 35 | What business objectives do you try to achieve in your current role? | Business strategy |

### 5.3.4.7 Enterprise IT Planning (EITP)

The position of the EITP school of thought in relation to the other EA schools of thought is depicted within Figure 5-T. The EITP school of thought is one of the four new EA schools of thought as identified and confirmed by this research study.

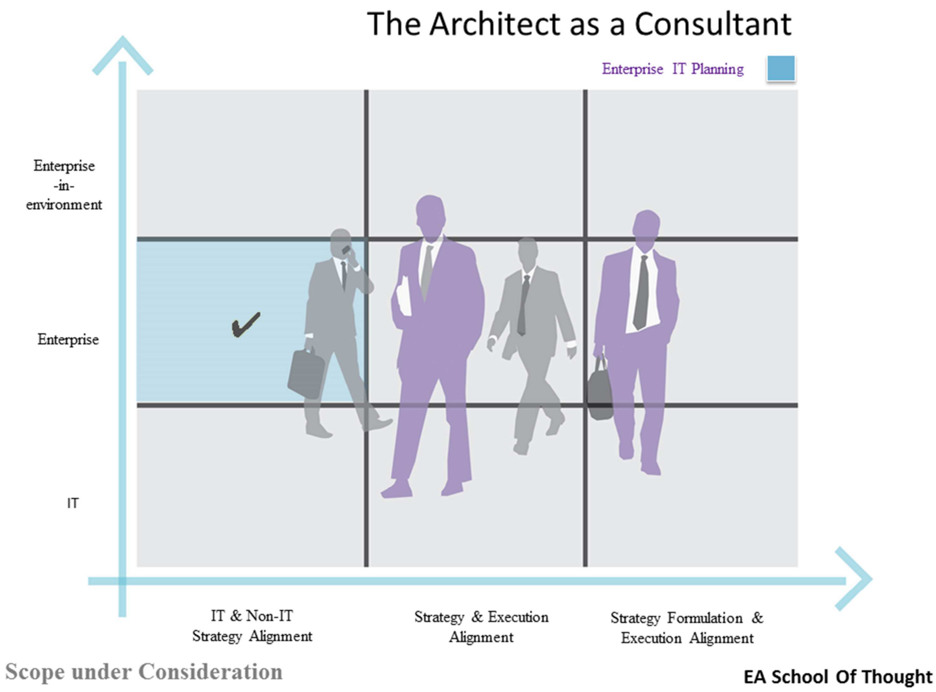



**Figure 5-T: EITP school of thought**

From this research study 23% of participating architects fell within the EITP School having 1-5 years of EA experience, having a bachelor's degree in a professional and applied sciences discipline and being senior architects. These architects have TOGAF certification and make use of TOGAF, although they make use of Gartner's definition to explain EA. The EITP architects see themselves as fulfilling the role of leader while they concentrate their EA efforts on the enterprise level rather than on solution level. However, as these architects are concerned with business-IT alignment, their EA domain focus is on applications within the organisation. The work of the architects within the EITP school of thought affect the business function within the organisation, while only performing the EA function to a high level of detail. These architects deliver their work, being focused on the logical perspective as well as on the process abstraction. Using the Zachman Framework for Enterprise Architecture, these architects concentrate their efforts within the process representation intersection of the ontology while creating composite or viewpoint models to create awareness of EA within the organisation. By performing their EA function, they belief they have created awareness of EA within the organisation by providing EA as a capability to meet their commitments. As architects they interact with project managers and governance committees. The EITP architects also make use of the UML modelling notation to document their architecture effort. These architects see their primary competency as that of a consultant, while they create models of the future state of IT. They perform their function by trying to achieve improvements to the effectiveness and efficiency of IT. Similarly to other architects, they are concerned with realising business value while being challenged by factors that hinder effective collaboration. The EITP architects strive to realise business-IT alignment by getting their architecture effort formally approved. These architects often find themselves in an organisation with a hierarchical organisational culture with the EA function reporting to the CIO of the organisation. The EITP architects believe they add benefit to the organisation by integrating and standardising processes and systems in order to enable business.

Enterprise architects within the EITP school of thought consider EA to focus on an analysis approach to IT & non-IT strategy alignment (Hjort-Madsen & Pries-Heje, 2009; Ouriaghli & Nsubuga, 2012). The EITP school of thought is concerned with the process of EA from analysis to IT & non-IT strategy alignment within the organisation (Hjort-Madsen & Pries-Heje, 2009; Ouriaghli & Nsubuga, 2012). Architects within the EITP school of thought are advisors (Ouriaghli & Nsubuga, 2012; Strano & Rehmani, 2007; Van Den Berg & Van Vliet, 2014; Wagter *et al.*, 2012), often concerned about a high-level view of the organisational system (Bredemeyer & Malan, 2004; Espinosa *et al.*, 2011; Espinosa & Boh, 2009; Foorthuis *et al.*, 2015, 2010), more so than just the IT system. The enterprise architects however do not break down the organisational system into a lower level of abstraction for a detailed understanding (Lindström *et al.*, 2006; Naranjo *et al.*, 2014), but rather do a high level assessment or analysis of the relationships between entities. This high-level assessment or analysis is then used as input to the process to execute the IT strategy (Hendrickx *et al.*, 2011). The aim of the EITP architect is that of the planning process and the simplification of planning activities and reduction of related costs (Barnes *et al.*, 2014).

The priorities for the EITP school of thought is to plan and advise the organisational system by understanding relationships between entities (The Open Group, 2009), ensuring the alignment of the IT and non-IT strategies (Hjort-Madsen & Pries-Heje, 2009; Ouriaghli & Nsubuga, 2012), delivering value and enabling IT to succeed. Organisational coherence features high on the list of objectives for the EITP school of thought (Gøtze, 2013; Wagter *et al.*, 2012). Enterprise architects within the EITP school of thought describe EA as a planning process or development methodology (Barnes *et al.*, 2014; Boster *et al.*, 2000; Harmon, 2005; Ouriaghli & Nsubuga, 2012; The Open Group, 2009). For example, the TOGAF is used as a basis for performing EA. The EITP school of thought also featured as a prominent school of thought revealed within this exploratory research study, depicted within Figure 5-U.

Architects within the EITP school of thought see themselves as consultants within the organisation or advising to the various divisions within an organisation (Rehkopf & Wybolt, 2003; Woods & Rozanski, 2005). The architects' aim is to formally approve the EA in order to ensure adoption and ultimately acceptance of the target architecture within the organisation (Espinosa *et al.*, 2013; Foorthuis *et al.*, 2015, 2010; The Open Group, 2009). The EITP school of thought lends itself to understanding (Gøtze, 2013; Harmon, 2005; Nakakawa *et al.*, 2009), considering the organisational environment as the system requiring planning from the current state to the future state ensuring IT & non-IT strategy alignment (Gøtze, 2013; The Open Group, 2009).

Collaboration is a concern within the organisational system and methods of collaboration are used to mitigate the risk (Nakakawa *et al.*, 2009, 2010). The enterprise architect within the EITP school of thought struggles with a detailed understanding of the organisational system (Akenine, 2008; Harmon, 2005; Ouriaghli & Nsubuga, 2012; Strano & Rehmani, 2007) when providing a capability to meet their EA commitment to IT & non-IT strategy alignment. Their understanding of EA is centred on integration, standardisation and eliminating duplication of abstract components of the organisational system (Foorthuis *et al.*, 2015, 2010; Van Steenbergen *et al.*, 2011).

In the EITP school of thought, one interpretation can be that the IT strategy validates the non-IT strategy through logical analysis (Ouriaghli & Nsubuga, 2012; The Open Group, 2009). The organisation is also seen as the system that needs to be understood (Aier, 2014; Akenine, 2008; Bredemeyer & Malan, 2004; Strano & Rehmani, 2007). In this school of thought, the impact of the IT on non-IT dimensions is understood. Understanding, advising and consulting are core to the EITP school of thought beliefs. The strengths of the school of thought lie within the EA planning process and understanding the complex organisational system relationships. The main concern within the EITP school of thought is that the organisational system is seen from a logical perspective and little attention is given to the understanding of the system as a whole.

The enterprise architects within the EITP school of thought see themselves as "consultants" involved in consulting, advising and guiding the EA planning process from analysis to IT & non-IT strategy alignment. In this case the organisation is seen as the system and careful attention is given to include other organisational dimensions. A good analogy for architects within the EITP school of thought is that of a consultant.

A summary of the beliefs that form part of the EITP school of thought belief system is depicted with Table 5-20.

**Table 5-20: EITP school of thought beliefs**

| Belief | Enterprise IT Planning (EITP) |
|---|---|
| Motto | • EA as an analysis approach to IT strategy execution |
| Objectives & concerns | • Effective enterprise IT strategy analysis and business strategy execution<br>• IT Planning & Cost reduction<br>• Organisational coherence |
| Principles and assumptions | • Reductionism<br>• IT strategy validates the business strategy through effective analysis<br>• IT environment as something to manage.<br>• Impact of IT on organisational dimensions. |
| Skills | • Technical competence<br>• Engineering knowledge<br>• Small group facilitation |
| Belief concepts | • Reductionism<br>• Closed System<br>• Determinism |

| Belief | Enterprise IT Planning (EITP) |
|---|---|
| | • Mechanism |
| Challenges | • Organisational understanding and acceptance of designed plans<br>• Organisational collaboration |
| Insights | • Fosters the creation of highly analytical models and planning scenarios<br>• Permits the design of complex analytical solutions |
| Limitations | • Susceptible to considerable solution acceptance and implementation barriers<br>• Susceptible to "perfect" designs for unsustainable strategies syndrome<br>• Requires a paradigm shift from reductionism to holism |

A summary of the results from the study as it applies to the EITP school of thought is depicted with Table 5-21.

**Table 5-21: EITP study results**

| # | Investigative questions | Results |
|---|---|---|
| 1 | What architecture position do you most associate with? | EA |
| 2 | What experience do you have in enterprise architecture? | 1-5 |
| 3 | In what educational discipline are you formally trained? | Professional & applied science |
| 4 | What is your highest level of education obtained? | Bachelors |
| 5 | What enterprise architecture certification have you obtained to date? | TOGAF |
| 6 | What is the scope of EAM? | IT |
| 7 | What is the purpose of EAM? | Strategy & execution alignment |
| 8 | What architecture definition would you most associate with? | Gartner |
| 9 | What EA role do you most associate with? | Leader |
| 10 | What enterprise architect position level do you currently hold? | Senior level |
| 11 | What enterprise architecture segment do you work on? | Enterprise level |
| 12 | What enterprise architecture domain do you associate with? | Application |
| 13 | What organisational segment is most affected by the architecture effort you work on? | Strategy + business |
| 14 | What level of detail do you perform in the architecture effort? | High level |
| 15 | What stakeholder perspectives do you focus on for the architecture function? | Logical |
| 16 | What architecture abstractions do you focus on? | Process |
| 17 | What architecture models do you create? | Composite |
| 18 | What stage of maturity do you believe the architecture effort has obtained? | Create |
| 19 | What CSF or success attributes has the architecture effort realised? | Provide |
| 20 | What EAM frameworks do you align most with? | TOGAF |
| 21 | Which stakeholders do you interact with? | PM |
| 22 | What governance structure do you interact with? | Committee |
| 23 | What modelling notations do you most often use in your current role? | UML |
| 24 | What skills category do you most often use as an architect? | N/A |
| 25 | What enterprise architecture competency do you most associate with? | Consulting |
| 26 | What value do you add to the enterprise architecture effort? | Future state |
| 27 | What outcomes do you try to achieve by delivering on the EAM effort? | Efficiency |
| 28 | What enterprise architecture concerns do you have in your current role? | Business value |
| 29 | What enterprise architecture challenges do you have in your current role? | Collaboration |
| 30 | What enterprise architecture goals do you try to achieve in your current role? | IT alignment |
| 31 | What enterprise architecture techniques do you use within your current role? | Approve EA |
| 32 | What organisational culture best describes the enterprise architecture function within your organisation? | Hierarchical |
| 33 | To whom does the enterprise architecture function report to? | CIO |
| 34 | What enterprise architecture benefits do you believe you bring in your current role? | Integrate |
| 35 | What business objectives do you try to achieve in your current role? | Enable business |

## 5.4 Formulate classification

A premise of the study is that:

> ***EA SoT:** The EA schools of thought represent enterprise architects' belief systems on the planning of EA initiatives. This includes the beliefs centred on the scope and purpose of the EA initiative and other architect attributes.*

While only considering EA factors and architect attributes showing a strong indication in the understanding of the EA schools of thought, a visible pattern emerged. It became evident that none of the identified EA factors influence the identification or alignment of an architect to a specific EA school of thought, but rather that only architect attributes, described within **Appendix B**, were influencing the participants' alignment to a specific EA school of thought.

This lack of alignment is due to EA factors not being about the architect, but what the architect does and as such have no relevance to who the architect is or what their belief system is about. This could have been initially anticipated, but was included in the study to verify that this was indeed the case.

These EA schools of thought included the initial three and "ideal" EA schools of thought as identified by Lapalme (2012a) as well as four newly identified EA schools of thought. The definition and description of the various EA schools of thought were based on results from the collected research study data (Du Preez *et al.*, 2014); the interpretation of the EA school of thought in relation to the other EA schools of thought, depicted within Figure 5-M, where the placement of the EA school of thought in the matrix taxonomy is considered in relation to the other EA schools of thought, as well as the understanding of the foundational beliefs on EA scope and EA purpose. A chart depicting the survey responses of the participants are depicted within Figure 5-U. In addition, the description and the definition of the EA schools of thought made references to the SLR studies identified within the first internal DSR development cycle. Finally the interpretation of the EA schools of thought was done with guidance from the ten business strategy schools of thought as defined by Mintzberg *et al.* (2005).

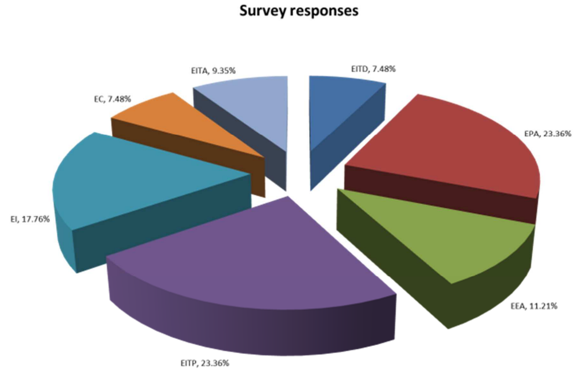



**Figure 5-U: Research study responses**

An alternative representation of the EA schools of thought is to align the EA scope and the EA purpose of Lapalme (Lapalme, 2012a) with the architect scope aligned roles and the architect purpose aligned types from Gøtze (2013) respectively, depicted within Figure 5-V.

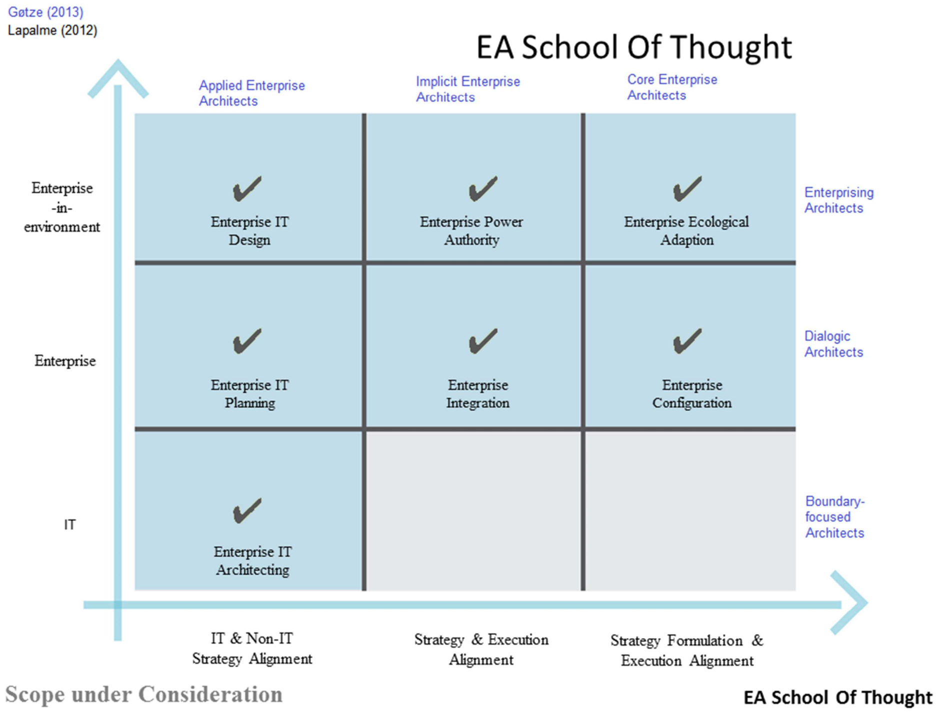



**Figure 5-V: Relationship between EA SoT (Gøtze, 2013; Lapalme, 2012a)**

Investigating what the architects within the different EA schools of thought focus their architecture effort on; the different EA schools of thought is represented in relation to the Zachman Framework for enterprise architecture. This representation, depicted within Figure 5-W, clearly indicates that all the architects focus their architecture effort on resources ideas and are concerned with process work. All of the EA schools of thought concentrate their efforts on building composite models or viewpoints rather than building primitive models as proposed by Zachman (2007).

The discussion illustrated that the EA schools of thought represent enterprise architects' belief systems on the planning of EA initiatives. This includes the beliefs centred on the scope and purpose of the EA initiative and other architect attributes.

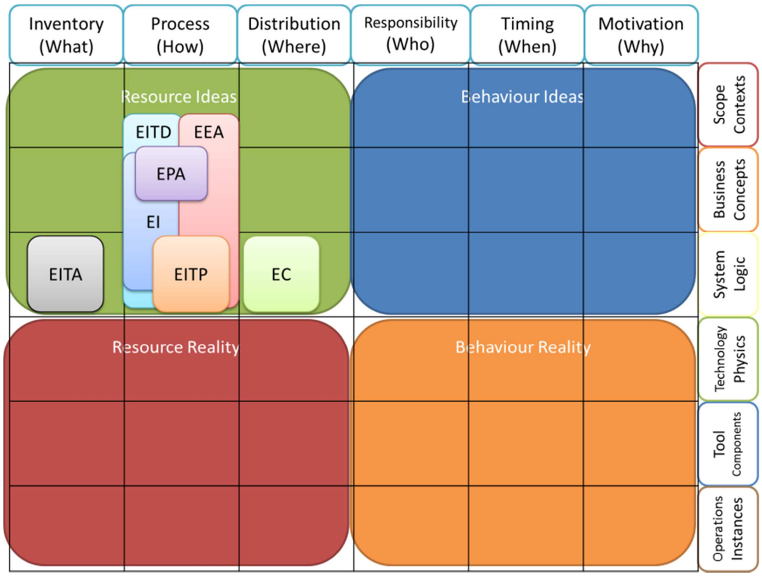



**Figure 5-W: EA schools of thought effort represented on Zachman Framework (1987)**

## 5.5 Conclusion

This chapter gave the design and analysis of the EA school of thought indicator and taxonomy, which form part of the Daedalus Instrument for Architects. The design of the EA school of thought indicator, depicted within **Appendix B**, was done to be in line with the research question, objective, purpose as well as the strategy. In addition, the EA school of thought indicator identified EA factors and architect attributes, and can be used to determine any preferences or alignment for an architect to a specific EA school of thought. Figure 5-X depicts the relationships between the EA schools of thought, architect belief systems and enterprise architects.

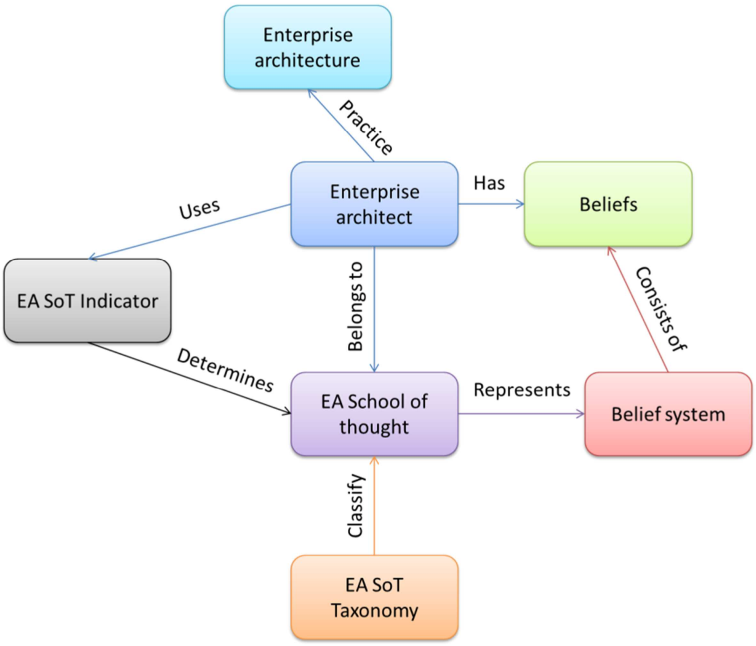



**Figure 5-X: Enterprise architect, EA SoT relationships**

**Chapter 5** also described the second component set of the Daedalus Instrument for Architects, depicted within Figure 5-Y. The outputs of the second internal development cycle, the architect attributes and the EA schools of thought taxonomy, were used in the development of the third internal development cycle. **Chapter 6** describes the awareness, suggestion and development of the enterprise architect styles.

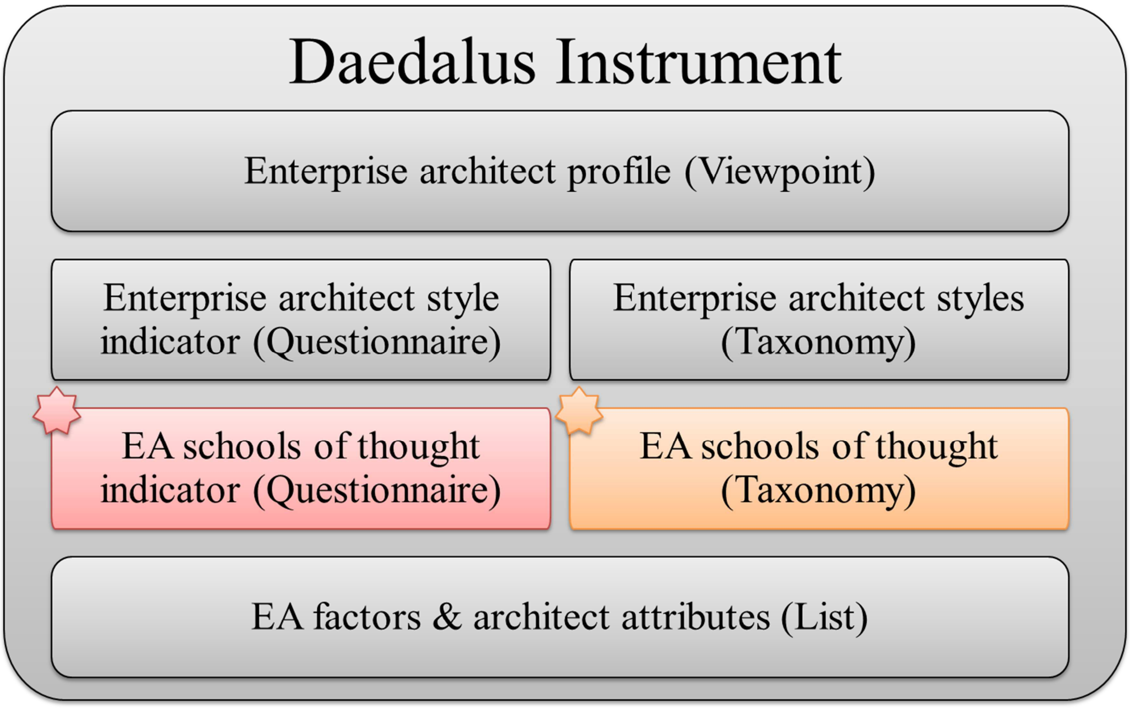
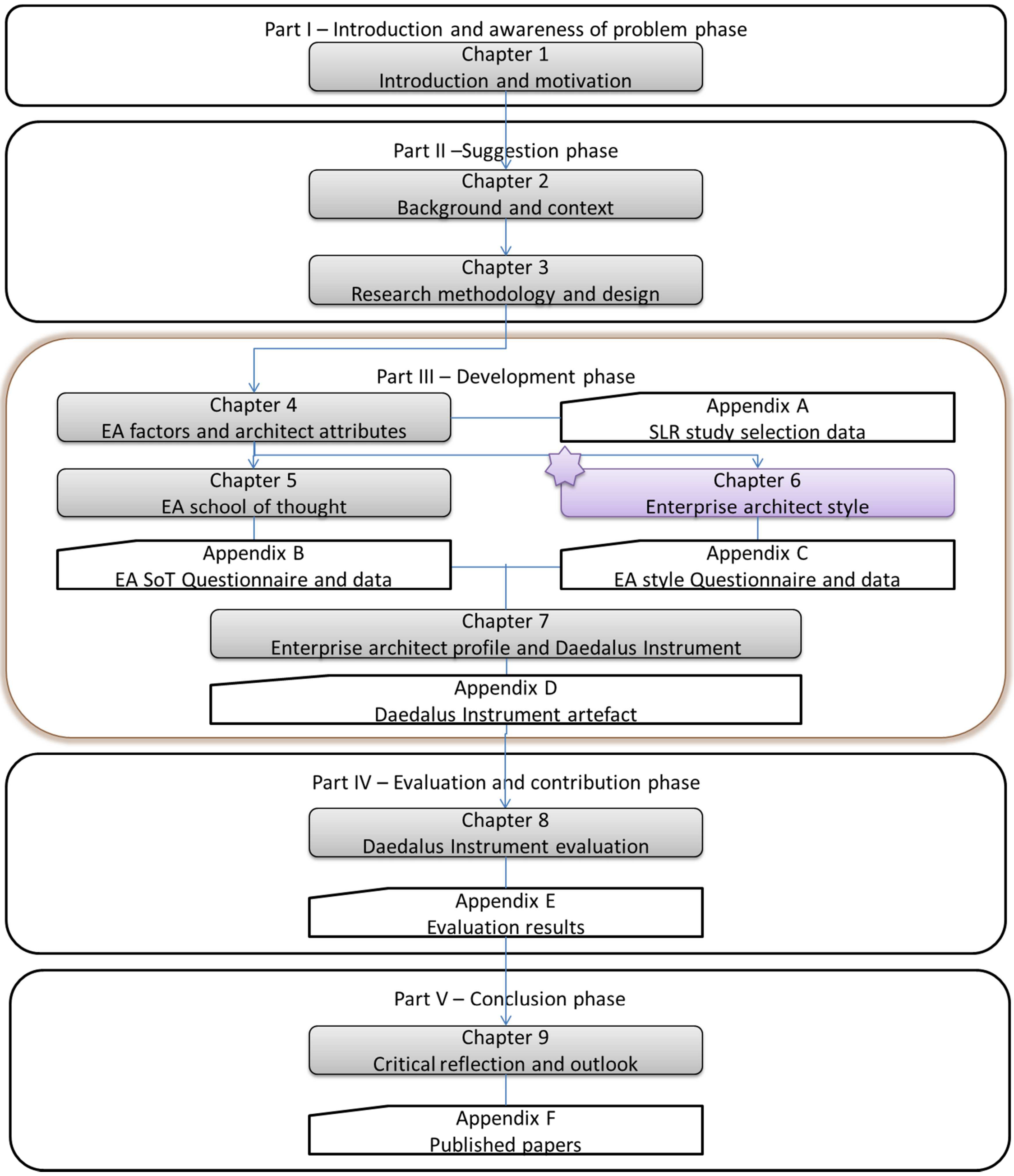



**Figure 5-Y: Daedalus Instrument for Architects (DIA) – EA SoT indicator and taxonomy**

# 6 Enterprise architect styles



## 6.1 Introduction

**Chapter 4** detailed the systematic literature review (SLR) identifying a comprehensive list of EA factors and architect attributes, as the first internal development cycle of the design science research (DSR) strategy, followed by **Chapter 5** describing the enterprise architecture (EA) schools of thought, as the second internal development cycle of the design science research strategy. **Chapter 5** concluded with an EA schools of thought indicator and taxonomy, which described the different belief systems of enterprise architects, which formed the second set of components of the Daedalus Instrument as well as the input into the next internal development cycle of the design science research strategy. In this chapter, **Chapter 6**, the third internal development cycle is described, which is concerned with the process of understanding enterprise architects' behavioural styles.

Part III of the thesis is concerned with the development of the design artefact, the Daedalus Instrument for Architect (DIA). **Chapter 6** describes the execution of a research study to collect and analyse data on the different enterprise architect behavioural styles as it relates to architect roles and competencies, depicted within Figure 6-A. Section 6.1 introduces the research process and necessity while introducing the construct of enterprise architect styles. The research study is executed by collecting field data in section 6.2, analysing the field data in section 6.3 and then formulating the classification on architect behavioural styles as it relates to the enterprise architect in section 6.4. Finally, the chapter is summarised and concluded in section 6.5.

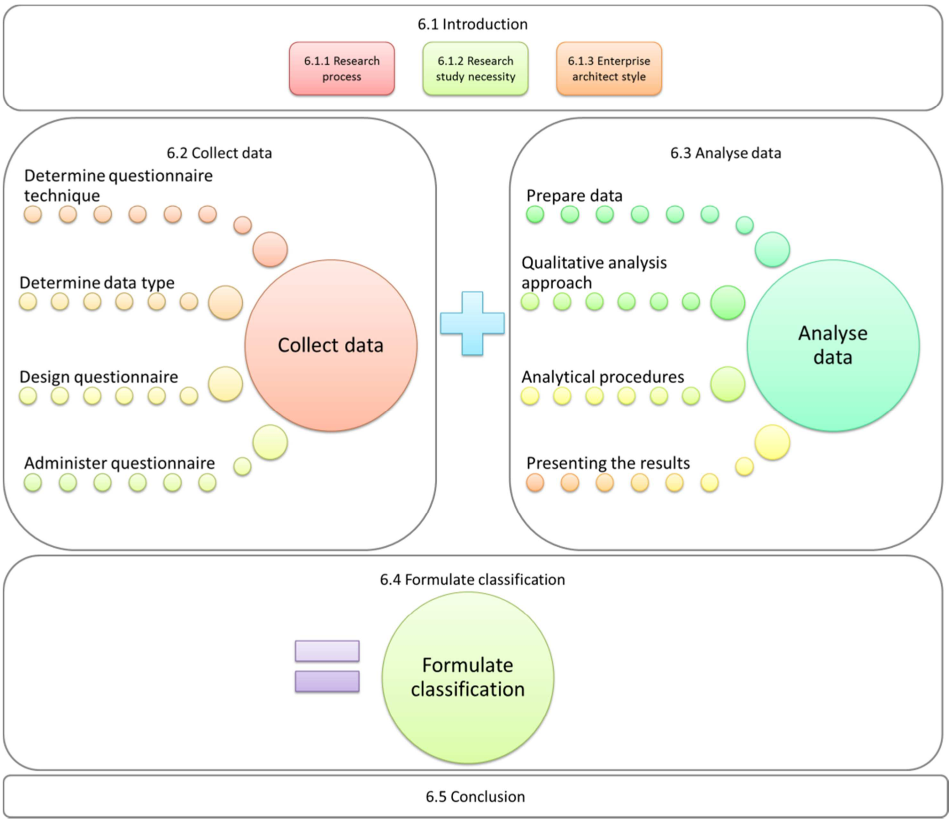



**Figure 6-A: Chapter layout**

Enterprise architect styles are concerned with the behavioural styles of enterprise architects working within their organisational environment. The enterprise architect behavioural styles take into account the architects' EA roles and the EA competencies they hold in order to be competent in their respective EA functions or organisational environment. To understand enterprise architects' behavioural styles, there needs to be a way to consistently determine and classify the behavioural styles of enterprise architects. This chapter deals with determining the classification by developing the enterprise architect styles taxonomy and by developing a questionnaire as an indicator to allow enterprise architects and EA stakeholders to consistently determine the behavioural styles an architect holds.

This chapter explores and evaluates information pertaining to the enterprise architect behavioural styles in order to answer a specific research question. The alignment of **Chapter 6** to that of the thesis is depicted within Table 6-1.

**Table 6-1: Chapter 6 alignment summary**

| # | Sub-research question | Sub-objective | Challenge | Chapter | DSR Process Step | Deliverable |
|---|---|---|---|---|---|---|
| 3 | How can an enterprise architect style indicator be developed for the consistent classification of enterprise architect behavioural styles? | To develop an enterprise architect style indicator for the consistent classification of the enterprise architect styles. | An instrument and classification needs to be created to allow an organisation to determine the specific enterprise architect style of an architect. | Chapter 6 – Enterprise architect style | [D1.3] | Enterprise architect styles + classification |

### 6.1.1 Research process

The development of the enterprise architect style indicator as well as the enterprise architect style taxonomy are completed as part of the third internal development cycle of the design science research strategy as depicted within Figure 6-B.

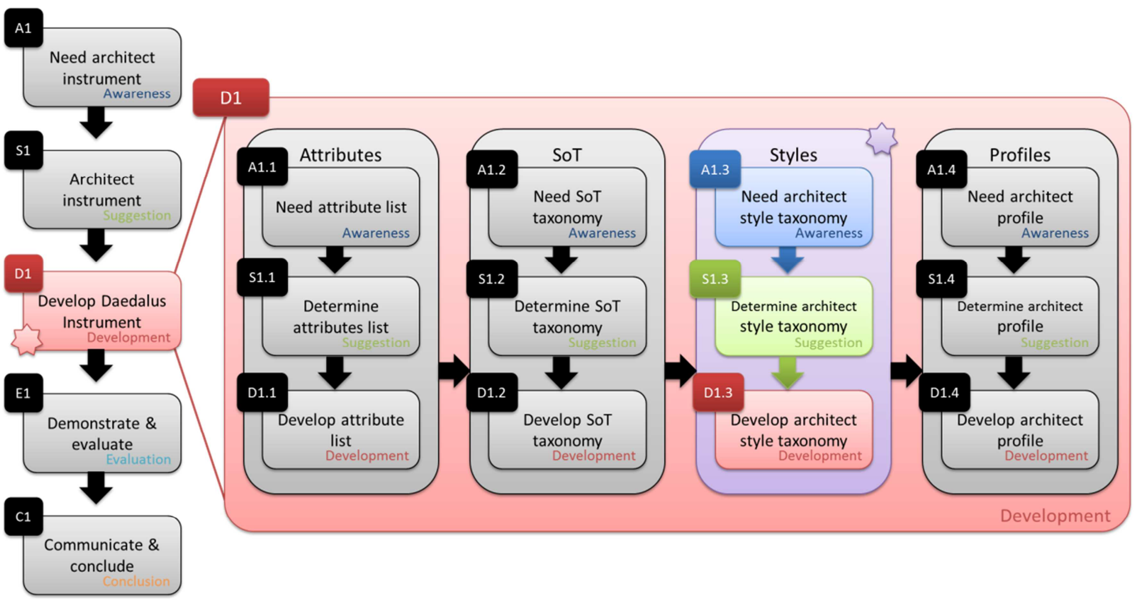



**Figure 6-B: Enterprise architect styles in relation to the DSR development cycle**

The aim of this chapter and internal development Cycle 3 was to determine if any architect attributes identified within the SLR and the EA schools of thought internal development cycles, were relevant to the understanding of enterprise architects' behavioural styles. Enterprise architect behavioural styles represent the third psychosocial functioning connection of the social cognitive theory, as described within sections 2.3.1 and 2.3.4. A questionnaire was used to question practising architects in South African companies, where each question within the questionnaire was aligned to an architect attribute to explore any relevance to architects' role and competency.

The systematic literature review led to the creation of a comprehensive list of EA factors and architect attributes, defined within **Chapter 4**. In **Chapter 5** these EA factors and architect attributes were used to determine how they characterised EA beliefs. It was found that only the architect attributes were relevant to the understanding of enterprise architects' belief system. Information from the questionnaire as described within **Chapter 5** and a second questionnaire completed by practising enterprise architects in South African companies were used in **Chapter 6** to describe the understanding of enterprise architect's behavioural styles in terms of their roles and competencies. Architect roles and competencies were two of the identified architect attributes, which were found to be relevant to the understanding of the enterprise architect. These two architect attributes were also identified within the SLR, as architect roles and architect, which were found to be relevant to the understanding of the enterprise architect.

The study was executed in three process steps: collecting data, analysing data and formulating a classification.

### 6.1.2 Research study necessity

In the systematic literature review, described in **Chapter 4**, a comprehensive list of EA factors and architect attributes were identified. From the research study, **Chapter 5** on EA schools of thought, different enterprise architect belief systems were identified. With multiple architect attributes being associated with the architect, an indicator needs to be created to better understand behavioural traits as it relates to enterprise architects, as well as a classification scheme to enhance the understanding of enterprise architects' behavioural styles.

Two attributes, namely architect roles and architect competencies were identified from the comprehensive list of EA factors and architect attributes within the SLR in **Chapter 4**. These attributes were identified based on their understanding and definition of the different architects' roles (Akenine, 2008; Gøtze, 2013; Ouriaghli & Nsubuga, 2012; Strano & Rehmani, 2007) and competencies (Bredemeyer & Malan, 2004; Lu & Lin, 2012; Steghuis & Proper, 2008; Tambouris *et al.*, 2012). A number of studies described architect roles and competencies and how these two attributes relate to each other. These two architect attributes, role and competency, address behavioural traits with regards to the enterprise architect (Ouriaghli & Nsubuga, 2012; Strano & Rehmani, 2007; Tambouris *et al.*, 2012), are closely related (Akenine, 2008; Gøtze, 2013; Ouriaghli & Nsubuga, 2012; Steghuis & Proper, 2008; Strano & Rehmani, 2007) and are crucial in the understanding of the enterprise architect (Gøtze, 2013; Strano & Rehmani, 2007). The architect *role* represents the different roles architects can fulfil in their duties as practising enterprise architects, while the architect *competency* represents the different competencies architects use while assuming a specific architect role. The behavioural traits of architects are fundamental to understanding the enterprise architects as architects execute their respective functions differently.

Understanding architect roles and competencies allows for the understanding of enterprise architects, their behavioural styles and which classification scheme can be used. Enterprise architect roles and competencies related to architect behavioural styles and are not directly related to the understanding of EA schools of thought, which is concerned about architects' belief systems regarding the scope of planning an EA initiative, as well as the purpose of planning an EA initiative.

### 6.1.3 Enterprise architect style

The enterprise architect behavioural style construct is formulated using the enterprise architect role and the enterprise architect competency concepts.

#### 6.1.3.1 Enterprise architect role

From the execution of the SLR, architect attributes were identified which were associated with enterprise architects. One of these attributes was the concept of enterprise architect roles. Enterprise architect roles describe the various role architects fulfil when executing their respective functions.

##### 6.1.3.1.1 Akenine's roles

Considering architect roles, Akenine (2008) relates architect roles to artefacts being created and classifies the artefacts according to levels. In the study, four position aligned architect roles (enterprise architect, business architect, software architect and solution architect) were defined with three artefact creation purpose levels (strategy creation, business IT alignment, and model technical architecture) and forty different artefacts being identified. The study defined each of the position aligned roles using a description of the role; typical artefacts being created by the role; and the typical competencies of the position aligned roles. According to Akenine (2008), architects fulfil a specific architect role. Architects fulfilling a specific role would create different architecture artefacts, which are aligned to different levels of creation purpose. The relationship between architect role, artefacts and artefact purpose levels are depicted within Figure 6-C.

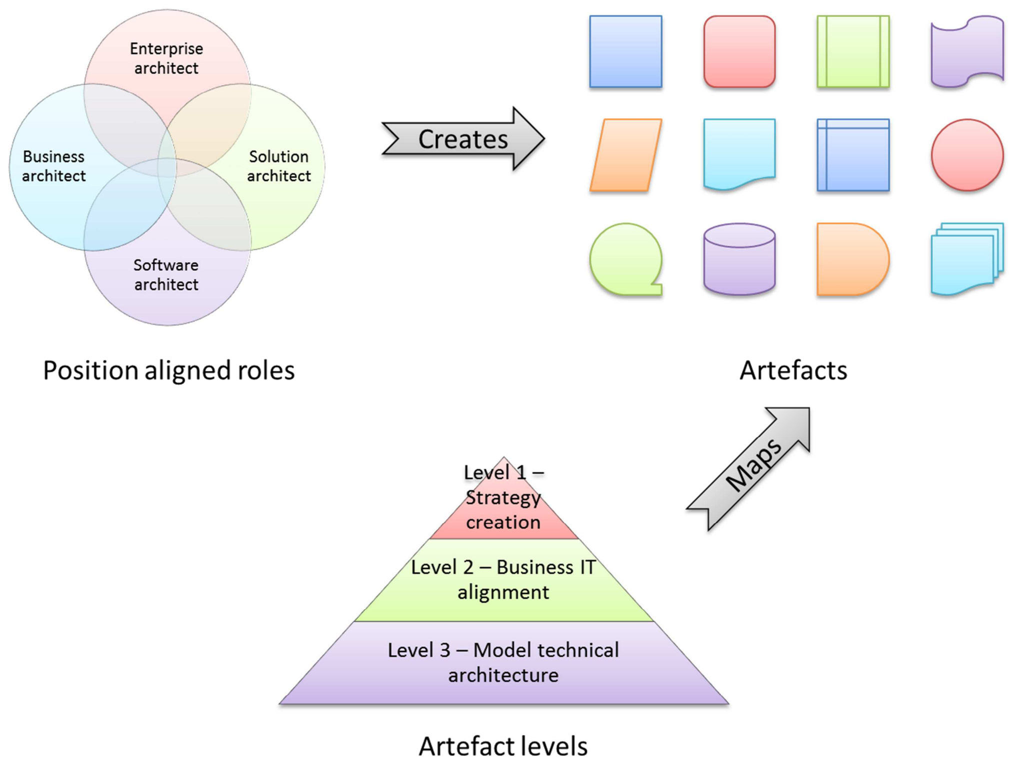



**Figure 6-C: Relationships between roles, artefacts and levels (Akenine, 2008)**

### 6.1.3.1.2 Gøtze's roles

Another perspective on architect roles is taken by Gøtze (2013), where he describes different styles of enterprise architects with their distinct roles. He specifies the importance of enterprise architects' understanding of EA scope as the understanding of boundary issues in the EA practice. This understanding of EA scope is also closely related to the work of Lapalme on the EA schools of thought (Lapalme, 2012a). Similar to the EA schools of thought, where Lapalme specifies that the EA scope and EA purpose refer to the planning of the EA initiative rather than the execution of the EA initiative, Gøtze (2013) specifies that architects' purpose should be on problem finding rather than problem solving and states that enterprise architects should gain a better understanding of the enterprise scope, while realising that participation with other organisational disciplines are vital. By specifying that architects should focus on finding problems, Gøtze (2013) stipulates that enterprise architects should develop dialogic (communicating to participate in dialogue) as well as dialectic (communicating to resolve disagreement) dichotomy skills. As a result of these differences in enterprise architects' skills, roles, and understanding, Gøtze (2013) claims that EA is practised in different ways and that the understanding of the enterprise architect relates to the understanding of architect roles and architect competencies (Gøtze, 2013). With the understanding of the different architect roles and architect competencies, Gøtze identifies three different types of architects based on their purpose within the EA practise. He specifies that different enterprise architect roles exist based on their understanding of EA scope. The three different enterprise architect types as roles (core enterprise architects, implicit enterprise architects and applied enterprise architects) are depicted within Figure 6-D, where architect roles are depicted as having different purposes and Figure 6-E, where architect roles are depicted as having different scopes (boundary focused architects, dialogic architects and enterprise architecting architects). Although Gøtze defines his architect types and roles based on purpose and scope respectfully, Lapalme (2012a) defined the different EA schools of thought based on architects' belief systems regarding the understanding of EA, which were based on architects' definitions using EA scope and EA purpose. Enterprise architects have different interpretations of the EA concepts and may use similar terms to describe different concepts, based on their own vocabulary.

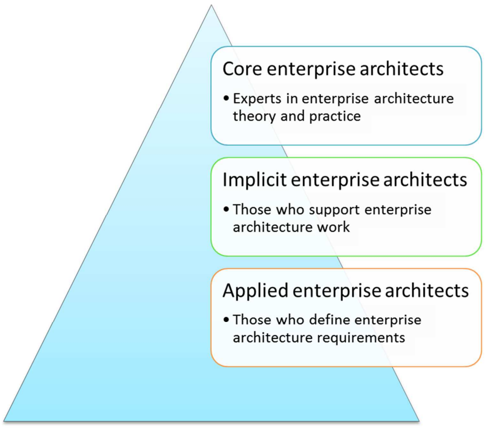



**Figure 6-D: Enterprise architect purpose aligned types (Gøtze, 2013)**

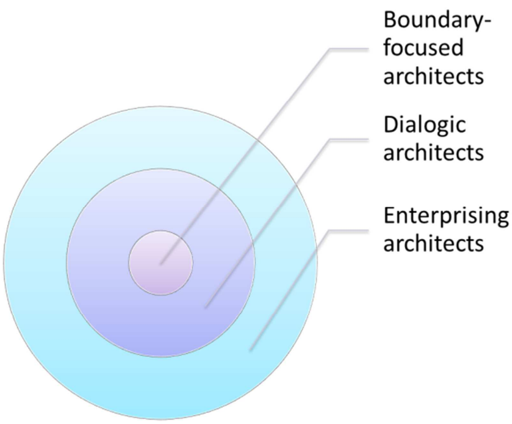



**Figure 6-E: Enterprise architect scope aligned roles (Gøtze, 2013)**

### 6.1.3.1.3 Ouriaghli and Nsubuga's roles

Another study focuses on the understanding of architect roles and competencies in a proactive enterprise development, which could be used to improve the influence of enterprise architects in practice (Ouriaghli & Nsubuga, 2012). The authors believe that a strong relationship exists between the role of enterprise architect and proactive enterprise development as well as a relationship between enterprise architect impact and stakeholder management (Ouriaghli & Nsubuga, 2012). Similar to the understanding of EA scope and EA purpose by Lapalme (2012a), the authors proclaim that the concept of proactivity can be understood in terms of both planning an EA initiative and the architects' stakeholders. The authors defined three roles of enterprise architects (change agent, expert and facilitator) in a proactive enterprise development context, depicted within Figure 6-F.

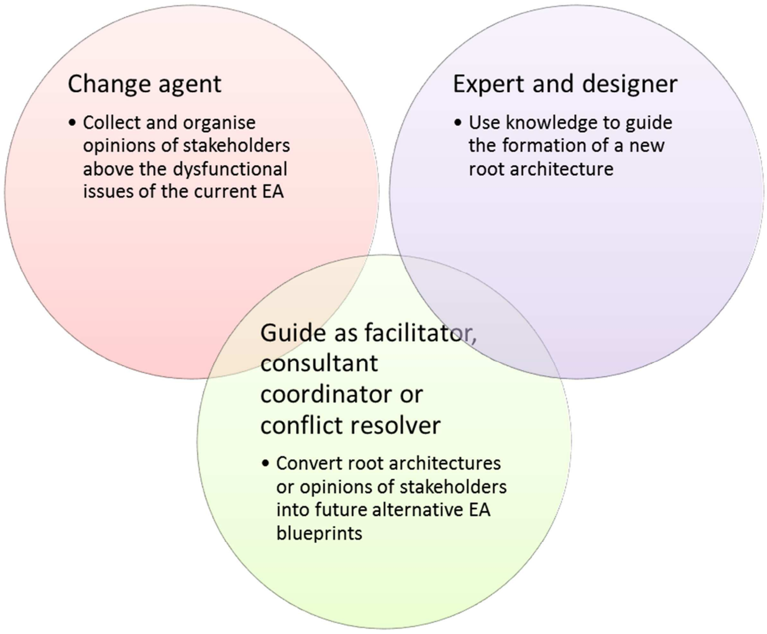



**Figure 6-F: Architect roles in enterprise development (Ouriaghli & Nsubuga, 2012)**

#### 6.1.3.1.4 Strano and Rehmani's roles

In a study by Strano and Rehmani (2007), the role of the enterprise architect as viewed by experts was investigated. The study identified several functional enterprise architect roles and described the interfaces with other functional organisational roles (Strano & Rehmani, 2007). The roles (change agent, communicator, leader, manager and modeller) are depicted within Figure 6-G. Each of the identified roles were described using the unique value the roles provided as well as the impact of not fulfilling the specific architect roles. In addition the study highlighted the organisational positioning or reporting line of the roles as well as the required competencies for each role to ensure maximum effectiveness of the architect role. The authors continued to state that the understanding of architect roles forms the foundation to support the profession of enterprise architects (Strano & Rehmani, 2007).

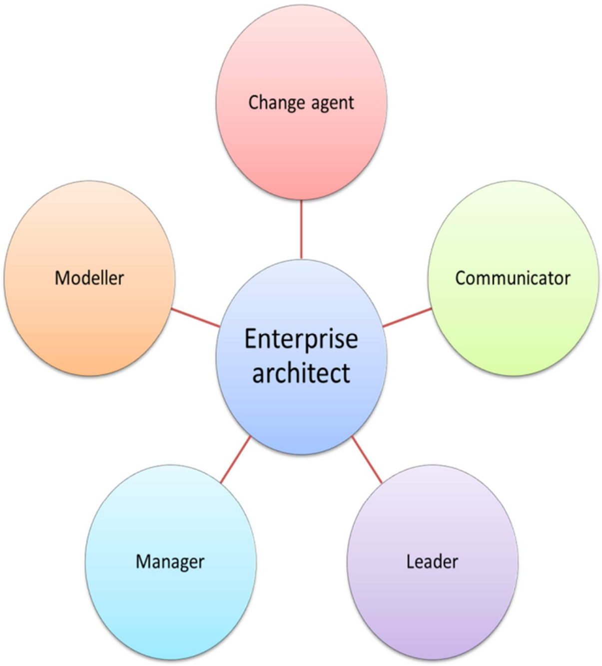



**Figure 6-G: Enterprise architect roles (Strano & Rehmani, 2007)**

The enterprise architect interfaces with other organisational roles (project managers, business strategists, senior executives, other architects, capital investment planners, oversight officials, functional groups and external stakeholders) and this is depicted within Figure 6-H.

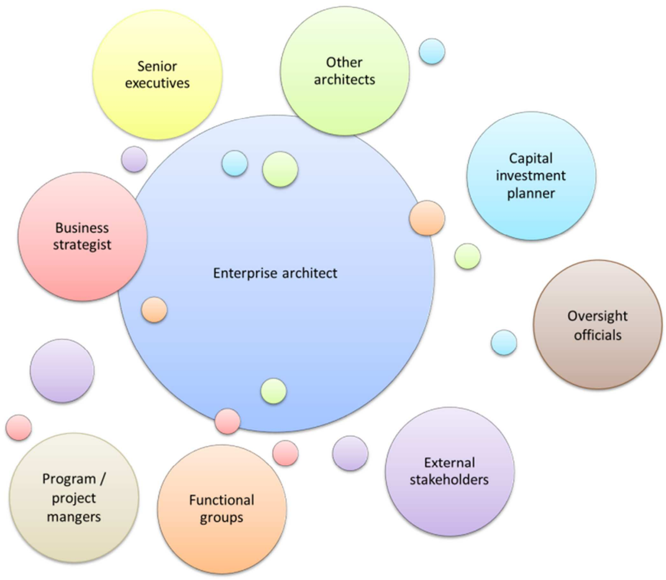



**Figure 6-H: Enterprise architect relationship interfaces (Strano & Rehmani, 2007)**

### 6.1.3.2 Enterprise architect competency

From the execution of the SLR, architect attributes were identified which were associated with enterprise architects. One of these attributes was the concept of enterprise architect competencies. Enterprise architect competencies describe the various competencies architects require to fulfil their respective roles.

#### 6.1.3.2.1 Bredemeyer and Malan

In an executive report Bredemeyer and Malan (2004) look at the necessary qualities for great enterprise architects. The executive report explores the qualities for an architect by using a narrative to express their understanding and conveys lessons on what qualities an enterprise architect should have. These qualities were then expressed as five competency areas, depicted within Figure 6-I. Although these competencies can be associated with architect roles, the architect competencies define capabilities and aptitudes architect should possess when they fulfil specific architect roles, rather than representing the architect roles itself. Each of the competency areas are then explored from three contextual perspectives using their "know, do, be" framework, depicted within Figure 6-I (Bredemeyer & Malan, 2004).

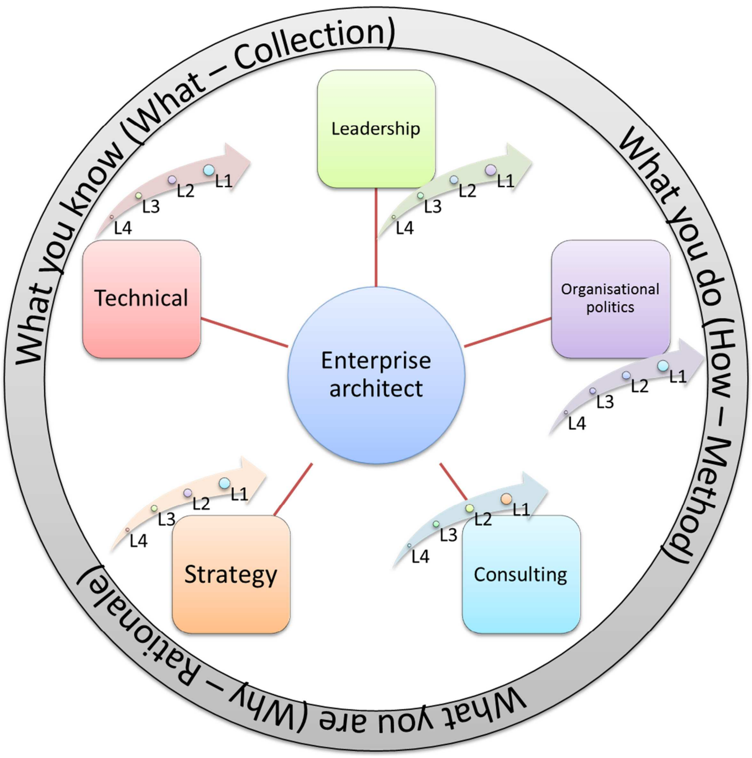



**Figure 6-I: Enterprise architect competency framework (Bredemeyer & Malan, 2004)**

This framework can also be viewed from three of the interrogative pronouns (What, How, Why). This contextual perspective is similar to the philosophy of Sinek (2011), where he specifies that great leaders' behaviour starts with understanding rationale (Why), then method (How) and then collection (What). This also coincides with the work of Zachman (2007, 1987) where he proclaims that all six interrogative pronouns should be used to understand and describe an idea in its entirety. As the competency areas refer to architects' behaviour rather than enterprise architecture, the three perspectives are sufficient to understand architects' behaviours in terms of Why they perform their architect roles, How they go about performing their architect roles, and What architect competencies are required to fulfil their architect roles.

**Table 6-2: Competency domains**

| Competency | What you KNOW | What You DO | What You ARE |
|---|---|---|---|
| Technology | In-depth understanding of the domain and pertinent technologies | Identify and address architectural challenges | Creative |
| Technology | Understand what technical issues are key to success | Create models and assess alternative approaches | Investigative |
| Technology | Development methods and modelling techniques | Prototype / experiment / simulate | Practical / pragmatic |
| Technology | | Prepare architectural documents and presentations | Insightful |
| Technology | | Technology trend analysis | Tolerant of ambiguity, willing to backtrack, seek multiple solutions |
| Technology | | Take a system viewpoint | Good at working at an abstract level |
| Consulting | Elicitation techniques | Consulting frameworks | Committed to others' success |
| Consulting | Consulting frameworks | Understand what the developers want and need from the architecture | Empathetic, approachable |
| Consulting | | Help developers see the value of the architecture and understand how to use it successfully | An effective change agent, process savvy |
| Consulting | | Mentor junior architects | A good mentor, teacher |
| Strategy | Your organisation's business strategy and rationale | Influence business strategy | Visionary |
| Strategy | Your competition (products, strategies and processes) | Translate business strategy into technical vision and strategy | Entrepreneurial |
| Strategy | Your company's business practices | Understand customer and market trends | |
| Strategy | | Capture customer, organisational and business requirements of the architecture | |
| Organisational Politics | Who the key players are in the organisation | Communicate, communicate, communicate! | Able to see from and sell to multiple viewpoints |
| Organisational Politics | What they want, both business and personal | Listen, network, influence | Confident and articulate |
| Organisational Politics | | Sell the vision, keep the vision alive | Ambitious and driven |
| Organisational Politics | | Take and retake the pulse of all critical influencers of the architecture project | Patient |
| Organisational Politics | | | Resilient |
| Organisational Politics | | | Sensitive to where the power is and how it flows in your organisation |
| Leadership | Yourself | Set team context (vision) | You and others see you as a leader |
| Leadership | | Make decisions (stick) | Charismatic and credible |
| Leadership | | Build teams | You believe it can and should be done, and that you can lead the effort |
| Leadership | | Motivate | You are committed, dedicated, passionate |
| Leadership | | | You see the entire effort in a broader business and personal context |

These competency areas are also dependent on levels of decision scope, which is similar to the work of Lapalme on the architects' beliefs on EA scope (Lapalme, 2012a). Architects' activities, responsibilities and personal characteristics shift, based on four different levels (level 1 - 4) of decision scope, depicted within Figure 6-J (Bredemeyer & Malan, 2004). These competency areas and levels of decision scope can be used by architects to help set targets and establish a path for personal growth toward their desired level of decision scope (Bredemeyer & Malan, 2004).

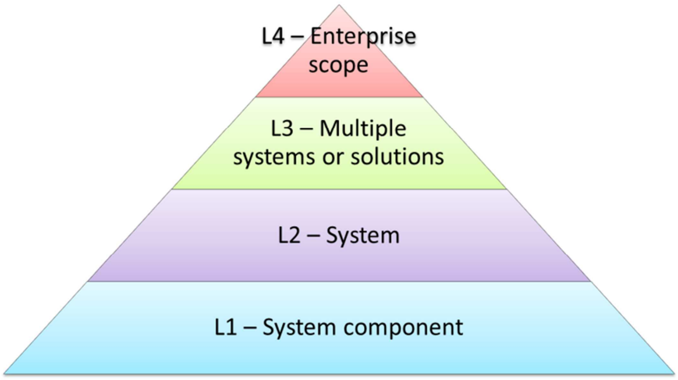



**Figure 6-J: Decision scope levels (Bredemeyer & Malan, 2004)**

#### 6.1.3.2.2 Lu and Lin

While considering core enterprise architect competencies rather than competency areas, a subsequent study considered enterprise architects within the higher education industry (Lu & Lin, 2012). The study pronounced that with an increasing demand for understanding of EA that it has implications for enterprise architects' expertise (Lu & Lin, 2012). Using the practical competence model, the study identifies the seven core competences categories (personal traits, general skills, professional skills, industrial knowledge, project management skills, team management skills and communication and negotiation skills) of enterprise architects in the higher education industry, depicted within Figure 6-K. These core competencies can guide decision-makers on enterprise architect personal development and skills required for success in the EA discipline (Lu & Lin, 2012).

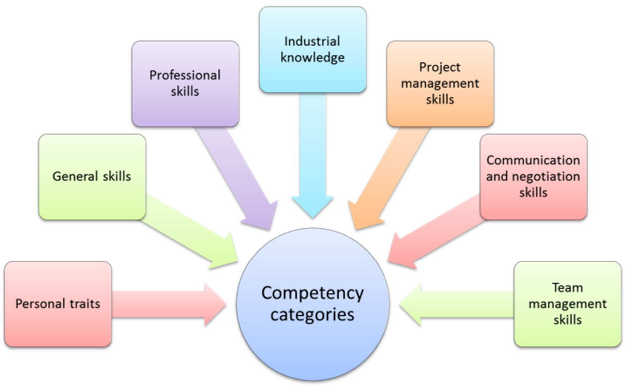



**Figure 6-K: Enterprise architect skills aligned core competencies (Lu & Lin, 2012)**

An alternative perspective can be created by mapping Lu and Lin's competencies categories to the TOGAF skills categories respectively (2012; 2009). The competency categories are similar to the professional competencies (knowledge, attitude and skill) as described by Steghuis and Proper (2008) and although the concepts of competencies categories and skills categories are not technically the same, a close relationship exists between the professional competency an architect has and the skill required to be competent in their role (Steghuis & Proper, 2008). A mapping between the two concepts of professional competencies and skills are depicted within Table 6-3, where X indicates an alignment and O indicates that there is a gap in the understanding between professional competencies and the skills required to be competent.

**Table 6-3: Competency categories and TOGAF skills framework respectively (Lu & Lin, 2012; The Open Group, 2009)**

| Lu & Lin / TOGAF | Personal traits | Generic skills | Personal skills | Industrial knowledge | Project management skills | Communication and negotiation skills | Team management skills | Gap |
|---|---|---|---|---|---|---|---|---|
| Generic skills | | X | | | | | | |
| Business skills & methods | | | | X | | X | X | |
| EA skills | | | | X | | | | |
| Project management skills | | | | | X | | | |
| IT general knowledge skills | | | | X | | | | O |
| Technical IT skills | | | | X | | | | |
| Legal environment | | | | | | | | O |
| Gap | O | | O | | | | | |

#### 6.1.3.2.3 Steghuis and Proper

A similar but unrelated study by Steghuis and Proper (2008) considered basic competencies, responsibilities, and personality types of enterprise architects.

These basic competencies included the required competencies for operating in enterprise architecture teams. The foundation for creating the basic competencies were based on existing literature, questionnaires and practical experience (Steghuis & Proper, 2008). Similar to the work of Bredemeyer and Malan, and Lu and Lin respectively (2004; 2012), the authors classified the basic competencies into two distinct competency categories as personal and professional competencies (Steghuis & Proper, 2008), where professional competencies represent three competencies dealing with knowledge, attitude, and skills necessary to perform a role, and personal competencies represent 35 competencies concerned with the influence behind performing a specific role, depicted within Figure 6-L.

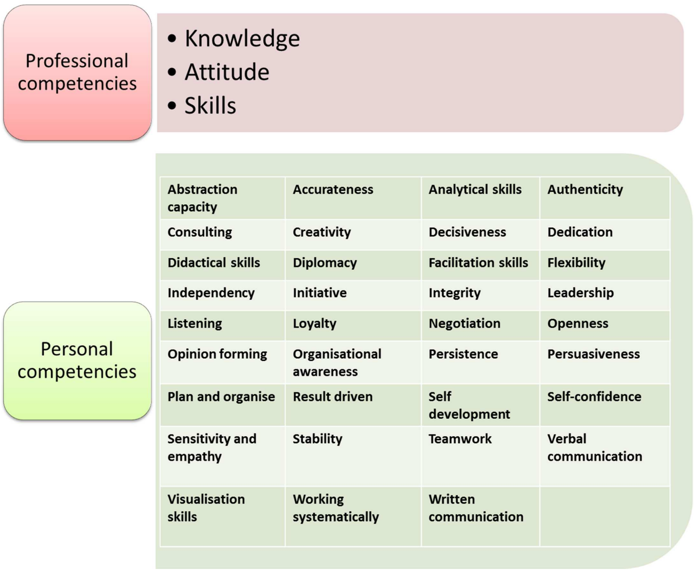



**Figure 6-L: Basic competency categories and competencies (Steghuis & Proper, 2008)**

Based on a literature review, the authors considered several studies on enterprise architecture methodologies and enterprise architect responsibilities and described a four phase EA process with their respective responsibilities, depicted within Figure 6-M. Understanding the personal competencies of enterprise architects fulfilling their responsibilities, the authors created a mapping indicating the relationship between architect process responsibilities and personal competencies (Steghuis & Proper, 2008).

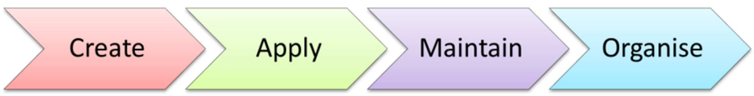



**Figure 6-M: Four phase EA process (Steghuis & Proper, 2008)**

The Strano and Rehmani (2007) study created a second mapping between enterprise architect roles and enterprise architect competencies. This allowed them to create a third mapping of enterprise architect roles and process responsibilities. These three mappings can be represented as a cube of relationships between roles, competencies and responsibilities, depicted within Figure 6-N.

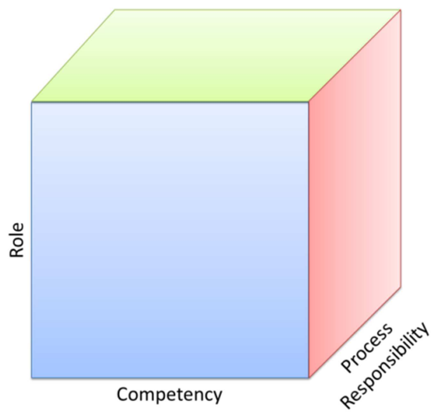



**Figure 6-N: Strano and Rehmani relationships model (2007)**

A fourth mapping was created based on the process responsibilities and Belbin team roles (Aritzeta *et al.*, 2007), as architects do not work in isolation but rather with other architects in teams (Steghuis & Proper, 2008). Based on the relationships identified within the different mappings, no direct link exists between enterprise architect roles and their responsibilities (Steghuis & Proper, 2008).

### 6.1.3.3 Enterprise architect style design

There is a need to understand enterprise architects and what influences their behavioural styles have as they relate to enterprise architecture. Several studies (Akenine, 2008; Bredemeyer & Malan, 2004; Gøtze, 2013; Lu & Lin, 2012; Ouriaghli & Nsubuga, 2012; Steghuis & Proper, 2008; Strano & Rehmani, 2007; Tambouris *et al.*, 2012) emphasise the importance of architect roles and architect competencies and how they relate to their environment and the different architect styles. These studies, however, did not consider the behavioural styles of the architects with specific roles and competencies, but rather considered roles and competencies only in the context of their organisational system.

Without an indicator that can assist organisations in understanding the different architect styles, there might never be a common understanding of their behavioural styles on why enterprise architects execute enterprise architecture management (EAM) differently, how they work together as a team, how they go about doing EAM, or what impact it has on EAM efficiency and success within the organisation.

The proposition is to develop an indicator and taxonomy that could assist organisations to understand enterprise architects' behavioural styles. The indicator and taxonomy can be used as a tool to determine the enterprise architect styles.

A tentative design of the enterprise architect style indicator and taxonomy is suggested within Figure 6-O.

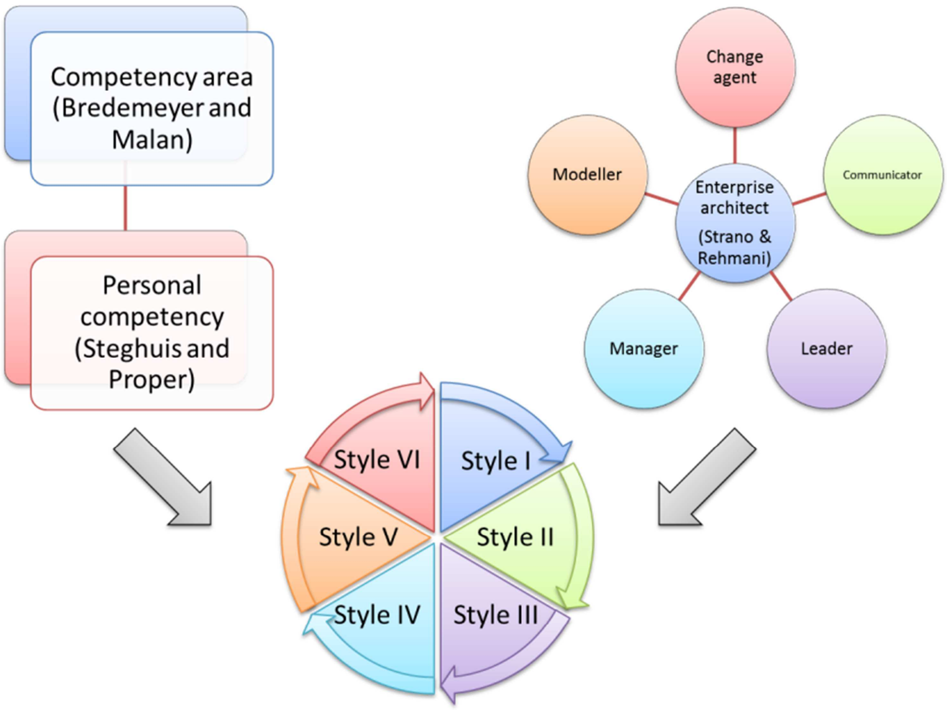



**Figure 6-O: Enterprise architect styles design**

In section 6.2, the collection of data is described within the research study methodology. The data formed the basis for understanding and conceptualising enterprise architect styles.

## 6.2 Collect data

The research method used for collecting data refers to using a questionnaire and how to ensure the data being collection is reliable to ensure effective data analysis, depicted within Figure 6-P (Saunders *et al.*, 2009).

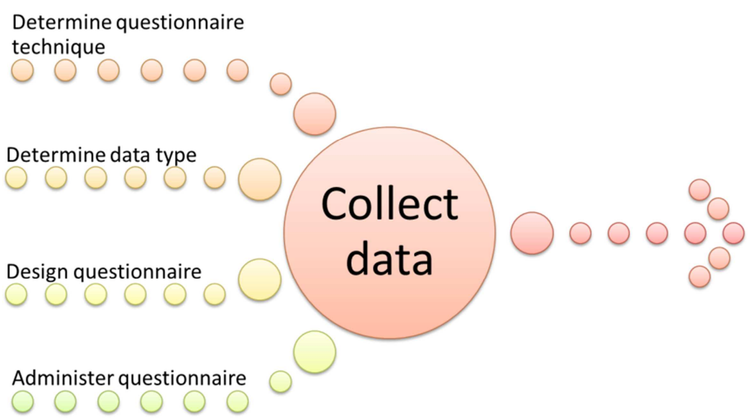



**Figure 6-P: Collect data process**

Several different perspectives exist regarding architect roles and competencies. This is due to the different views the authors took when defining the various enterprise architect roles and competencies. These two architect attributes, role and competency, address behavioural traits with regards to the enterprise architect (Ouriaghli & Nsubuga, 2012; Strano & Rehmani, 2007; Tambouris *et al.*, 2012), are closely related (Akenine, 2008; Gøtze, 2013; Ouriaghli & Nsubuga, 2012; Steghuis & Proper, 2008; Strano & Rehmani, 2007) and are crucial in the understanding of the enterprise architect (Gøtze, 2013; Strano & Rehmani, 2007).

What is unknown is the understanding of how the context of architect roles and competencies define architect styles. As both architect EA roles and competency concepts relate to the behaviour of the architect, an architect style can be defined based on the understanding of architect roles and competencies.

The approaches followed in this study considered existing literature, the SLR described in **Chapter 4** relating to enterprise architect roles and competencies, being two of the identified architect attributes. It then determined the relation between these attributes (**Appendix C**, Figure 6-V). Certain attributes as defined in **Chapter 4** were identified as related to role and competencies (e.g. experience) and were thus included in the questionnaire as well as the final categorisation. The architect styles were formulated from focusing on roles, as is discussed in section 6.1.3.1, and personal competencies, as defined by section 6.1.3.2. The questionnaire purpose was to obtain the understanding of enterprise architects about EA roles and competencies. From this understanding nine EA styles were identified. This is discussed in section 6.3.4.

As the identified companies are operating within different industries and are geographically distributed, the best way to execute the study was to make use of a self-mediated online questionnaire.

### 6.2.1 Determine questionnaire technique

The main data collection method used was that of a questionnaire. The questionnaire made use of the architect attributes identified within the SLR in **Chapter 4** that guided the construction of the questionnaire.

In addition to the collection of primary data from the questionnaire, a secondary source data was used. This secondary data represented the data collected during the execution of the SLR, described in **Chapter 4** as the comprehensive list of architect attributes, the list of primary studies identified within the SLR, as well as data on the EA schools of thought questionnaire described in **Chapter 5,** which included architect attributes and opinions.

The purpose of the study was to determine and explain if there was any relation between the architect attributes and the architects' behavioural styles. As a result an exploratory questionnaire was constructed. For the first few questions, each question was aligned to an architect attribute using specific predefined options from secondary sources such as the SLR. The remaining questions were structured on the architects' understanding of their role and the architect competencies required fulfilling their specific role. Each question had an additional option, "other", to determine alternatives options which were not specified.

The questionnaire was executed as an Internet-mediated questionnaire using an online academic questionnaire tool, depicted within Figure 6-Q.


1.

What organisation do you represent?*

2.

What is your interest in enterprise architecture?

- As an EA practitioner
- As an academic
- As an EA author
- As an EA consultant
- As an EA stakeholder
- Other (Please specify)

**Figure 6-Q: Internet mediated questionnaire**

### 6.2.2 Determine data type

The data collected were guided by the SLR, described in **Chapter 4,** as well as the first questionnaire on the aligned architect attributes, which was also used to understand belief systems of enterprise architects as their EA schools of thought, described in **Chapter 5**. As the study was concerned with the architects and their behavioural styles as it relates to architect roles and architect competencies, the relationships that would exist between the architect roles and architect competencies would be interdependent. The questionnaire was designed to collect their opinions on their architect roles and architect competencies, as well as to collect information about their environment.

The research study methodology aligned with the research study's purpose to understand roles and competencies and consequently identify architect styles. Using the SLR as well as limiting the comprehensive list of EA factors and architect attributes to a short list of only architect attributes, a set of questions was designed to do an exploratory qualitative study using an open ended questionnaire. The questionnaire consists of 83 questions. Two questions (8 and 10) focus on the role and competency whereas questions 1 to 14 were taken from the questionnaire used to determine the EA schools of thought, as described in **Chapter 5**, since it is considered relevant to role as well as competency. The remaining 69 closed questions were asked to further determine opinions of roles and competencies on a more granular level. These Likert type questions were based on existing work on the topics (Bredemeyer & Malan, 2004; Ellinger, 2009; Strano & Rehmani, 2007). See **Appendix C.2** and **C.3** respectively. The exploratory study ensured the effective collection and analysis of the necessary data. An extract of the questions and their data requirements are listed within Table 6-4. For the complete questionnaire, refer to **Appendix C.2** and **C.3**.

**Table 6-4: Example questions mapping and data requirements table**

| | | | | |
|---|---|---|---|---|
| Research type | Exploratory | | | |
| Research question | How can an enterprise architect style indicator be developed for the consistent classification of an enterprise architect styles? | | | |
| Research objective | To develop an enterprise architect style indicator for the consistent classification of the enterprise architect styles. | | | |
| Question # | Investigative questions | Variable(s) required | Detail in which data measured | Data variables (opinion, behaviour, attribute) |
| 1 | What organisation do you represent? | Participant attribute as representing organisation | Free text | Attribute |
| 2 | What is your interest in enterprise architecture? | Participant attribute as interest in enterprise architecture | As an EA practitioner<br>As an academic<br>As an EA author<br>As an EA consultant<br>As an EA stakeholder<br>Other (Specify) | Attribute |

### 6.2.3 Design questionnaire

The research design is depicted within Figure 6-R with the research study methodology being depicted within Figure 6-S. The research design is primarily concerned with and aligned to the objective and research question of the research study. In order to determine architects' behavioural style, the study makes use of a questionnaire where the architect attributes determined within the SLR, and specially architect roles and competencies, are aligned to questions specifically formulated to determine the architect roles and competencies relationships.

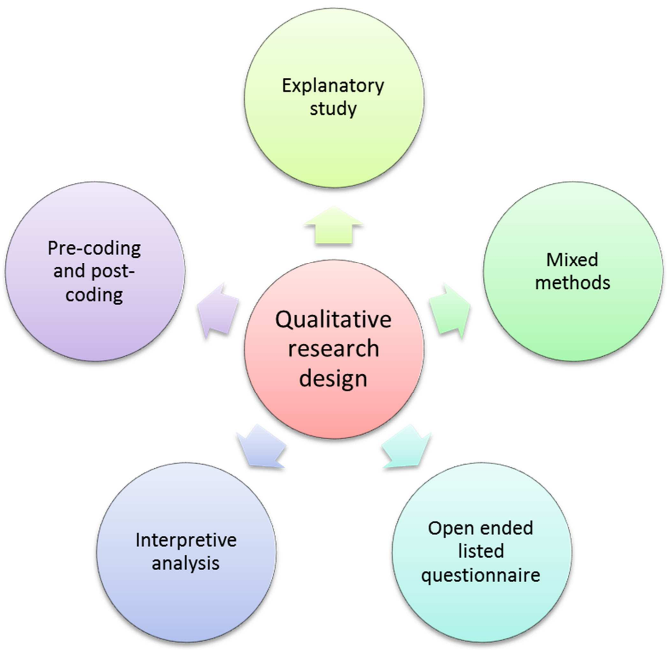



**Figure 6-R: Qualitative research design**

A classification was created based on architect roles (Strano & Rehmani, 2007) and architect competency classes which represents architect competency areas as well as architects' personal competency characteristics, depicted within Figure 6-O (Bredemeyer & Malan, 2004; Steghuis & Proper, 2008).

The research study methodology used is depicted in Figure 6-S. A self-mediated online questionnaire was used to gather information from enterprise architects, which would take about 15 minutes. The data collected from the study was then analysed to determine the actual architect styles as oppose to any theoretical number of architect styles. The questionnaire was targeted towards enterprise architects within South African organisations. These architects were EA practitioners, authors, academics or consultants.

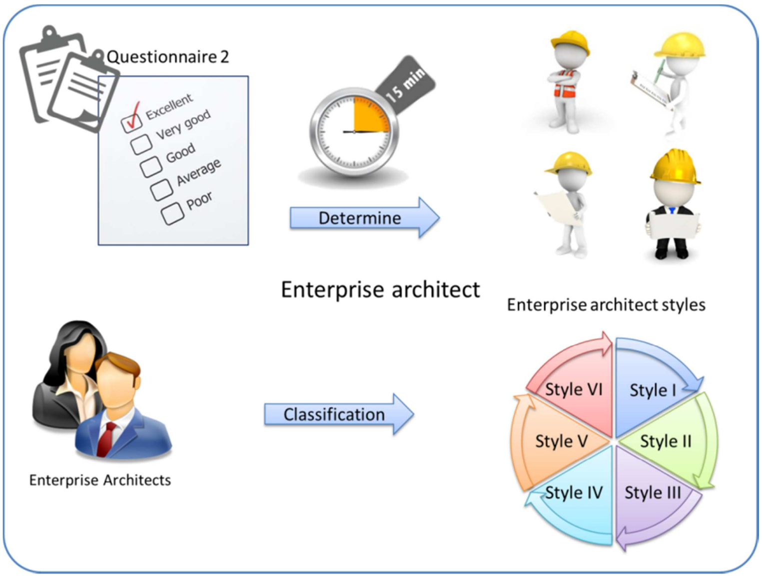



**Figure 6-S: Research study methodology**

Heterogeneous purposeful sampling was selected as a non-probability sampling method for selecting the required sample of architects, as a typical case. A non-probability method was selected as it was difficult to obtain the list of the study population, which represented South African organisations actively practising enterprise architecture (Salant & Dillman, 1994). This sampling technique allowed for collected data to describe key themes that were observed. Additionally, understanding the patterns that emerged and how they contributed to the key themes of the research results, enabled the identification of uniqueness. To ensure maximum variation from the population sample, the population sample selection criteria were based on enterprise architects within South African organisations. The selection of the sampling was based on the two-stage heterogeneous sampling process, depicted within Figure 6-T.


**Figure 6-T: Heterogeneous sampling process (Saunders *et al.*, 2009, p. 233)**

During stage one of the heterogeneous sampling processes, a dual approach was taken to publicise the need for participation in the study. This was done by contacting South African organisations which actively practise enterprise architecture within their organisation, as well as approaching South African enterprise architects directly via email. Enterprise architects of these South African organisations were then requested to participate in the research study and complete the anonymous questionnaire. Anonymity and privacy of the study was in accordance with required ethic conditions.

As part of stage two and to ensure simple, accurate and effective collection of the research study data, the questionnaire was hosted by a site dedicated to academic research and was available online at www.thesistools.com. Willing participants (19) self-completed the online questionnaire, allowing for data to be collected in a consistent manner.

As part of the mixed method research study methodology and in addition to collecting primary data from the online questionnaire, the study made use of journal publications as written documentary materials from the systematic literature review to assist in answering the research study question and meet the research study objective. The suitability of the secondary data was evaluated in terms of coverage, validity, reliability and measurement bias (Saunders *et al.*, 2009). This was done to ensure knowledge, skill and understanding gained from the secondary data could be applied to the research study.

Questionnaires are well-suited for an exploratory study using a limited number of open-ended questions, the sampling population demographic, the alignment to the research question and research objective which allowed for the selection and use of a self-administered internet mediated questionnaire. The intent and design of the questionnaire were to ensure maximum response rates, validity, and reliability of the data being collected. The motivation on the selection of the Internet-mediated questionnaire is depicted within **Appendix C**.

With the exception of the architect role and competency, each other architect attribute was used within a single question. The questions asked the participating architect their specific opinions with regards to the architect attributes. This was done to determine if there was a link between the specific architect attribute and their understanding of their architect role and competency, and ultimately their specific architect style.

### 6.2.4 Administer questionnaire

While taking into account the design of the questionnaire, key factors such as the relationship between variables and variable types were considered as well as the understanding of the organisational context.

Content validity was ensured through the systematic literature review and the first research study that formed the basis of the initial options for the measurement of each question.

No pre-testing was used for the second research study, as the first research study confirmed the reliability of the second questionnaire by ensuring participants consistently interpret the questions within the questionnaire in the same manner as what the study intended. This is done to produce consistent findings regardless of research sample, time or condition. With exception of the questions on architect roles and competencies, which were derived from previous studies (Bredemeyer & Malan, 2004; Steghuis & Proper, 2008; Strano & Rehmani, 2007), each of the questions within the questionnaire was consistent with the questions in the EA schools of thought questionnaire. The questionnaire makes use of open questions in the form of lists, which is in line with an exploratory research strategy. The list questions provide a comprehensive list of options taken from the SLR and other online sources while adding the option of “other” to catch any alternative answers to the question.

The requirements for data collection specific to this study are depicted within **Appendix C**.

## *6.3 Analyse data*

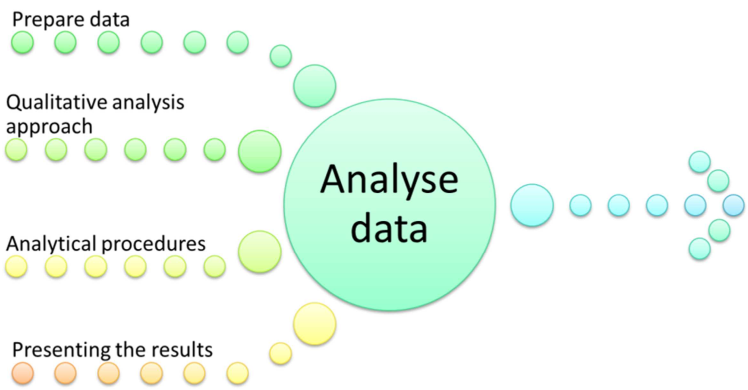



**Figure 6-U: Analyse data**

The process for data analysis is depicted within Figure 6-U. Based on the electronic data collected from performing the online questionnaire on the architect styles and behavioural style architects have, the architect style taxonomy was created based on the architect roles and personal competency characteristics (Bredemeyer & Malan, 2004; Steghuis & Proper, 2008; Strano & Rehmani, 2007). A detailed definition and description of each of the architect styles are described in section 6.3.4. This taxonomy has its foundation based on the initial work on architect roles (Strano & Rehmani, 2007), architect competency areas (Bredemeyer & Malan, 2004) and personal architect competencies (Steghuis & Proper, 2008), the architect attributes as defined within the SLR, as well as the outcomes of the second questionnaire on EA styles and refined within the first questionnaire on the EA schools of thought completed within **Chapter 4**, **Chapter 5** and **Chapter 6** respectively.

### 6.3.1 Prepare data

Limited preparation was needed as the data were electronically available. A number of participants' entries had to be discarded as they did not complete the questionnaire adequately to use their input as part of the analysis. Where participants used the "other" field to answer the questions, the answers were interpreted with the objective of the question in mind. If the answer was similar in nature to an existing option, it was included as the identified option; otherwise it was recorded as an alternative answer.

The required sample size was calculated based on an acceptable sampling error, the preferred accuracy or confidence level, available budget, and the preferred statistical value (Salant & Dillman, 1994). For this questionnaire, an acceptable sampling error of 15% was selected with desired level of accuracy with at least a 95% confidence interval. The statistical values required from the research study were percentages of the selected target population. These values were then used to calculate the desired sample size, as described by Salant and Dillman (1994) as follows:

$$s = \frac{z^2(p(1 - p))}{e^2}$$

**Equation 6-1: Research study sampling size calculation**

Where **s** represents the required sample size, **z** represents the fraction corresponding to the preferred level of confidence, **p** represents the population target respondent proportion and **e** represents the acceptable sampling error. The values used within the Equation 6-1 to calculate the required sampling size were the following:

- **z** = 1.96 as a statistical lookup value based on a 95% confidence level
- **p** = 90% with a decimal value of 0.9
- **e** = 15% with a decimal value of 0.15

This resulted in a suggested minimum research study sample **s** as 15 participants. The research study managed to obtain 19 responses from architects within South African organisations of which 17 responses were useful. This ensured the required sampling error rate from an initial 15% to an actual sampling error rate of 14%, which ensured an 86% certainty in the research study results. These 17 participants are in addition to the EA schools of thought research study's 96 participants, which also included questions on EA roles and EA competencies.

### 6.3.2 Qualitative analysis approach

The shortlist of architect attributes allowed for the classification of architect attributes into categories; an example of the categories are depicted within Table 6-5.

**Table 6-5: Example coding classification**

| Interrogative | Area | Topic - EA factor / Architect attribute | Interest |
|---|---|---|---|
| Who | Enterprise Architect | Roles | Strano & Rehmani roles |
| Who | Enterprise Architect | Personal competency characteristics | Steghuis & Proper |
| Who | Enterprise Architect | Competency areas | Bredemeyer & Malan |
| Who | Enterprise Architect | Experience | < 1 Year experience |

The categories clarified the alignment and understanding of the different architect styles, depicted within **Appendix C.6**. Bredemeyer and Malan (2004) categorised the competency of architects in three contextual perspectives, using their "know, do, be" framework. Whereas Steghuis and Proper (2008) categorised the competency of architects as personal and professional competencies. In this study, the focus was on the personal competencies of the architect. Therefore, the classification of the architect roles and architect competencies was done to align to a single architect-related category, which aligned to the category – "Be - what you are", which relates to the "Why" interrogative pronoun (Bredemeyer & Malan, 2004); see section 6.1.3.2.1. In addition, the personal competencies as defined by Steghuis and Proper (2008), see section 6.1.3.2.3, were also included in questions in the questionnaire. Finally the role definition of Strano and Rehmani (2007) was used to inform some of the questions. The classification of the different architect roles and architect competencies is depicted within **Appendix C**. The different styles were identified from the answers to questions 8 and 10. These styles are discussed in detail in section 6.3.4. From the answers of participants on the questions about roles and competencies, they were classified according to these styles.

Then, a further elaboration of the description style was obtained in the following way. Considering the different architect attribute aligned questions (question 1 – 14), a qualitative rating system was used for the grading of architect attributes, depicted within Table 6-6. A second qualitative rating system was used for the grading of architect opinions, depicted within Table 6-7. This means that if more than half of architects belonging to a style (e.g. Translating Technology) chose a specific attribute, then that attribute was considered relevant to understanding the EA style.

**Table 6-6: Relevance qualitative rating system for attributes**

| Indication | Percentage | Value |
|---|---|---|
| Strong | >= 50% | >= ½ |
| Weak | < 50% | < ½ |

A second qualitative rating system was used for the grading of architect opinions, given in questions 15 – 83, depicted within Table 6-7.

**Table 6-7: Relevance qualitative rating system for opinions**

| Likert scale | Percentage | Value |
|---|---|---|
| Strongly disagree | < 20% | 1 |
| Disagree | 20% >= 40% | 2 |
| Neither agree nor disagree | 40% >= 60% | 3 |
| Agree | 60% >= 80% | 4 |
| Strongly agree | 80% >= 100% | 5 |

Architect attributes were only considered when there was a strong indication it influenced the different architect behavioural styles. Architect opinions about role and competency were considered when the option of "agree" or "strongly agree" was given. Where there was no strong indication, or a weak indication, the modes of analysis classification depicts the architect attributes as not being applicable or "N/A".

### 6.3.3 Analytical procedures

With a short list of architect attributes used within the study as well as the opinions of architects on their personal competency characteristics, several different steps were taken on the understanding of architects' behavioural styles. The research study followed four different steps on the data analysed:

1. Classifying personal competencies: The step was to get to a new classification of personal competencies (from the data). This was done to analyse the second questionnaire to determine the relationship between Bredemeyer and Malan's (2006, 2004) personal competency characteristics (Be – Why – Rationale) for each competency area and Steghuis and Proper's personal competency characteristics (2008).
2. Determining architect styles: The step was to analyse the EA schools of thought questionnaire to determine the possible number of architect styles, as the questionnaire also asked architects their respective EA roles and competencies. This could be done as both questionnaires included the same questions on EA roles and competencies, whereas the questionnaire on EA styles elaborated on the opinions of architects on their EA roles and competencies. It was found that in theory 25 styles exist – discussed in detail in section 6.3.4.
3. Determining the number of architect styles: The step was to analyse the first and second questionnaire to determine which of architect attributes aligned questions relate to the architect styles, identified within the second analysis step. An architect style was identified when it represented at least 5% of the participating architects. It was found that only nine EA styles exist, based on the following rule: at least 5% of the 122 participant must be of that style for it to exist.

4. Determine EA style attributes: The step was to analyse the EA schools of thought questionnaire on architect attributes, to determine for each architect attribute aligned question the answer to the question which showed a strong indication of a relationship to the description of the architect styles.

Analysis of the EA styles questionnaire indicated the relationship between personal competency characteristics as defined by Bredemeyer and Malan, and Steghuis and Proper respectively (2006, 2004; 2008). Alignment of the five different positions on architect roles and the five different positions on architect competency classes, allowed for 25 theoretical architect styles. A 5X5 matrix, depicted within Figure 6-V, was used to represent the different architect behavioural styles. These architect styles were identified through the analysis of the EA schools of thought questionnaire on architect attributes and defined based on the answers from the participating architects.

Using the electronic data collected from the participants of the EA schools of thought questionnaire on architect attributes, each participant was then placed in a specific architect style based on their understanding of their aligned architect roles and architect competencies.

The data collected as part of EA schools of thought questionnaire on architect attributes and specifically the architects' answers on architect roles and architect competencies were used as the foundation for the understanding of the architect behavioural styles.

Each of the answers from each of the architects was then viewed from the perspective of their specific architect style as their answers on their understanding of architect roles and competency. These answers on the architect attribute aligned questions provided insight into the understanding of the architect styles, in addition to the identification of the architect styles.

### 6.3.4 Presenting results

To date a number of studies described architect roles and competencies, how these two attributes relate to each other, and two of the architect attributes were identified within the SLR in **Chapter 4** and reaffirmed in the research study described in **Chapter 5**.

The architect role represents the different roles architects can fulfil in their duties as practising enterprise architects, while the architect competency represents the different competencies architects use while assuming a specific architect role. Existing literature indicates that architect roles and competencies also influence behavioural traits with regards to the enterprise architect (Ouriaghli & Nsubuga, 2012; Strano & Rehmani, 2007; Tambouris *et al.*, 2012). The behavioural traits or styles of architects are fundamental to understanding the enterprise architects as architects execute their respective functions differently.

#### 6.3.4.1 Enterprise architect competency taxonomy

With the execution of the SLR in **Chapter 4**, several studies were identified with regards to architect competencies (Bredemeyer & Malan, 2004; Lu & Lin, 2012; Steghuis & Proper, 2008). These studies took different perspectives and created different classifications on architect competencies. The executive report of what it takes to be a great architect, grouped and classified competencies according to the authors' own framework (Bredemeyer & Malan, 2004). This framework considered competencies from three perspectives: what architects do, how they work, and who they are. The competencies referring to who the architects were, were classified as personal architect competencies (Bredemeyer & Malan, 2004).

In a second study, the authors considered competencies from two different perspectives, being professional and personal competencies (Steghuis & Proper, 2008), with the focus of the study concentrating on the personal competency characteristics of enterprise architects.

In both these studies, the common denominator was the personal competency characteristics, which refers directly to who the architects are and not what they do or how they do it. Based on the analysis of the EA styles questionnaire, which refers to the two studies (Bredemeyer & Malan, 2006, 2004; Steghuis & Proper, 2008), a novel taxonomy was created, allowing for the identification of how these personal architect competencies relate. The architect competency taxonomy is depicted within **Appendix C**, with a fragment depicted with Table 6-8.

**Table 6-8: Enterprise architect competency taxonomy (fragment)**

| Personal competency characteristics (Natural ability) | Contextual perspective | Charismatic and credible | Optimistic belief | Seen as a leader | Commitment & dedication |
|---|---|---|---|---|---|
| Abstraction capacity | X | | | | |
| Accuracy | | | | | |
| Analytical skills | | | | | |
| Authenticity | | X | | X | |
| Consulting | X | | | | |
| Creativity | | | | | |
| Decisiveness | | X | | X | |
| Dedication | | | | | X |

The enterprise architect competency taxonomy was used as the first component in the creation and classification of the enterprise architect style taxonomy. The second component refers to the classification on enterprise architect roles (Strano & Rehmani, 2007).

#### 6.3.4.2 Enterprise architect style taxonomy

As no taxonomy exists for the consistent classification of enterprise architects' styles, a 5X5 matrix taxonomy was created to understand the behavioural styles of enterprise architects, analysing the participant's answers in the first questionnaire on their understanding of enterprise architect roles and competencies. With the execution, collection and analysis of the data from the first research study, nine distinct architect styles were identified. An architect style was identified if it represented at least 5% of the participating architect population. These nine architect styles represented 77% of the participating architects.

These nine architect styles were based on the participating enterprise architects' understanding of their architect roles and their architect competencies. Using the 5X5 matrix to depict the behavioural styles, Figure 6-V indicates the number of architects that represented a specific behavioural style.

**Architect style taxonomy**

**Architect role** / **Architect competency**

| | Change agent | Communicator | Leader | Manager | Modeller |
|---|---|---|---|---|---|
| Technical | Architect style # 1<br>7 ◇ | Architect style # 2<br>5 ◇ | Architect style # 3<br>7 ◇ | Architect style # 4<br>5 ◇ | Architect style # 5<br>1 |
| Strategy | Architect style # 6<br>9 ◇ | Architect style # 7<br>2 | Architect style # 8<br>9 ◇ | Architect style # 9<br>1 | Architect style # 10<br>1 |
| Organisational politics | Architect style # 11<br>1 | Architect style # 12<br>1 | Architect style # 13<br>1 | Architect style # 14<br>0 | Architect style # 15<br>0 |
| Leadership | Architect style # 16<br>0 | Architect style # 17<br>1 | Architect style # 18<br>4 | Architect style # 19<br>1 | Architect style # 20<br>1 |
| Consulting | Architect style # 21<br>16 ◇ | Architect style # 22<br>11 ◇ | Architect style # 23<br>5 ◇ | Architect style # 24<br>3 | Architect style # 25<br>4 |

◇ **Architect style 5% representation**

**Figure 6-V: Architect style taxonomy**

The focus of this study was on the architect and not what architecture or how architecting is being done. In the context of this study, an architect style refers to an architect behavioural style, as a verb, rather than an architectural style, as a noun. The identified enterprise architect styles are named and listed within Figure 6-W. Each enterprise architect style is described in sub-sections 6.3.4.3 to 6.3.4.11.

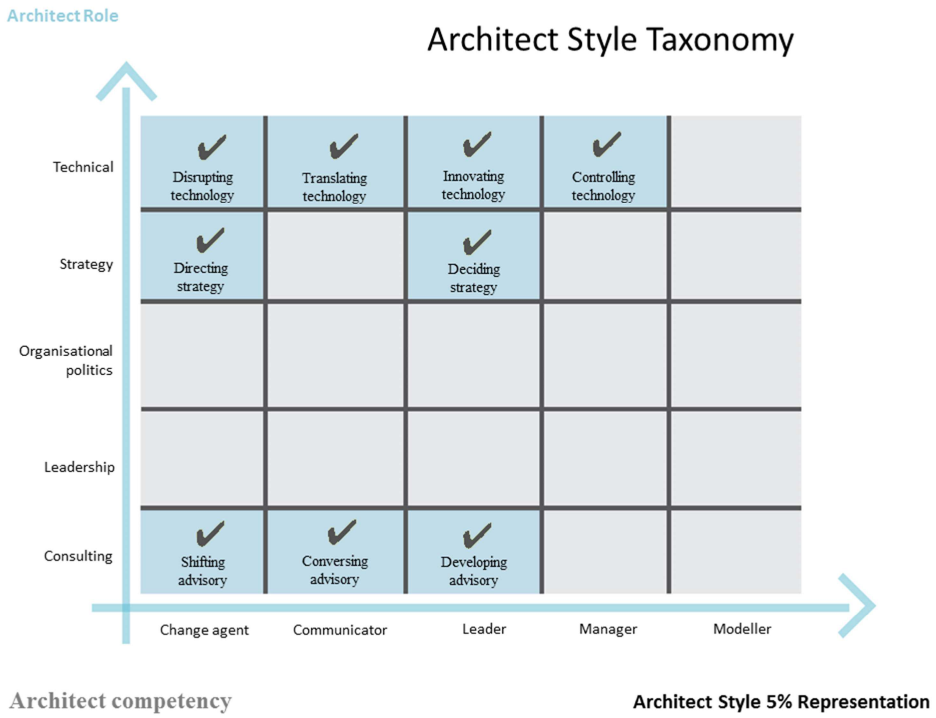



**Figure 6-W: Enterprise architect styles**

## 6.3.4.3 Disrupting technology style

Architects from this study with a Disrupting technology architect style can be seen as change agents. They support organisational leaders in instituting and endorsing the best technology strategy to accomplish technology goals and objectives (Strano & Rehmani, 2007). These architects are often investigative, pragmatic, insightful, creative, investigative and tolerant of ambiguity while being great at working at an abstract system level (Bredemeyer & Malan, 2006, 2004). These architects have strong EA skills with a Bachelor's degree in a formal sciences educational discipline. When considering their thinking style about change, the Disrupting technology style architects concentrate on ensuring that EA stakeholders are aware of new perspectives, while inspiring them to learn new things by creating suitable shared learning experiences (De Caluwé & Vermaak, 2003). Within the architecture team, they consider the team members and are team players. They are often good listeners but can have problems making difficult decisions (Aritzeta *et al.*, 2007). Internally focused, these architects often value creativity, leadership, integrity, openness, team work and opinion-forming personal characteristics highly (Steghuis & Proper, 2008) and are often creative, pragmatic, investigative, insightful, and tolerant individuals (Bredemeyer & Malan, 2006, 2004).

The position of the Disrupting technology architect style in relation to the other architect styles is depicted within Figure 6-X.

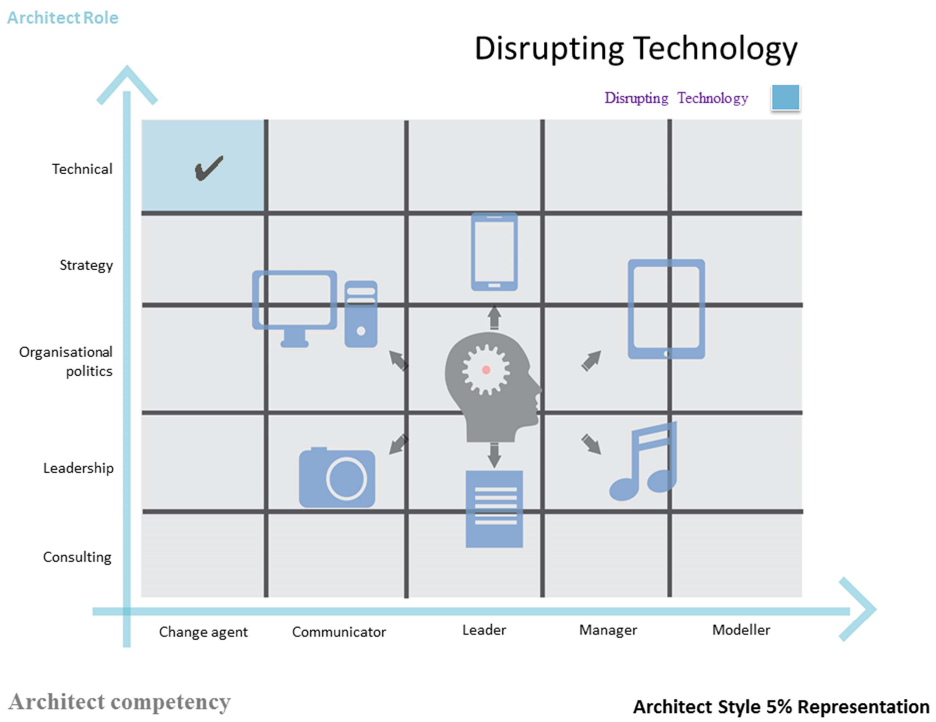



**Figure 6-X: Disrupting technology style**

A summary of the behaviours that form part of the Disrupting technology architect style is depicted with Table 6-9.

**Table 6-9: Disrupting technology style architect attributes**

| Architect attribute | Disrupting technology style |
|---|---|
| Role | • Change agent |
| Competency area | • Technical |
| Position | • N/A |
| Position level | • N/A |
| Experience | • N/A |
| Educational discipline | • Formal sciences |
| Education level | • Bachelor |
| Stakeholders | • N/A |
| Skills category | • EA |
| Thinking style | • Green |
| Team role | • Team worker |
| Characteristics | • Creativity, integrity, leadership, openness, opinion forming, team work |
| | • Creative, Investigative, Pragmatic, Insightful, Tolerance |

## 6.3.4.4 Translating technology style

Architects from this study with a Translating technology architect style can be seen as communicators. They assist other architects, executives and project managers in understanding the details of the technology strategy adequately well to make decisions and execute the plan to ensure realisation of the shared vision (Strano & Rehmani, 2007). These architects are often investigative, pragmatic, insightful, creative and tolerant of ambiguity while being great at working at an abstract system level (Bredemeyer & Malan, 2006, 2004). These architects are often senior professionals with 10 to 15 years of EA experience and have a Bachelor's degree in a professional and applied sciences educational discipline. The Translating technology architects often work closely with executives, project managers and other architects by bringing their business and EA related skills to the table.

The position of the Translating technology architect style in relation to the other architect styles is depicted within Figure 6-Y.

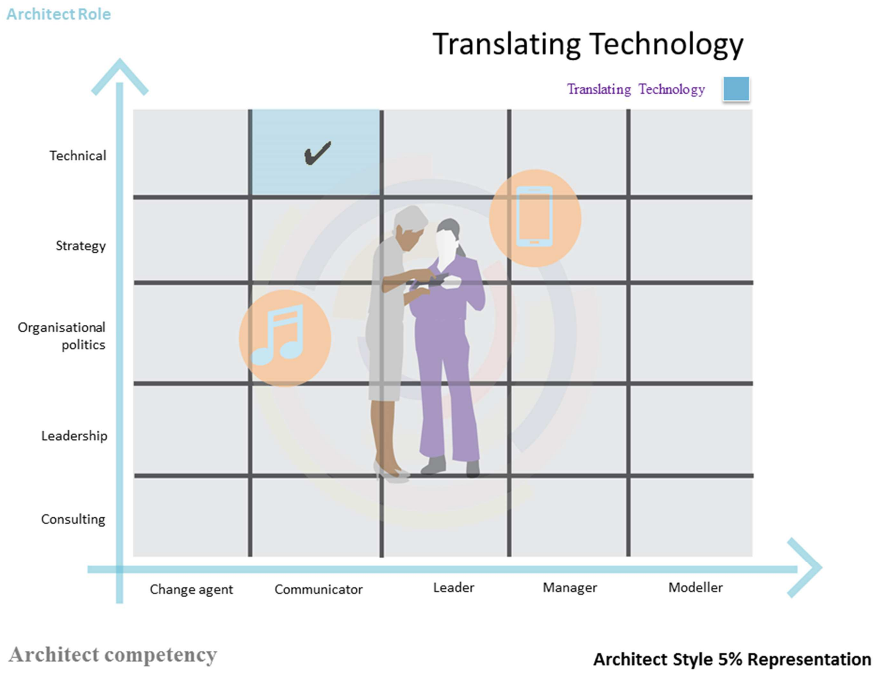



**Figure 6-Y: Translating technology style**

A summary of the behaviours that form part of the Translating technology architect style is depicted with Table 6-10.

**Table 6-10: Translating technology style architect attributes**

| Architect attribute | Translating technology style |
|---|---|
| Role | • Communicator |
| Competency area | • Technical |
| Position | • N/A |
| Position level | • Senior level |
| Experience | • 10 years > 15 years |
| Educational discipline | • Professional and Applied Sciences |
| Education level | • Bachelor |
| Stakeholders | • Architects, PM, Exec |
| Skills category | • Business, EA skills |
| Thinking style | • N/A |
| Team role | • N/A |
| Characteristics | • N/A |

### 6.3.4.5 Innovating technology style

Architects from this study with an Innovating technology architect style can be seen as leaders. They participate in creating a shared technology vision, motivating members in order to achieve the vision, while providing clear direction on executing the technical strategy. These architects aim to accomplish technology goals and objectives to ensure technical performance improvements (Strano & Rehmani, 2007). These architects are often investigative, pragmatic, insightful, creative and tolerant of ambiguity while being great at working at an abstract system level (Bredemeyer & Malan, 2006, 2004). The Innovating technology style architects are often chief architects or enterprise architects at an executive level within the organisation and interact directly with executive members, project managers, analysts and other architects. They have a Master's degree in a professional and applied sciences educational discipline and have strong business, EA and general IT skills.

The position of the Innovating technology architect style in relation to the other architect styles is depicted within Figure 6-Z.

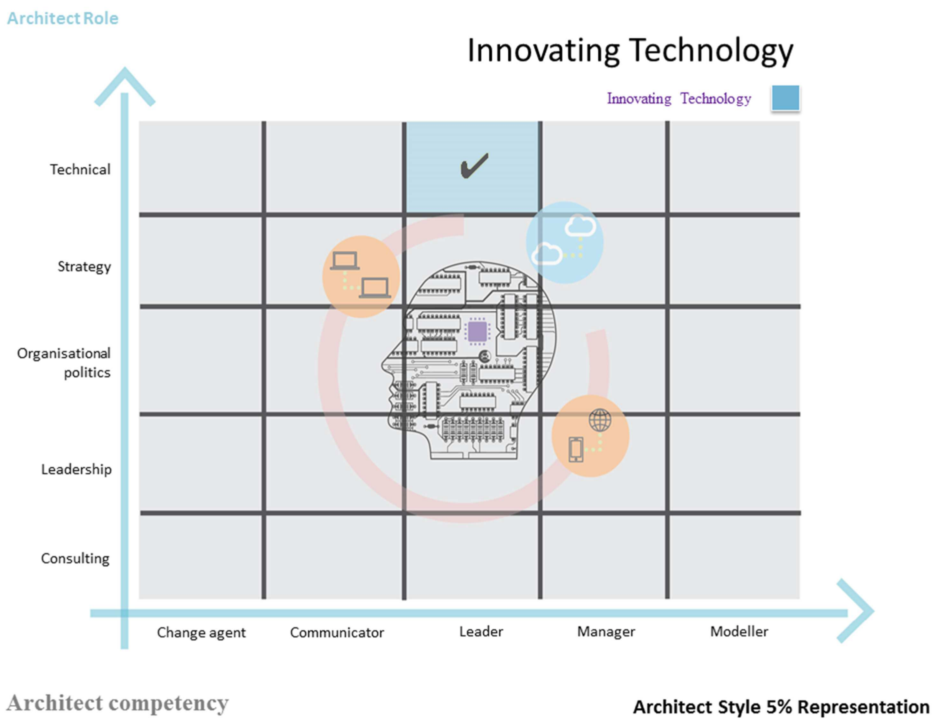



**Figure 6-Z: Innovating technology style**

A summary of the behaviours that form part of the Innovating technology architect style is depicted with Table 6-11.

**Table 6-11: Innovating technology style architect attributes**

| Architect attribute | Innovating technology style |
|---|---|
| Role | • Leader |
| Competency area | • Technical |
| Position | • Enterprise architect |

| Architect attribute | Innovating technology style |
|---|---|
| Position level | • Executive |
| Experience | • N/A |
| Educational discipline | • Professional and Applied Sciences |
| Education level | • Masters |
| Stakeholders | • Analyst, PM, Exec, other architects |
| Skills category | • Business, EA skills, general IT |
| Thinking style | • N/A |
| Team role | • N/A |
| Characteristics | • N/A |
| | • N/A |

### 6.3.4.6 Control technology style

Architects from this study with a Control technology architect style can be seen as managers. They often organises the architecture team whilst ensuring adequate resources are available to perform the enterprise architecture management process (Strano & Rehmani, 2007). These architects are often investigative, pragmatic, insightful, creative and tolerant of ambiguity while being great at working at an abstract system level (Bredemeyer & Malan, 2006, 2004). As enterprise architects, they often have limited EA experience but are well educated with a Master's degree having EA and general IT skills. The control technology style architects often focus on the formulation of unambiguous technology objectives, development of an action plan, monitoring and adjusting the technology change process (De Caluwé & Vermaak, 2003). These architects add value by solving demanding problems with original and creative thinking. They can however be poor at communicating and may ignore relevant details (Aritzeta *et al.*, 2007). Considering their personal characteristics, these architects have great organisational awareness, strong persuasiveness, are result driven, are self-confident have excellent written communication skills and work well within teams (Steghuis & Proper, 2008). The architects are often also creative, pragmatic, investigative, insightful, and are able to understand different levels of system abstractions (Bredemeyer & Malan, 2006, 2004).

The position of the Control technology architect style in relation to the other architect styles is depicted within Figure 6-AA.

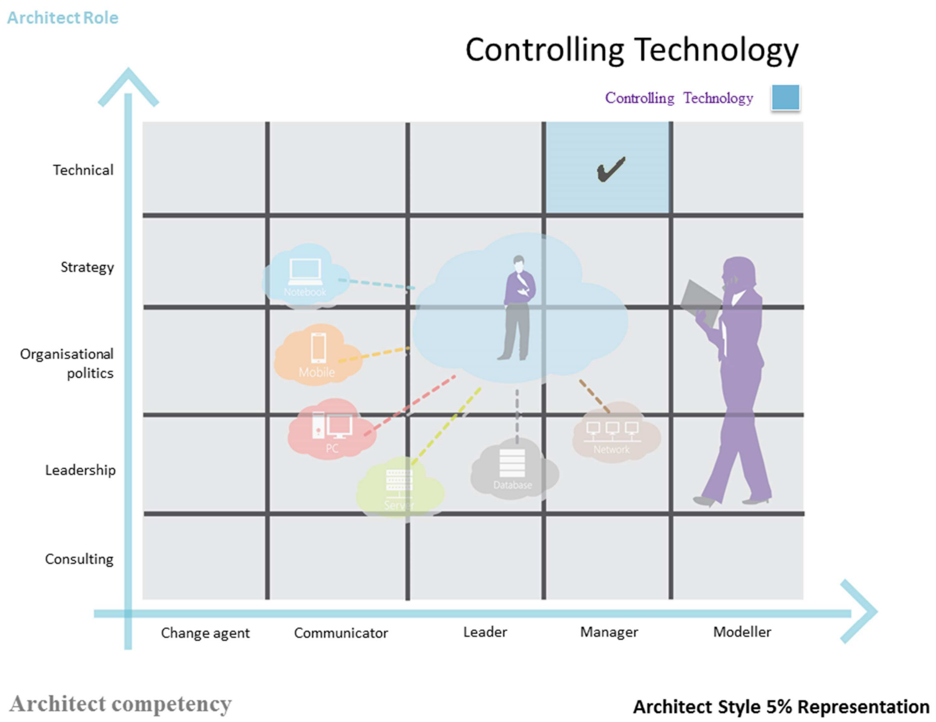



**Figure 6-AA: Control technology style**

A summary of the behaviours that form part of the Control technology architect style is depicted with Table 6-12.

**Table 6-12: Control technology style architect attributes**

| Architect attribute | Control technology style |
|---|---|
| Role | • Manager |
| Competency area | • Technical |
| Position | • Enterprise architect |
| Position level | • N/A |
| Experience | • 1 year > 5 years |
| Educational discipline | • N/A |
| Education level | • Masters |
| Stakeholders | • N/A |
| Skills category | • EA, general IT |
| Thinking style | • Blue |
| Team role | • Planter |
| Characteristics | • Organisational awareness, persuasiveness, result driven, self-confident, teamwork, written communication skills<br>• Creative, Investigative, Pragmatic, Insightful, Tolerance, Level of abstraction |

## 6.3.4.7 Directing strategy style

Architects from this study with a Directing strategy architect style can be seen as change agents. These architects support organisational leaders in instituting and endorsing the best organisational strategy to accomplish business goals and objectives (Strano & Rehmani, 2007). These architects often have a visionary and entrepreneurial perspective to directing the organisation with regards to the business strategy (Bredemeyer & Malan, 2006, 2004). Directing strategy style architects are senior enterprise architects and have over a decade of experience in the field of enterprise architecture. These architects also have a Bachelor's degree with EA, technical IT, and general IT skills. Directing strategy style architects often work closely with executives, other architects and line managers in their day-to-day operations. Considering their style of thinking about change, these architects focus on uniting interests, stimulating EA stakeholders to formulate opinions, creating mutually beneficial situations and forming strategic coalitions (De Caluwé & Vermaak, 2003). The directing strategy style architects spend a great deal of energy and action on challenging other architects and EA stakeholders to move forward. Doing so, they can be insensitive at times (Aritzeta *et al.*, 2007). Internally focused, these architects rely on their analytical, consulting, facilitation, verbal communication and visualisation skills to apply their trade. They are often abstract, independent, are organisation situationally aware and have empathy towards others (Strano & Rehmani, 2007). In fulfilling their roles, the Directing strategy style architects are strategic in nature, relying on their visionary and entrepreneurial competencies to execute their duties (Bredemeyer & Malan, 2006, 2004).

The position of the Directing strategy architect style in relation to the other architect styles is depicted within Figure 6-BB.

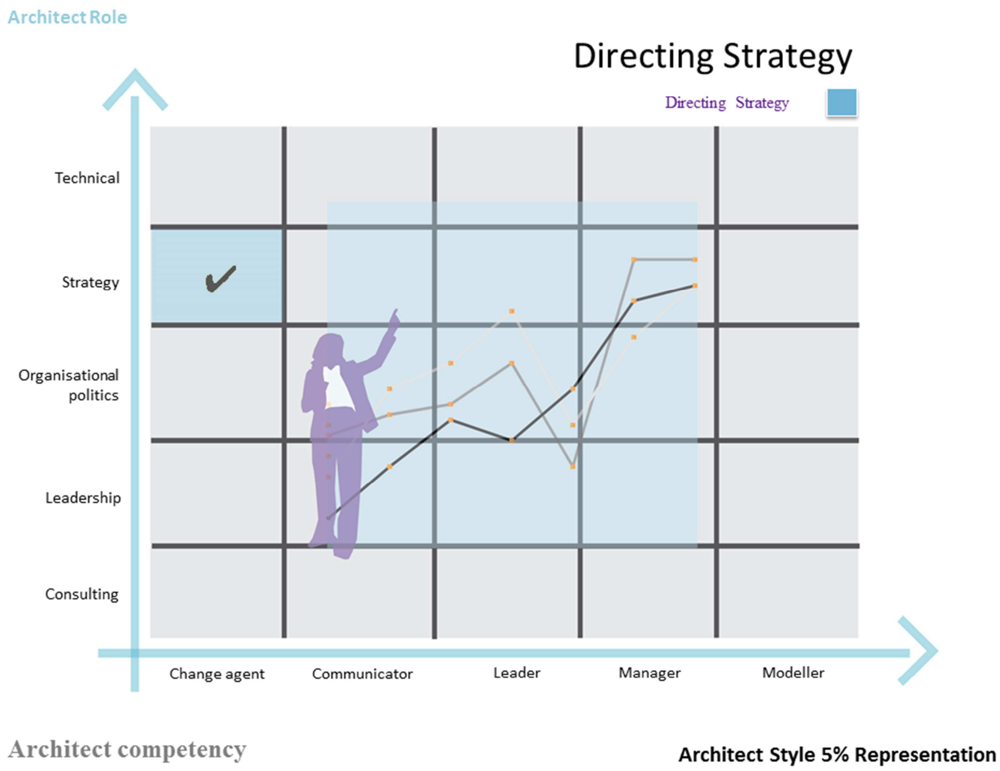



**Figure 6-BB: Directing strategy style**

A summary of the behaviours that form part of the Directing strategy architect style is depicted with Table 6-13.

**Table 6-13: Directing strategy style architect attributes**

| Architect attribute | Directing strategy style |
|---|---|
| Role | • Change agent |
| Competency area | • Strategy |
| Position | • Enterprise architect |
| Position level | • Senior level |
| Experience | • 10 years > 15 years |
| Educational discipline | • N/A |
| Education level | • Bachelor |
| Stakeholders | • Other architects, exec, line managers |
| Skills category | • EA, general IT, Technical IT |
| Thinking style | • Yellow |
| Team role | • Shaper |
| Characteristics | • Abstract, analytical skills, consulting, facilitation, independency, organisational awareness, sensitivity & empathy, verbal communication skills, visualisation skills<br>• Visionary, Entrepreneurial |

## 6.3.4.8 Deciding strategy style

Architects from this study with a Deciding strategy architect style can be seen as leaders. They participate in creating a shared strategic vision, motivating members in order to achieve the vision, while providing clear direction on executing the technical strategy. The Deciding strategy style architects aim to accomplish organisational goals and objectives to ensure organisational performance improvements (Strano & Rehmani, 2007). These architects often have a visionary and entrepreneurial perspective to directing the organisation with regards to the business strategy (Bredemeyer & Malan, 2006, 2004). As senior enterprise architects, they have over a decade of EA experience often with a Master's or a Doctoral degree. As senior architects they interact with executives and other architects on a day-to-day basis.

The position of the Deciding strategy architect style in relation to the other architect styles is depicted within Figure 6-CC.

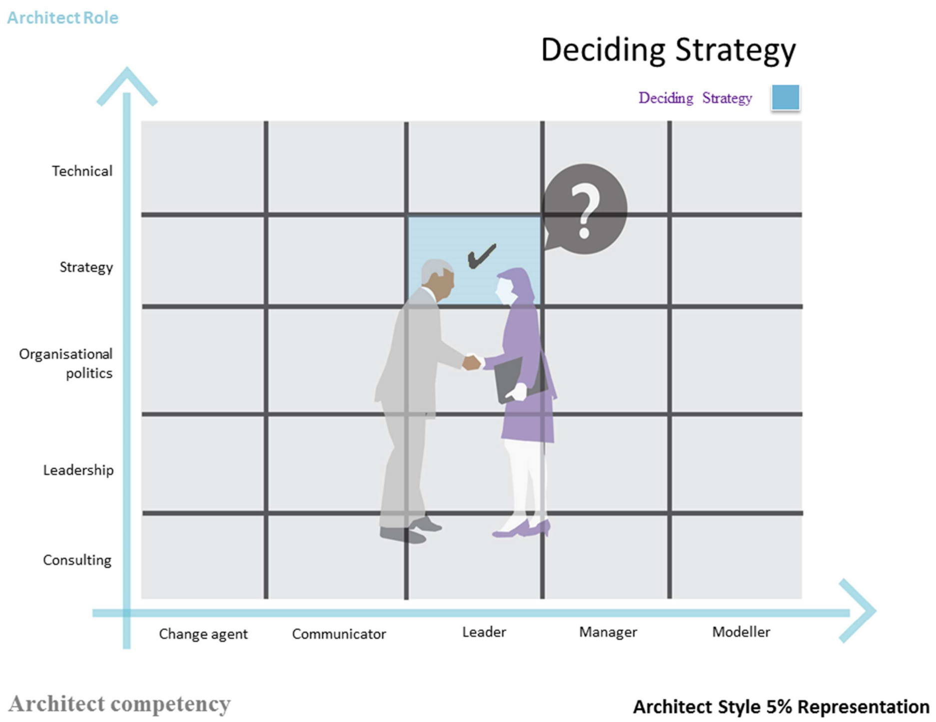



**Figure 6-CC: Deciding strategy style**

A summary of the behaviours that form part of the Deciding strategy architect style is depicted with Table 6-14.

**Table 6-14: Deciding strategy style architect attributes**

| Architect attribute | Deciding strategy style |
|---|---|
| Role | • Leader |
| Competency area | • Strategy |
| Position | • Enterprise architect |
| Position level | • Senior level |
| Experience | • 10 years > 15 years |
| Educational discipline | • Formal sciences |
| Education level | • Masters or Doctoral |
| Stakeholders | • Other architects, exec |
| Skills category | • N/A |
| Thinking style | • N/A |
| Team role | • N/A |
| Characteristics | • N/A |
| | • N/A |

## 6.3.4.9 Shifting advisory style

Architects from this study with a Shifting advisory architect style can be seen as change agents. These architects advise and support organisational leaders in instituting and endorsing the best organisational strategy to accomplish business goals and objectives (Strano & Rehmani, 2007). The Shifting advisory style architects are effective change agents, approachable, empathetic, and committed to others' success. These architects are also process savvy and good mentors and teachers (Bredemeyer & Malan, 2006, 2004). Although these senior enterprise architects have less than a decade of enterprise architecture experience, they bring a variety of consulting-related skills to the table, which include business skills, EA skills, project management skills and general IT skills. The architects have a Master's degree in a formal sciences educational discipline and interact with a wider audience, which includes analysts, other architects, executives and project managers. Although these architects are well-organised and predictable, they can also be slow to take basic ideas and realise them in practice (Aritzeta *et al.*, 2007). Shifting advisory style architects rely on their analytical, consulting, diplomacy, facilitation, independence, listening, organisational awareness and written communication personal competencies to execute their daily tasks (Steghuis & Proper, 2008). They are also committed to their team's success, empathetic and approachable, effective at change and are great mentors and teachers (Bredemeyer & Malan, 2006, 2004).

The position of the Shifting advisory architect style in relation to the other architect styles is depicted within Figure 6-DD.

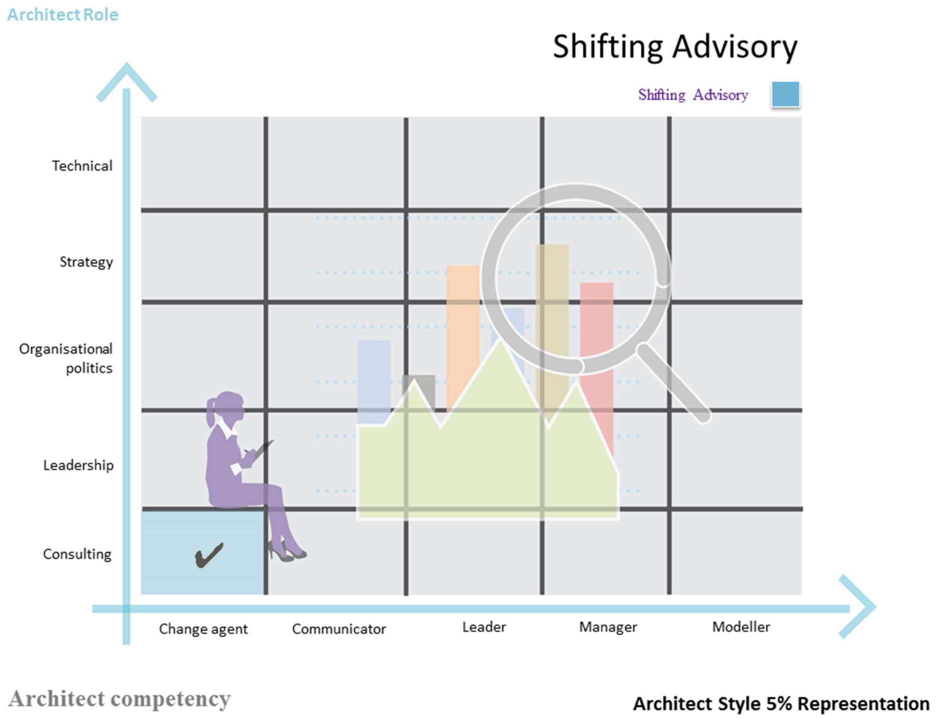



**Figure 6-DD: Shifting advisory style**

A summary of the behaviours that form part of the Shifting Advisory architect style is depicted with Table 6-15.

**Table 6-15: Shifting advisory style architect attributes**

| Architect attribute | Shifting advisory style |
|---|---|
| Role | • Change agent |
| Competency area | • Consultant |
| Position | • Enterprise architect |
| Position level | • Senior level |
| Experience | • 5 years > 10 years |
| Educational discipline | • Formal sciences |
| Education level | • Masters |
| Stakeholders | • Analysts, other architects, exec, pm |
| Skills category | • Business, EA skills, general IT, PM |
| Thinking style | • N/A |
| Team role | • Implementer |
| Characteristics | • Analytical, consulting, diplomacy, facilitation, independence, listening, organisational awareness, written communication<br>• Committed to team success, Empathetic and approachable, Effective change, Mentor and teacher |

### 6.3.4.10 Conversing advisory style

Architects from this study with a Conversing advisory architect style can be seen as communicators. They assist other architects, executives and project managers in understanding the details of the technology strategy adequately well to make decisions and execute the plan to ensure realisation of the shared vision (Strano & Rehmani, 2007). The Conversing advisory style architects are effective consultants, approachable, empathetic, and committed to others' success. These architects are also process savvy and good mentors and teachers (Bredemeyer & Malan, 2006, 2004).

These senior enterprise architects have less than a decade of EA experience and have Masters' degrees in a formal sciences educational discipline and interact with the management structures of the organisation by interacting with executives and line managers. These architects are generalists rather than specialists and focus on the natural flow of people's interests and processes and are concerned with efficiency (De Caluwé & Vermaak, 2003). Although these architects see the big picture, and think accurately and carefully about things, they may lack the ability to inspire others members of the team (Aritzeta *et al.*, 2007). Conversing advisory style architects are analytical, persuasive, result driven, and work well in teams (Steghuis & Proper, 2008). They are also committed to their team's success, empathetic and approachable, effective at change and are great mentors and teachers (Bredemeyer & Malan, 2006, 2004).

The position of the Conversing advisory architect style in relation to the other architect styles is depicted within Figure 6-EE.

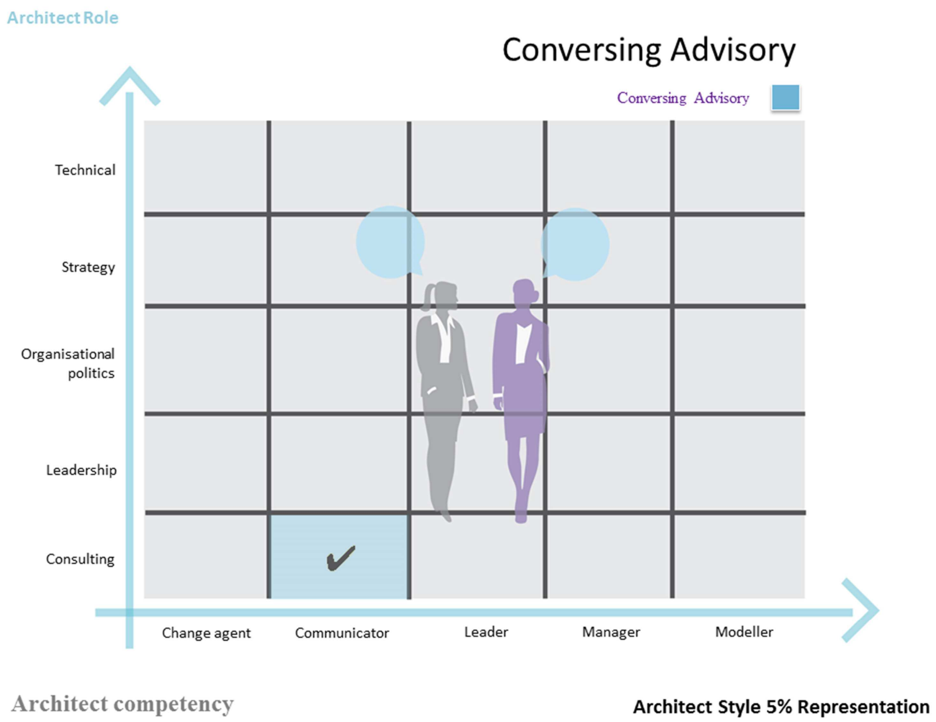



**Figure 6-EE: Conversing advisory style**

A summary of the behaviours that form part of the Conversing advisory architect style is depicted with Table 6-16.

**Table 6-16: Conversing advisory style architect attributes**

| Architect attribute | Conversing advisory style |
|---|---|
| Role | • Communicator |
| Competency area | • Consultant |
| Position | • Enterprise architect |
| Position level | • Senior level |
| Experience | • 5 years > 10 years |
| Educational discipline | • Formal sciences |
| Education level | • Masters |
| Stakeholders | • Exec, Line managers |
| Skills category | • General skills |
| Thinking style | • White |
| Team role | • Monitor |
| Characteristics | • Analytical, persuasive, result driven, team work |
| | • Committed to team success, Empathetic and approachable, Effective change, Mentor and teacher |

## 6.3.4.11 Developing advisory style

Architects from this study with a Developing advisory architect style can be seen as leaders. They participate in creating a shared organisational vision, motivating members in order to achieve the vision, while providing clear direction on executing the business strategy. These architects aim to accomplish business goals and objectives to ensure process performance improvements (Strano & Rehmani, 2007). The Developing advisory style architects are effective consultants, approachable, empathetic, and committed to others' success. These architects are also process savvy and good mentors and teachers (Bredemeyer & Malan, 2006, 2004).

These mid-level system architects have only a few years of enterprise architecture experience and have post-secondary and non-tertiary education in a professional and applied sciences discipline. On a day-to-day basis these architects interact with competency leads, analysts, other architects and project managers. These architects are also generalists rather than specialists, using a variety of skills, including business, project management, general IT and technical IT skills.

The Developing advisory style architects focus on bringing diverse interests together, encourage stakeholders to formulate opinions, creating mutual beneficial situations and forming coalitions (De Caluwé & Vermaak, 2003). As architects they are reliable and see tasks through to the end, eliminating concerns ensuring everything works well, although they have a tendency to worry too much and not trusting others (Aritzeta *et al.*, 2007).

Developing advisory style architects add consulting skills to their team function (Steghuis & Proper, 2008), while being committed to their team's success. They are empathetic and approachable, effective at change and are good mentors and teachers (Bredemeyer & Malan, 2006, 2004).

The position of the Developing advisory architect style in relation to the other architect styles is depicted within Figure 6-FF.

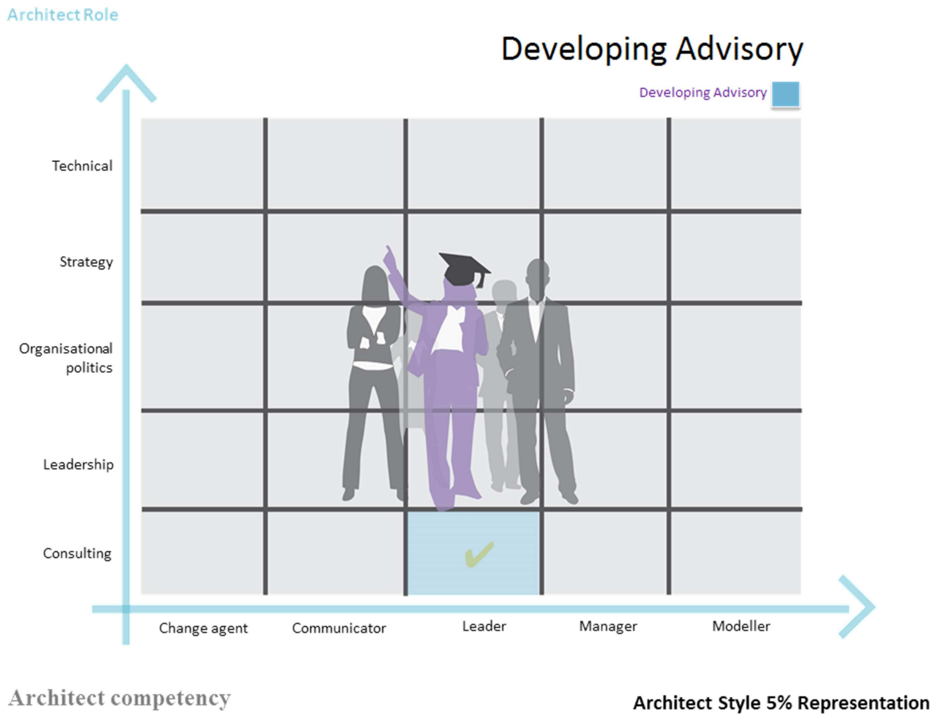



**Figure 6-FF: Developing advisory style**

A summary of the behaviours that form part of the Developing advisory architect style is depicted with Table 6-17.

**Table 6-17: Developing advisory style architect attributes**

| Architect attribute | Developing advisory style |
|---|---|
| Role | • Leader |
| Competency area | • Consultant |
| Position | • System architect |
| Position level | • Mid-level |
| Experience | • 1 year > 5 years |
| Educational discipline | • Professional and Applied Sciences |
| Education level | • Post-secondary non tertiary education |
| Stakeholders | • Analyst, architects, PM, competency lead |
| Skills category | • Business, PM, general IT, technical IT |
| Thinking style | • Yellow |
| Team role | • Completer / finisher |
| Characteristics | • Consulting |
| | • Committed to team success, Empathetic and approachable, Effective change, Mentor and teacher |

## 6.4 Formulate classification

***EA styles:*** ***Enterprise architect styles are directly related to the roles enterprise architects fulfil, having the competency to perform their functions, while operating within their working environment.***

A premise of the study is that:

While only considering architect roles, competencies and other architect attributes, showing a strong indication in the understanding of the architect styles, a visible pattern emerged. Three of the architect roles were identified as dominant, including change agent, communicator and leader. With regards to architect competency, three architect competencies were identified as dominant, including technical, consulting, and strategy competencies. Although the manager role influences one of the architect styles, architects align more with the leader role than the manager role. It may be as a result of the nature of the architect role, where it is concerned with realising architectural visions rather than managing people. The alignment of architects to roles and competencies, indicate that additional research is required to validate the identification and definition of architect roles and architect competencies in order to better understand enterprise architects.

The definition and description of the various architect styles were based on results from the two collected questionnaires' data of 113 participants. The interpretation of the architect styles in relation to the other architect styles, is depicted within Figure 6-W, where the placement of the architect style in the matrix taxonomy is considered in relation to the other architect styles, as well as the understanding of the behavioural traits in architect roles and architect competencies. In addition, the description and the definition of the architect styles made references to the SLR studies identified within the first internal DSR development cycle.

Figure 6-GG indicates the percentage of the participants having identified with a specific role. The roles as change agent and as leader represent the majority of greatest architect roles with 59% of participants identifying with one of the roles. Another dominant role identified was that of communicator with 18% of respondents identifying with that role.

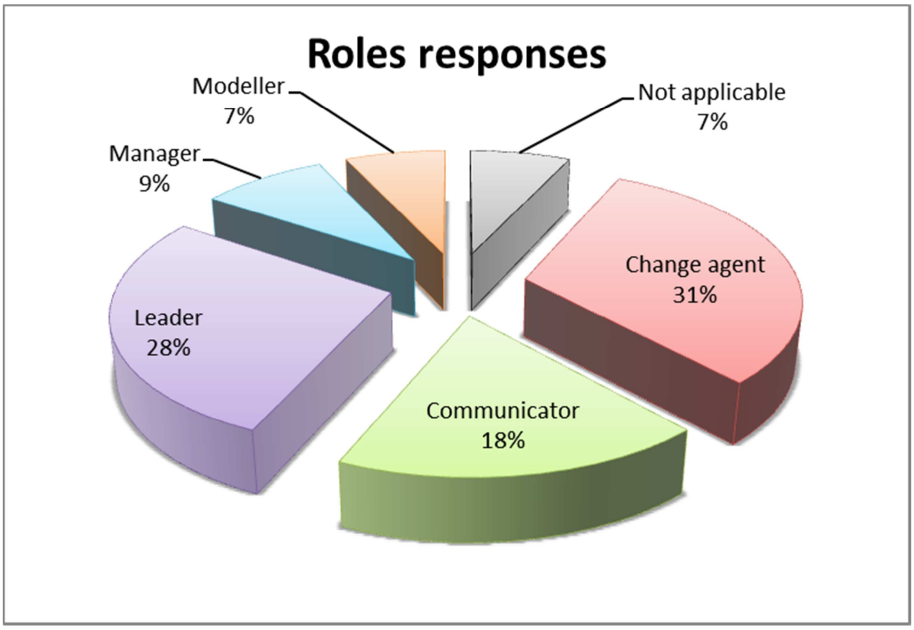



**Figure 6-GG: Architect roles 113 responses**

Figure 6-HH indicates the percentage of the participants having identified with a specific competency. The competencies of consultant and credible expert represent the majority of greatest architect roles with 56% of participants identifying with one of the competencies. Another dominant competency identified was that of the strategist with 19% of respondents identifying with that competency.

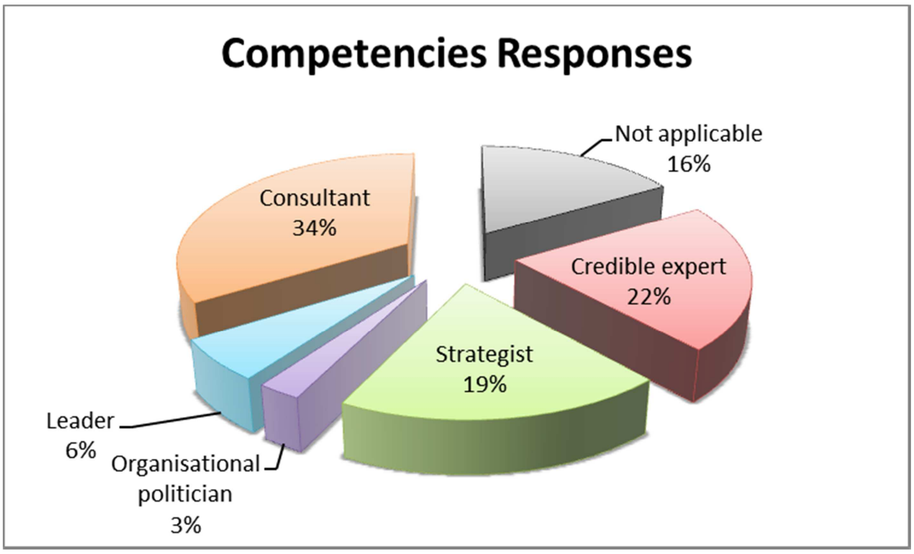



**Figure 6-HH: Architect competencies 113 responses**

Figure 6-II indicates the percentage of the participants having identified with a specific architect style. No architect style class was identified as being dominant, with the most dominant architect style representing 17% of the responses. A total of nine architect styles represented the majority of participants with a combined 75% of the responses. The identified nine architect styles each represented a minimum of 5% of the participants' responses.

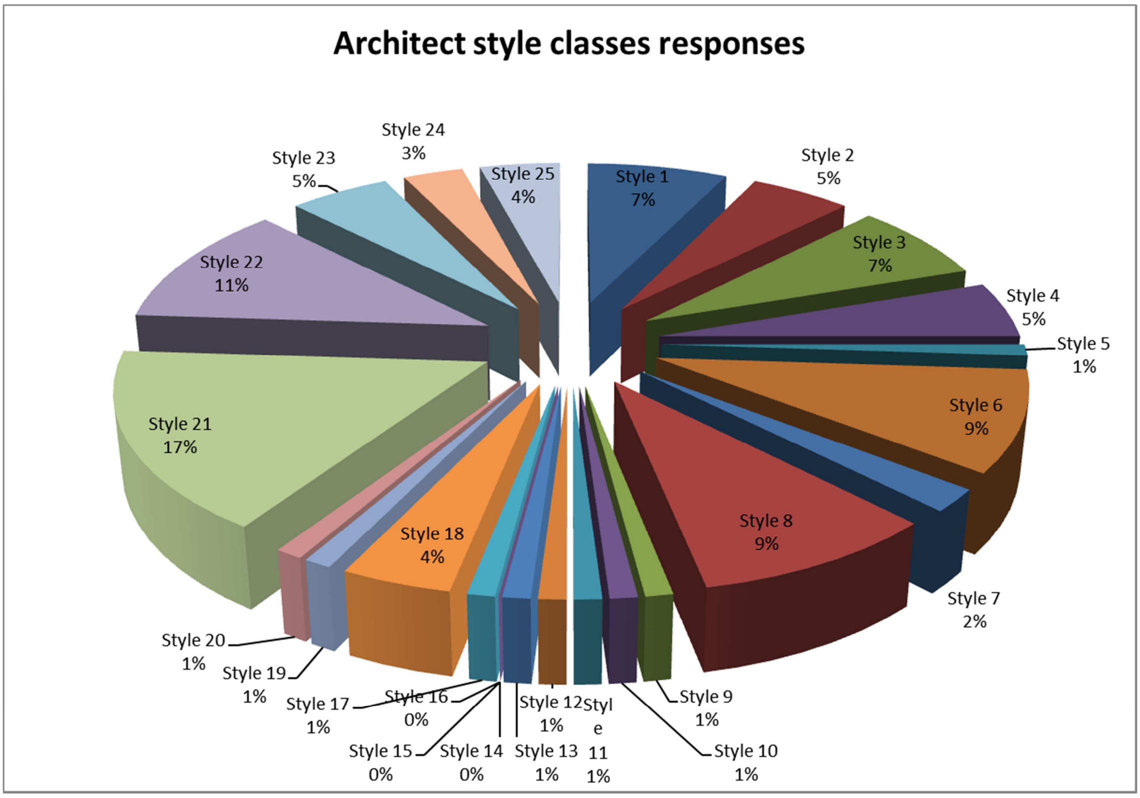



**Figure 6-II: Architect style classes 113 responses**

Having identified the nine relevant architect styles with the participants' population of 86, Figure 6-JJ indicates the percentage of the participants having identified with one of the nine specific architect styles. Four architect styles were identified as being dominant with the most dominant architect style representing 22% of the responses. A total of four architect style represented the majority of participants with a combined 61% of the relevant responses.

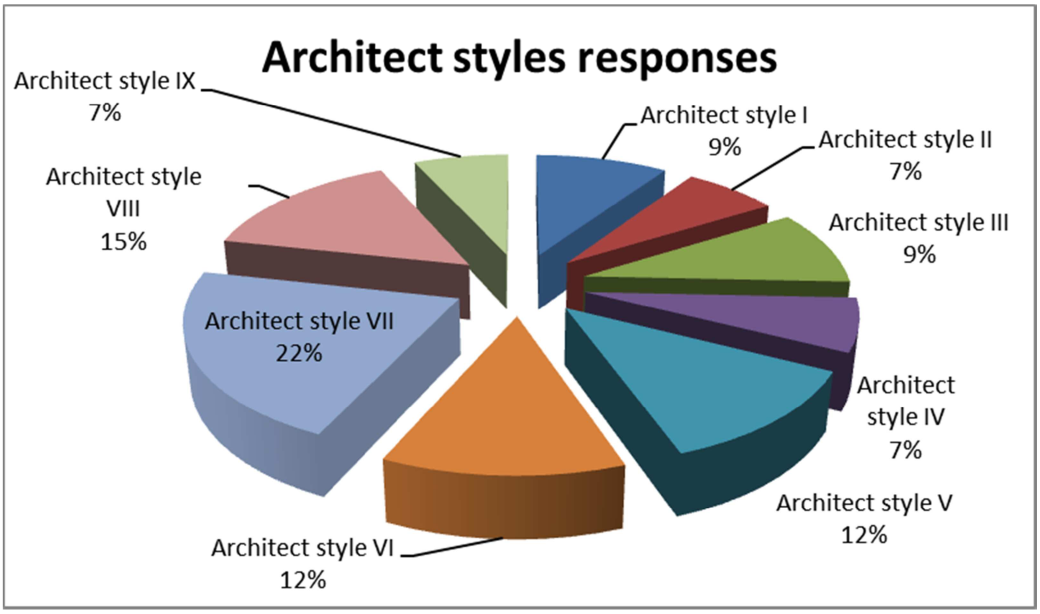



**Figure 6-JJ: Architect styles 86 responses**

## 6.5 Conclusion

This chapter gave the design and analysis of the architect styles indicator and taxonomy, which form part of the Daedalus Instrument. The design of the architect style indicator, depicted within **Appendix C**, was done to be in line with the research question, objective, purpose as well as the strategy. In addition, the architect styles indicator identified architect attributes can be used to determine any preferences or alignment for an architect to a specific architect style, depicted within Figure 6-W. The relationships between the architect styles, architect behaviours and enterprise architects are depicted within Figure 6-KK.

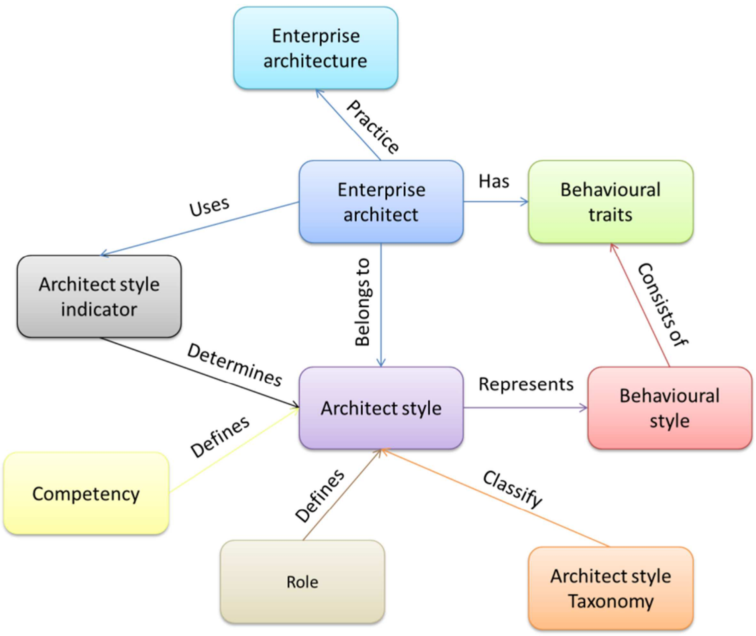



**Figure 6-KK: Enterprise architect, architect styles relationships**

**Chapter 6** also described the third component set of the Daedalus Instrument for Architects, depicted within Figure 6-LL. The outputs of the third internal development cycle, the architect competency and the architect styles taxonomy, were used in the development of the third internal development cycle. **Chapter 7** describes the awareness, suggestion and development of the enterprise architect profiles.

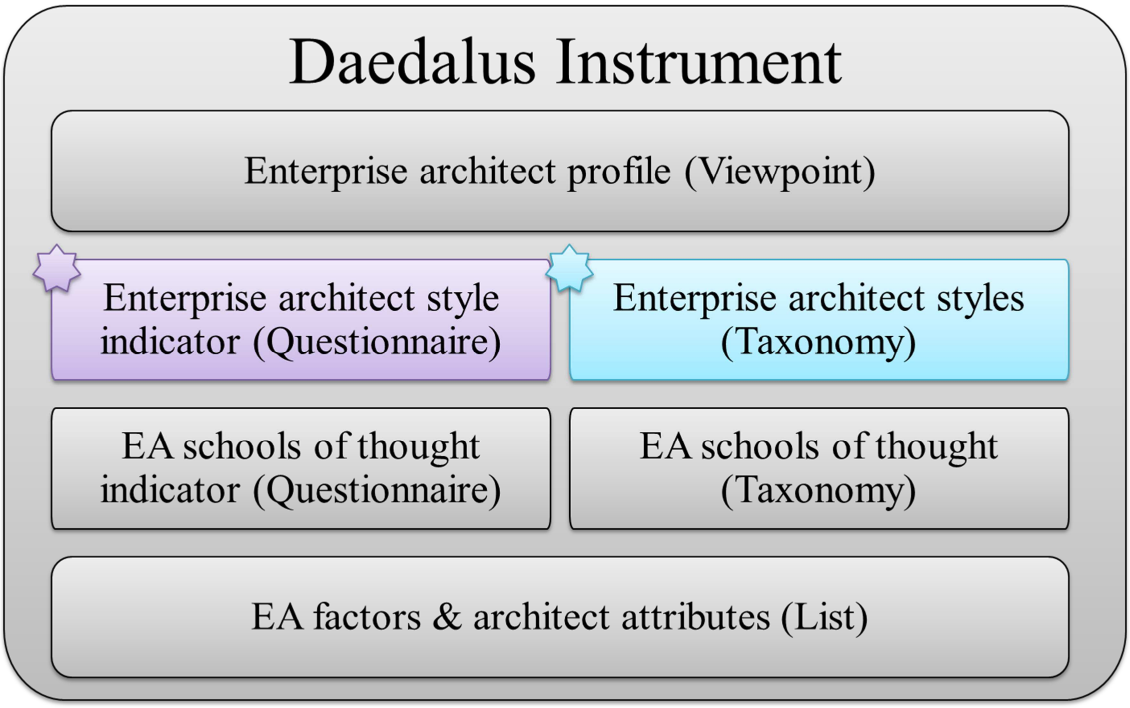
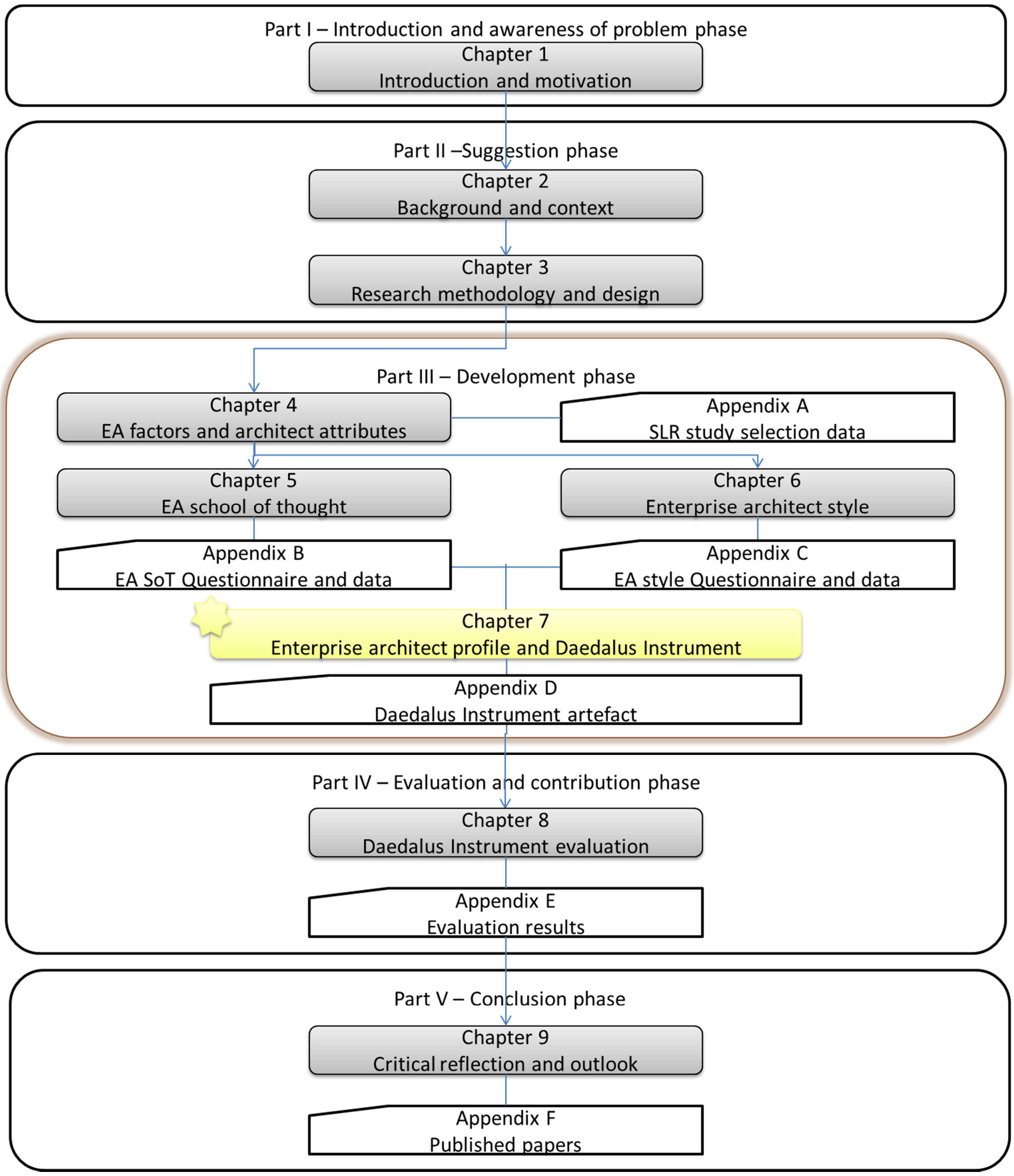



**Figure 6-LL: DIA – Architect style indicator and taxonomy**

# 7 Enterprise architect profiles



## *7.1 Introduction*

**Chapter 4** detailed the systematic literature review (SLR), as the first internal development cycle of the design science research (DSR) strategy, as well as the first component of the Daedalus Instrument, a comprehensive list of EA factors and architect attributes. The SLR led to the identification of core concepts, which are associated with the enterprise architect. **Chapter 5** followed by describing the enterprise architecture (EA) schools of thought as a construct and as the second internal development cycle of the DSR strategy, as well as the second component of the Daedalus Instrument. **Chapter 6** continued with the development of the enterprise architect styles as a construct and as the third internal development cycle of the DSR strategy, as well as the third component of the Daedalus.

Part III of the thesis is concerned with the development of the design artefact. The Enterprise architect profiles and Daedalus Instrument chapter, **Chapter 7,** is divided into six main parts. This chapter, **Chapter 7** with section 7.1, describes the definition and description of the architect profiles as a theory by showing how the constructs from **Chapter 5** and **6** relate. Section 7.1 also describes the fourth internal development cycle of the DSR strategy, as well as the fourth component of the Daedalus Instrument. Sections 7.2 and 7.2.2.1 describe the concepts and constructs relevant to the identification and definition of the architect profile theory. Section 7.4 provides insights into the creation of the architect profile theory by showing how these constructs and concepts relate. Section 7.5 describes the collection of the Daedalus Instrument relationships, as well as the design of the Daedalus Instrument itself as models. Section 7.6 describes the DIA and its components as the design artefacts, as well as its technical implementation using a website www.daedalusinstrument.com. Finally, the chapter concludes in section 7.6.1, by presenting an instrument, which includes this theory to be used by practitioners to better understand the enterprise architect. This is illustrated in Figure 7-A, which also gives the layout of this chapter.

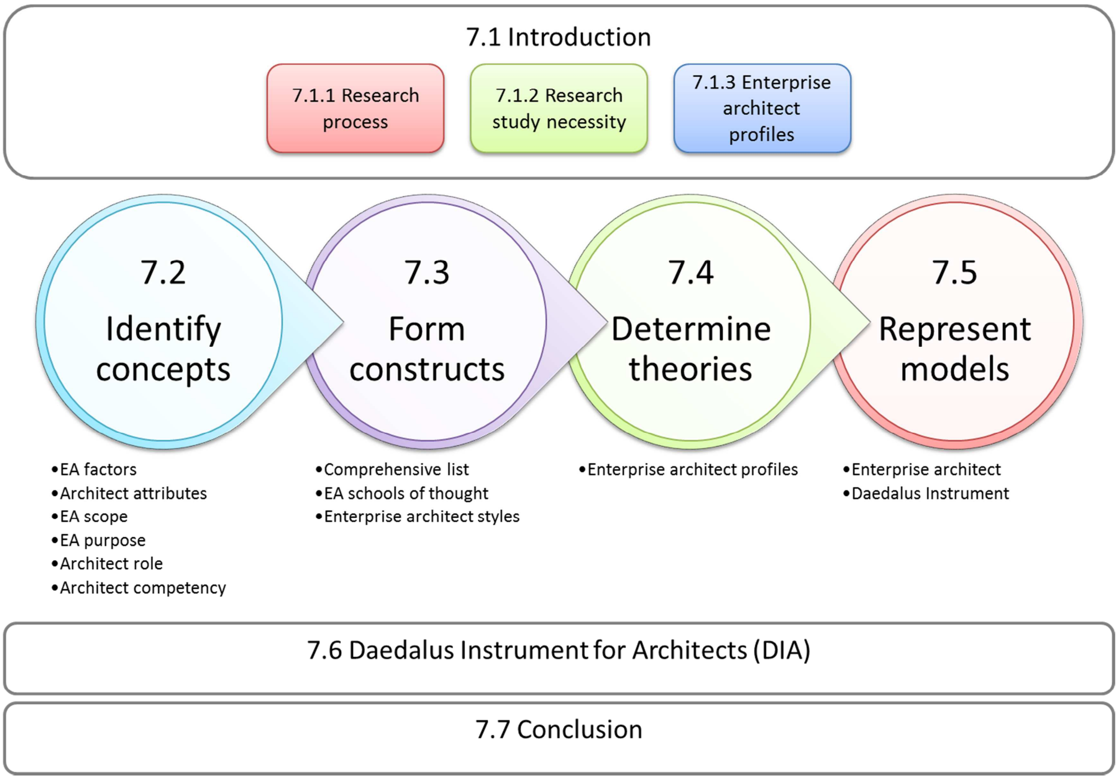



**Figure 7-A: Chapter layout**

This chapter explores and evaluates information pertaining to the enterprise architect in order to answer a specific research question. The alignment of **Chapter 7** to that of the thesis is depicted within Table 7-1.

**Table 7-1: Chapter 7 alignment summary**

| # | Sub-research question | Sub-objective | Challenge | Chapter | DSR Process Step | Deliverable |
|---|---|---|---|---|---|---|
| 4 | How can enterprise architect profiles be developed for the understanding of the enterprise architect? | To develop enterprise architect profiles for the understanding of the enterprise architect. | A view needs to be created to describe the various aspects of an architect as they relate to their enterprise architect styles and EA schools of thought. | Chapter 7 – Enterprise architect profile | [D1.4] | Enterprise architect profiles |

## 7.1.1 Research process

The development of the enterprise architect profiles are completed as part of the fourth internal development cycle of the DSR strategy as depicted within Figure 7-B.

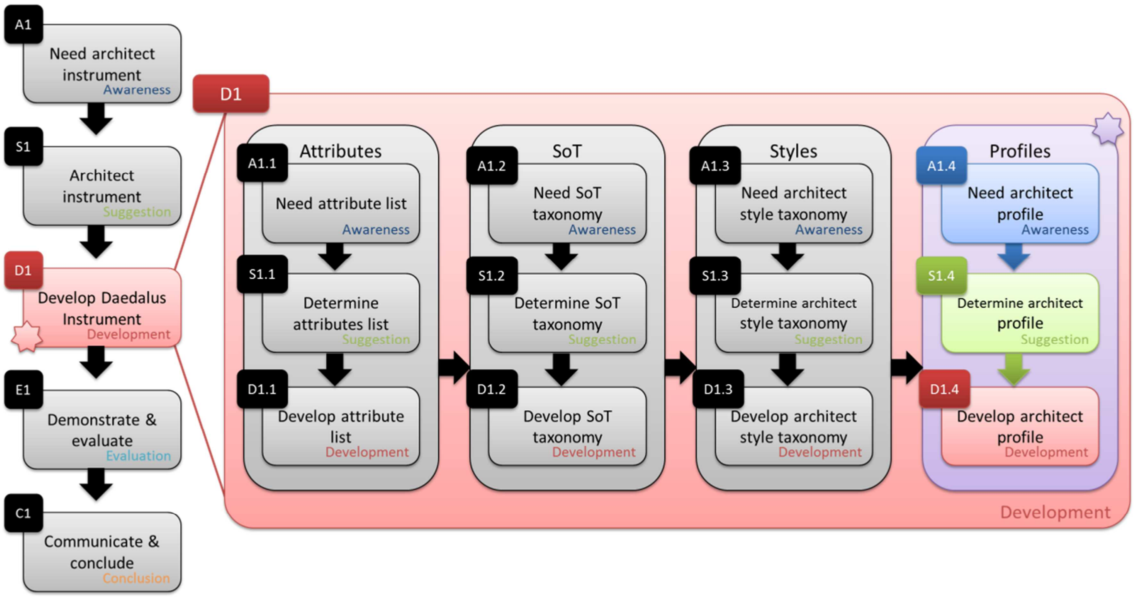



**Figure 7-B: Enterprise architect profiles in relation to the DSR development cycle**

The aim of the study is to develop enterprise architect profiles for the understanding of the enterprise architect. The definition and description of architect profiles will be given as a model representing a theory, which is developed by ordering concepts into a coherent framework. The theory considers concepts as building blocks of research ideas and constructs as an interlinked framework and grouping of concepts (Page & Meyer, 2000).

The constructs included the three building blocks as defined and described within each of the internal development cycle of the DSR strategy. In the first internal development cycle, the systematic literature review led to the creation of a comprehensive list of EA factors and architect attributes as core concepts describing Enterprise Architects, defined within **Chapter 4**. In the second internal development cycle, the EA factors and architect attributes were used to determine enterprise architects' belief systems as the EA schools of thought within **Chapter 5**. The third internal development cycle defined enterprise architects' behavioural styles as enterprise architect styles in terms of their roles and competencies, described within **Chapter 6**.

Linking the architect constructs which comprise core concepts, results in a theory for the enterprise architect profile, which can be represented by a model. This theory building process is depicted within Figure 7-C (Page & Meyer, 2000).

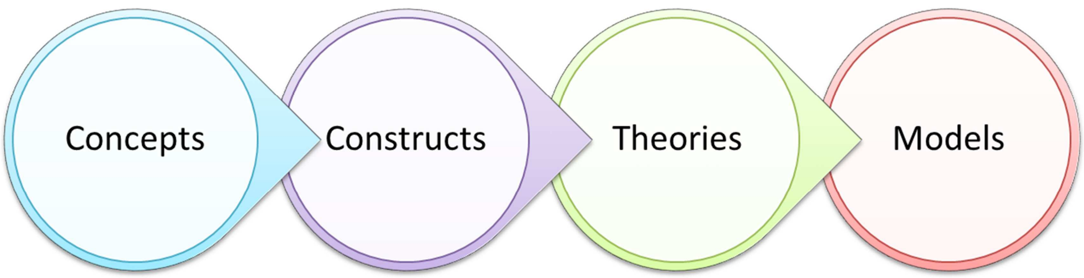



**Figure 7-C: Interrelationship of research notions (Page & Meyer, 2000)**

To ensure that the creation of a theory is consistent and in line with the DSR strategy, the enterprise architect profile theory was constructed using criteria, approaches and methods specifically for theory construction in design research, depicted within Figure 7-D (Friedman, 2003).

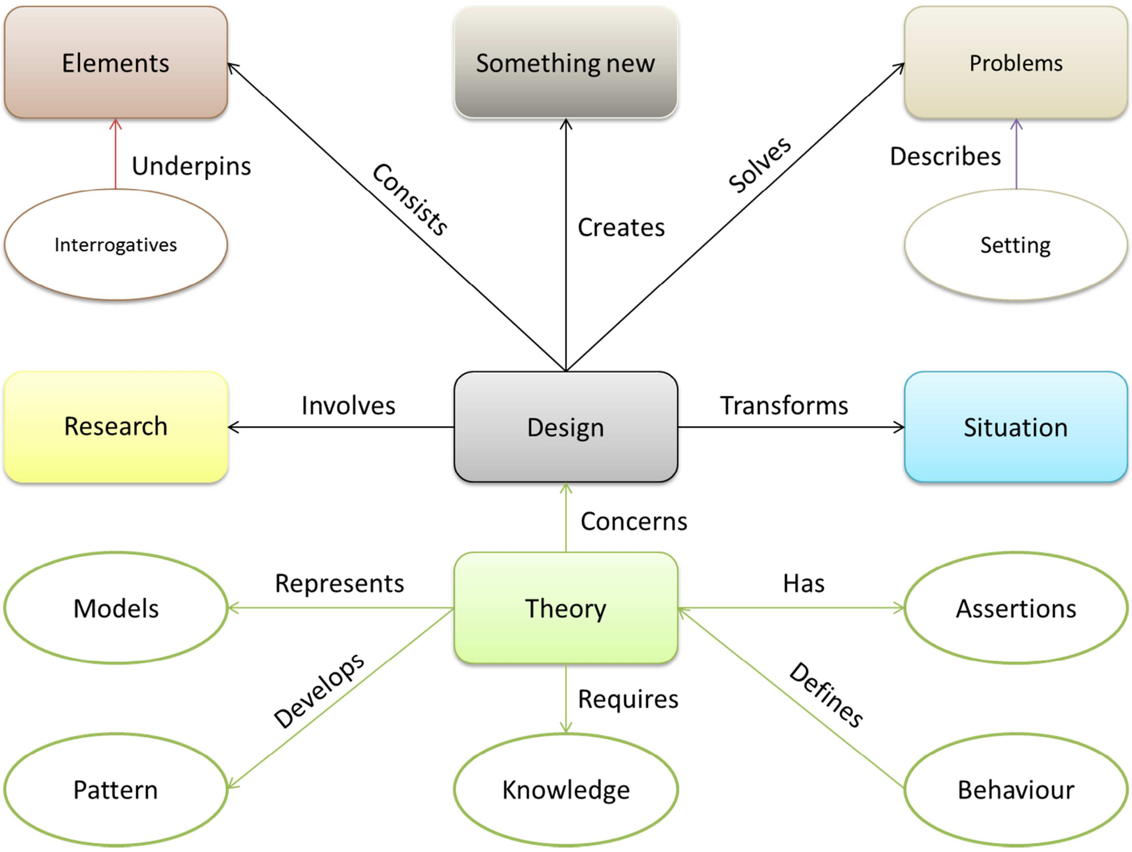



**Figure 7-D: Theory construction in design research (Friedman, 2003)**

### 7.1.2 Research study necessity

The creation of the three artefacts as they relate to enterprise architects describes distinct enterprise architect constructs. Although these three constructs, architect attributes, EA schools of thought and architect behavioural styles describe distinct aspects as they relate to the enterprise architect, a holistic classification and theory need to be created to better understand the various enterprise architect profiles. An EA profile is suggested to link these constructs into a holistic model. This architect profile theory aids in the understanding of enterprise architects from a more holistic perspective.

Considering the three described architect constructs, each of the construct concepts were identified within the SLR as described within **Chapter 4** and executed as the first internal development cycle of the DSR strategy. Architect profiles are fundamental to understanding the various enterprise architect profiles as architects have different architect aligned attributes, belief systems, and behavioural styles. This leads to architects understanding enterprise architecture and executing their respective EAM functions differently.

Understanding enterprise architect profiles allows for a holistic understanding of enterprise architects. Understanding how the Daedalus Instrument for Architects' (DIA) components can be used, allows for better understanding enterprise architects' profiles with respect to architect attribute list, EA schools of thought and architect styles.

### 7.1.3 Enterprise architect profile

A need exists to understand enterprise architects from a holistic perspective as they relate to enterprise architecture (Bredemeyer & Malan, 2004; Lu & Lin, 2012; Steghuis & Proper, 2008; Tambouris *et al.*, 2012). With the execution of the SLR, a comprehensive list of EA factors and architect attributes were identified. From this list of concepts, three constructs were identified, which provided insight into the understanding of the enterprise architect. These constructs formed the foundation for understanding the enterprise architect profile theory.

The proposition is to develop descriptive profiles that could assist organisations to holistically understand enterprise architects from an EA perspective. The enterprise architect profiles can be used as a tool to better understand enterprise architects on why they execute enterprise architecture management (EAM) differently, how they go about doing EAM, or what impact it has on EAM efficiency and success within the organisation.

A tentative design of the enterprise architect profiles was suggested within Figure 2-H. The design of the enterprise architect profile consisting of the enterprise architect belief systems, behavioural styles and personal factors were determined with the use of the social cognitive theory (Bandura, 1986); see **section 2.3.1** as a foundation to understand enterprise architects in their environment.

The formation of the enterprise architect profiles made use of the construction method, which set out to determine concepts (EA factors and architect attributes), construct (the comprehensive architect attribute list, EA schools of thought taxonomy and the enterprise architect style taxonomy) and formulate the enterprise architect profiles using the social cognitive theory. This method is graphically depicted within Figure 7-E.

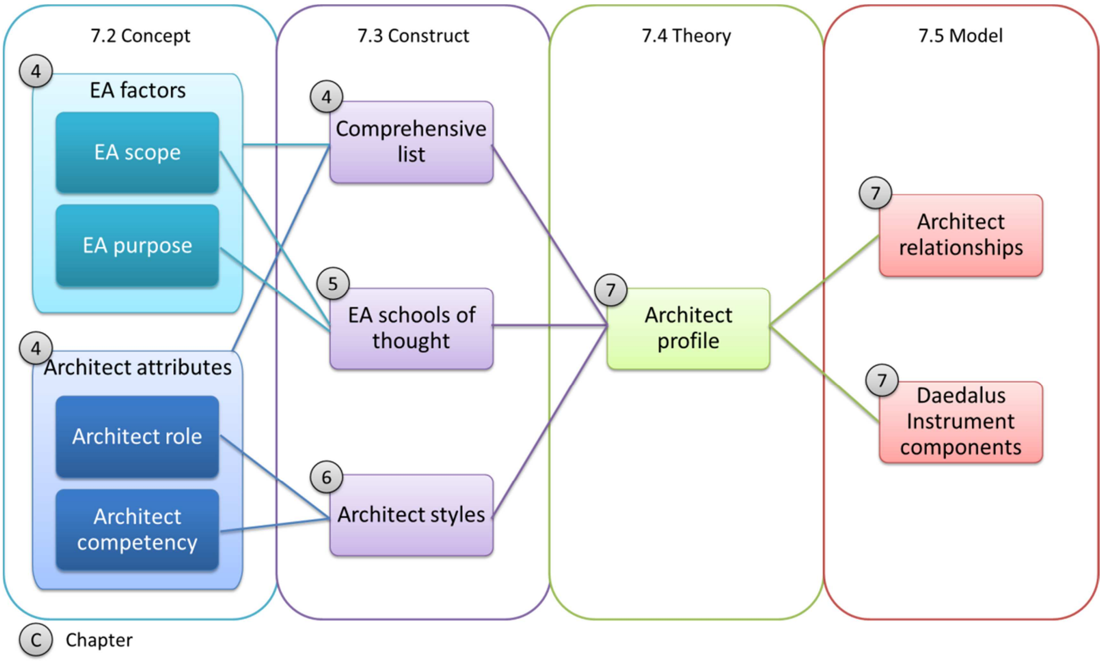



**Figure 7-E: Enterprise architect profiles**

In section 7.2, the concepts are described with their inter-relationships and the alignment to the applicable research question, objective, challenge, thesis chapter, DSR process step, and as a deliverable as depicted within Figure 7-C. The collection of concepts formed the foundation for the creation of the constructs.

## *7.2 Identify concepts*

Concepts are abstract representations of objects or phenomena and defined by identifiable features (Page & Meyer, 2000). These concepts were identified by the execution of the SLR within **Chapter 4**. Table 7-2 indicates the context of the concepts with the alignment to the thesis.

**Table 7-2: Concept context alignment**

| # | Sub-research question | Sub-objective | Challenge | Chapter | DSR Process Step | Deliverable |
|---|---|---|---|---|---|---|
| 1 | What enterprise architect associated EA factors and architect attributes are described in literature? | To determine which enterprise architect associated EA factors and architect attributes are described within literature. | A systematic study needs to be completed on existing literature concerning the enterprise architect. | Chapter 4 – Systematic literature review | [D1.1] | List of EA factors and architect attributes |

### 7.2.1 EA factors

Each of the EA factors as concepts identified within the execution of the SLR, was investigated to find relevant or typical representations of each of the concepts. E.g. one concept, the "level of detail" concept, was represented using four distinct options as "low level of detail", "medium level of detail", "high level of detail" and "various levels of detail".

The same process was then applied to all the EA factor concepts, which was then used in the creation of the two indicators. See **Chapter 4** for the identification of the EA Factors concepts. Figure 7-F illustrates the classification of the EA factors, represented as concepts. These EA factors were classified using four of the six interrogative pronouns (what, how, where and when). The interrogative pronoun (when), was later on determined to not be applicable to the identification of EA factors.

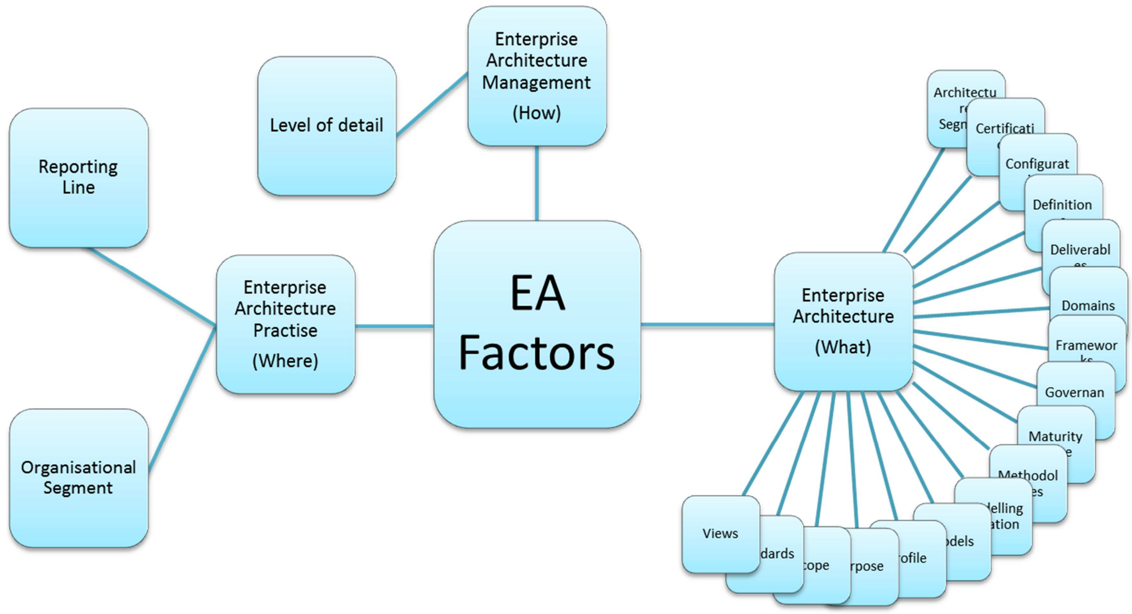



**Figure 7-F: EA factors as concepts**

### 7.2.1.1 EA scope

A number of concepts were selected from the identified architect attributes that related to the understanding of the enterprise architect regarding who they are and why they perform EAM in a certain way. These attributes were not selected on how an enterprise architect performed EAM or what EAM was about. These attributes were observed in multiple sources as identified within the SLR in **Chapter 4**.

The enterprise architect belief systems formed part of the behavioural factors as part of the social cognitive theory (Bandura, 1986). EA Scope was highlighted by Lapalme, who emphasised that "EA scope" represented the scope of planning the EA initiative, i.e. the scope of EA which is under consideration to be changed (Lapalme, 2012a). EA scope represented three common positions (enterprise-wide IT platform, enterprise, and enterprise in its environment) which architects take when considering planning an EA initiative, depicted with Figure 7-G. The EA scope concept was discussed in detail in **Chapter 5**.

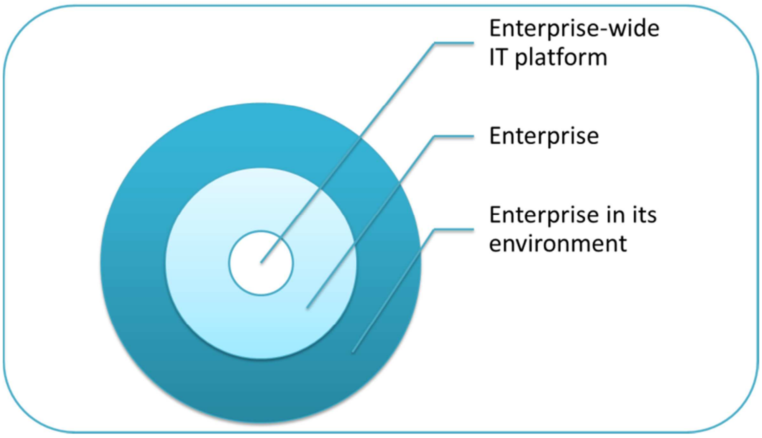



**Figure 7-G: EA scope as a concept (Lapalme, 2012a)**

### 7.2.1.2 EA purpose

EA purpose is similar to EA scope, where a number of concepts were selected from the identified architect attributes that related to the understanding of the enterprise architect on who they are and why they perform EAM in a certain way. EA purpose, identified within **Chapter 4**, was also highlighted by Lapalme, who emphasised that “EA purpose” represented the purpose for planning an EA initiative, rather than the purpose of executing the EA initiative (Lapalme, 2012a). Similarly, EA purpose represented three common positions (business strategic formation, business IT alignment, and business strategy implementation) which architects take when considering planning an EA initiative, depicted with Figure 7-H. The EA purpose concept was discussed in detail in **Chapter 5**.

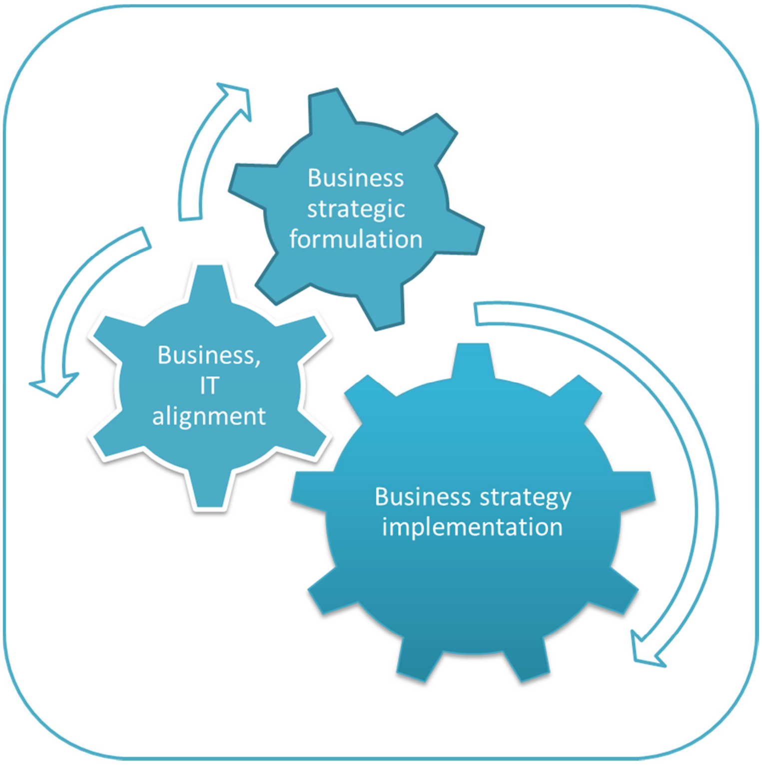



**Figure 7-H: EA purpose as a concept (Lapalme, 2012a)**

### 7.2.2 Architect attributes

Similarly to EA factors, each of the architect attributes as concepts identified within the execution of the SLR, were then investigated to find relevant or typical representations of each of the concepts. E.g. One concept, the "Position level" concept, was represented using five distinct options as "Junior level", "Mid-level", "Senior level", "Chief level" and "Executive level". The same process was then applied to all the architect attribute concepts, which were then used in the creation of the two indicators. See **Chapter 4** for the identification of the architect attribute concepts. Figure 7-I illustrates the classification of the EA factors, represented as concepts. These enterprise architect attributes were classified using two of the six interrogative pronouns (who and why).

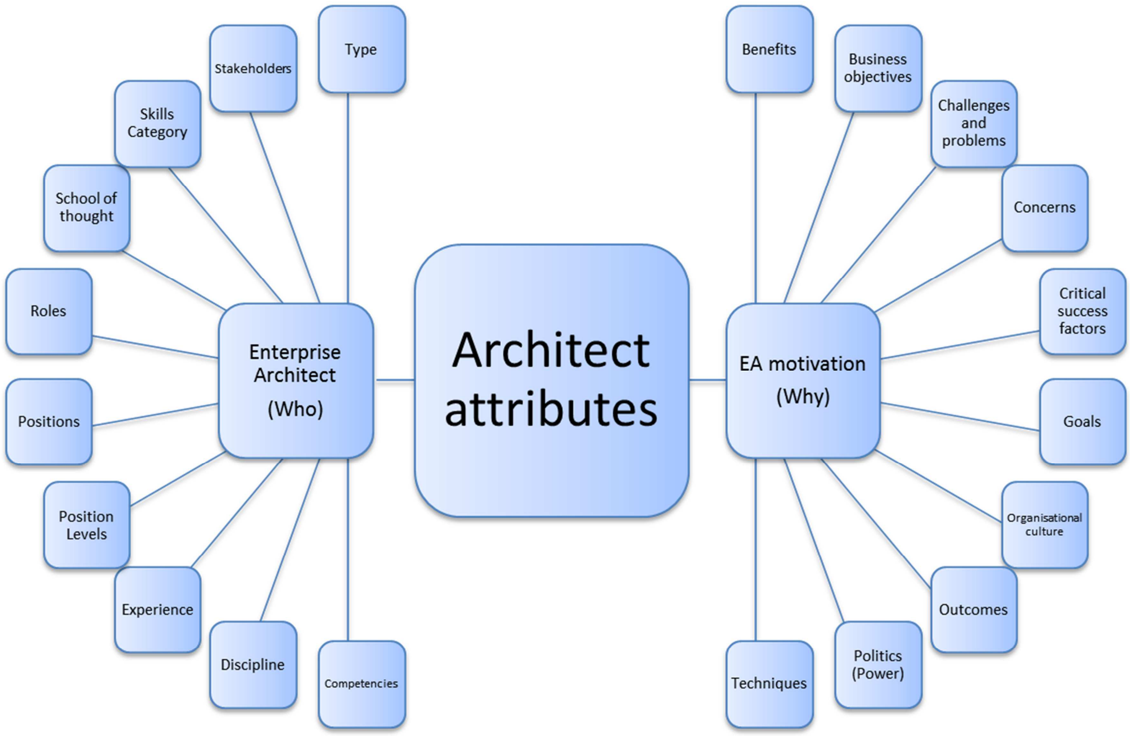



**Figure 7-I: Architect attributes as concepts**

#### 7.2.2.1 Architect role

Architect role was identified as one of the architect attributes within the SLR in **Chapter 4**. Similar to EA scope and EA purpose, architect role is related to the understanding of the enterprise architect on who they are and why they perform EAM in a certain way. The understanding of architect roles also forms the foundation to support the profession of enterprise architects (Strano & Rehmani, 2007). These five functional EA roles, depicted within Figure 7-J, were identified by subject matter experts (SME) within the executive branch of the US Federal Government, which also described the interfaces with other functional roles. The architect role concept was discussed in detail in **Chapter 6**.

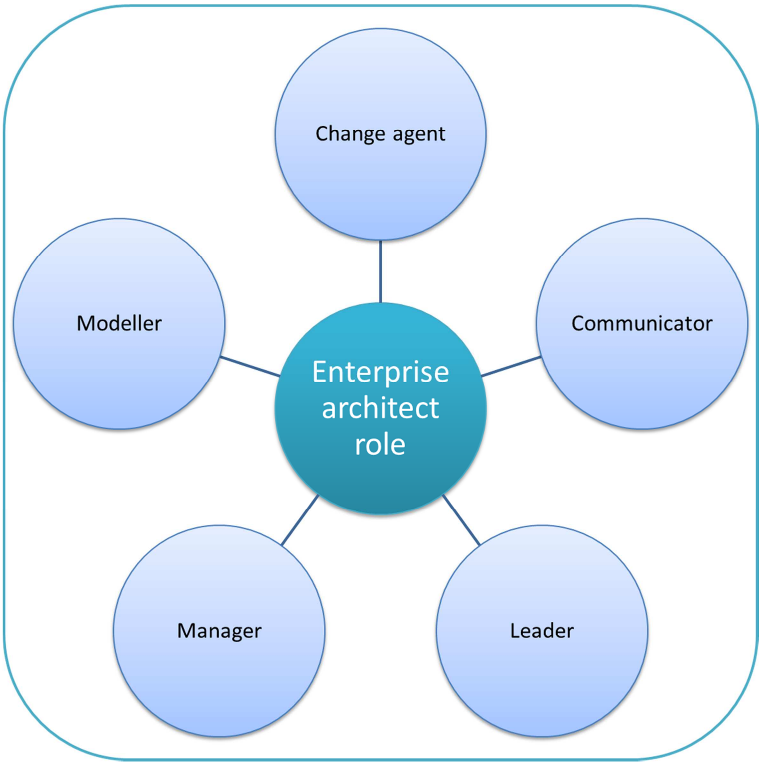



**Figure 7-J: Enterprise architect role as a concept (Strano & Rehmani, 2007)**

### 7.2.2.2 Architect competency

Similar to architect roles, architect competencies were also identified as one of the architect attributes within the SLR in **Chapter 4**. Architect competencies are related to the understanding of the enterprise architect on who they are and why they require specific competencies to perform their respective EA roles. In an executive report, enterprise architect competencies were expressed as five competency areas (leadership, technical, organisational politics, strategy and consulting), which addressed the necessary qualities of great enterprise architects, depicted within Figure 7-K (Bredemeyer & Malan, 2004). These five architect competencies were expressed using three contextual perspectives (what you are, what you know and what you do) as they refer to architects' behaviours, one of the contextual perspectives being personal characteristics.

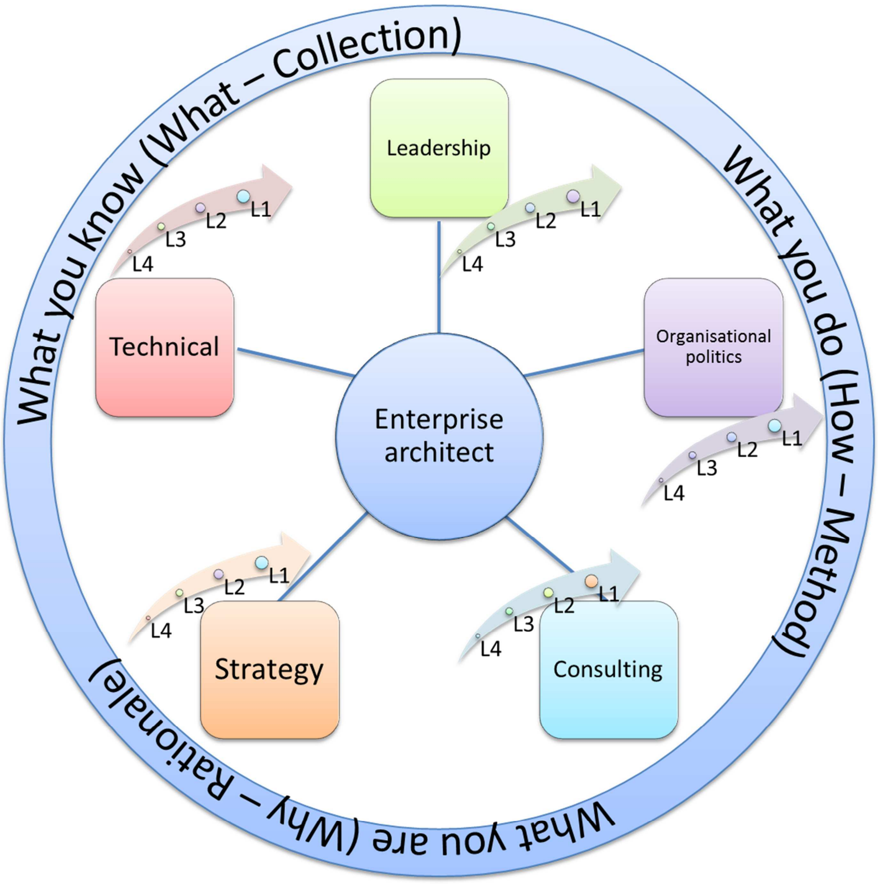



**Figure 7-K: Enterprise architect competency framework (Bredemeyer & Malan, 2004)**

In an unrelated study, basic competencies of enterprise architects were identified for operating within enterprise architecture teams (Steghuis & Proper, 2008). These competencies were classified within two distinct competency categories: professional competencies and personal competencies. Personal enterprise architect competencies represent 35 specific competencies concerned with the influence behind performing a specific role, depicted within Figure 7-L.

**Professional competencies**

- Knowledge
- Attitude
- Skills

**Personal competencies**

| | | | |
|---|---|---|---|
| Abstraction capacity | Accurateness | Analytical skills | Authenticity |
| Consulting | Creativity | Decisiveness | Dedication |
| Didactical skills | Diplomacy | Facilitation skills | Flexibility |
| Independency | Initiative | Integrity | Leadership |
| Listening | Loyalty | Negotiation | Openness |
| Opinion forming | Organisational awareness | Persistence | Persuasiveness |
| Plan and organise | Result driven | Self development | Self-confidence |
| Sensitivity and empathy | Stability | Teamwork | Verbal communication |
| Visualisation skills | Working systematically | Written communication | |

**Figure 7-L: Basic competency categories and competencies (Steghuis & Proper, 2008)**

An architect competency classification was then created using the personal architect competencies from both these studies (Bredemeyer & Malan, 2004; Steghuis & Proper, 2008). This architect competency as a concept was described in detail in **Chapter 6**.

## *7.3 Form constructs*

Constructs are the structural frameworks used for linking multiple concepts into inclusive and complete concept abstract representations or phenomena, which are not generally measurable or observable (Page & Meyer, 2000). These constructs were identified by the execution of the SLR, the study on the EA schools of thought and the study on the enterprise architect style and described within **Chapter 4**, **Chapter 5** and **Chapter 6**. Table 7-3 indicates the context of the constructs with the alignment to the thesis.

**Table 7-3: Constructs context alignment**

| # | Sub-research question | Sub-objective | Challenge | Chapter | DSR Process Step | Deliverable |
|---|---|---|---|---|---|---|
| 1 | What enterprise architect associated EA factors and architect attributes are described in literature? | To determine which enterprise architect associated EA factors and architect attributes are described within literature. | A systematic study needs to be completed on existing literature concerning the enterprise architect. | Chapter 4 – Systematic literature review | [D1.1] | List of EA factors and architect attributes |

| # | Sub-research question | Sub-objective | Challenge | Chapter | DSR Process Step | Deliverable |
|---|---|---|---|---|---|---|
| 2 | How can an EA schools of thought indicator be developed for the consistent classification of EA schools of thought? | To develop an EA schools of thought indicator for the consistent classification of EA schools of thought. | An instrument and classification needs to be created to allow an organisation to determine the specific EA school of thought an architect would align to. | Chapter 5 – EA schools of thought | [D1.2] | EA school of thought indicator + classification |
| 3 | How can an enterprise architect style indicator be developed for the consistent classification of enterprise architect behavioural styles? | To develop an enterprise architect style indicator for the consistent classification of the enterprise architect styles. | An instrument and classification needs to be created to allow an organisation to determine the specific enterprise architect style of an architect. | Chapter 6 – Enterprise architect style | [D1.3] | Enterprise architect styles + classification |

### 7.3.1 Comprehensive list of EA factors and architect attributes

The concepts identified within the SLR in **Chapter 4**, were classified using the six interrogative pronouns to better understand the context of each of the concept classes. EA factors were aligned to four concept areas (EA as what, EA practice as where, EA cycle as when, and EAM as how), while architect attributes were aligned to the remaining two areas (enterprise architect as who, and EA motivation as why), detailed within Figure 7-M.

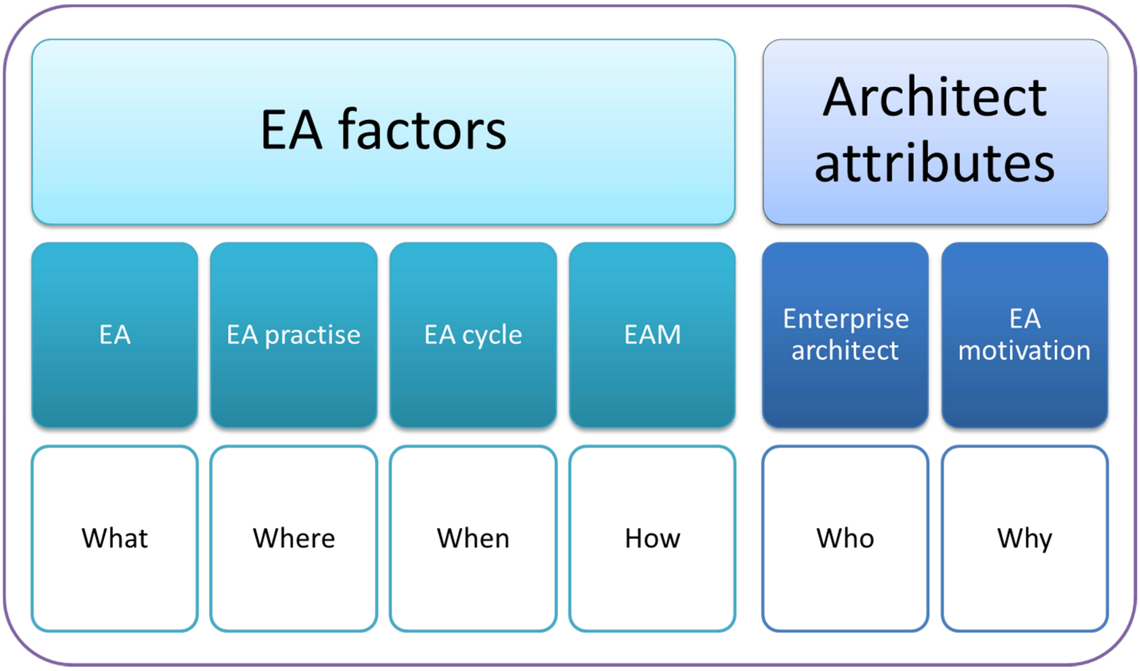



**Figure 7-M: EA factors and architect attributes design**

**Chapter 4** concluded with the suggestion, awareness and development of a comprehensive list of EA factors and architect attributes found within current literature. These EA factors and architect attributes were identified using a SLR, which was concerned with aspects as they relate to the enterprise architect. The SLR study resulted in a comprehensive list of 40

EA factors and architect attributes described in detail within **Chapter 4** and depicted within Figure 4-F and listed within Table 7-4.

**Table 7-4: Comprehensive list as a construct – EA factors and architect attributes**

| | | | | |
|---|---|---|---|---|
| Level of detail | Governance | Standards | Positions | Challenges and problems |
| Architecture Segment | Maturity stage | Views | Roles | Concerns |
| Certification | Methodologies | Organisational Segment (Business unit) | School of thought | Critical success factors |
| Configuration | Modelling Notation | Reporting Line | Skills Category | Goals |
| Definitions | Models | Competencies | Stakeholders | Organisational culture |
| Deliverables | Profile (Organisation, UML) | Discipline | Type | Outcomes |
| Domains | Purpose | Experience | Benefits | Politics (Power) |
| Framework | Scope | Position Levels | Business objectives | Techniques |

The construct of the comprehensive list of EA factors and architect attributes were created by linking multiple concepts, EA factors, and architect attributes into an inclusive and complete concept abstract representation. The relationships between EA factors, architect attributes and enterprise architects are depicted within Figure 4-G. The comprehensive list of EA factors and architect attributes formed the first component of the Daedalus Instrument, which was used as input into the second internal development DSR cycle. Figure 7-N depicts the relationships between concepts, constructs, theory and model, using the construction method.

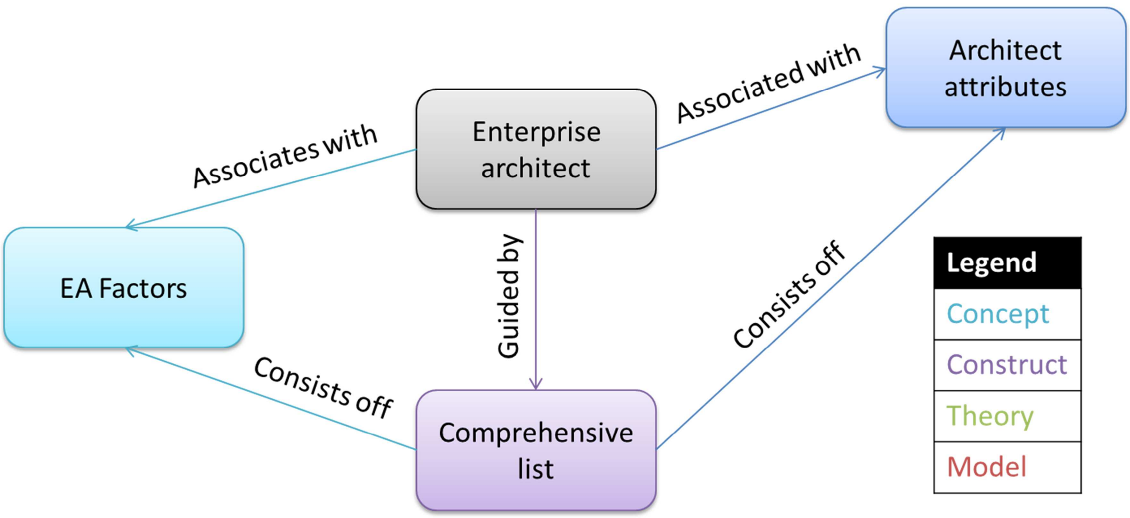



**Figure 7-N: Enterprise architect, EA factors and architect attributes relationships**

### 7.3.2 EA schools of thought

**Chapter 5** described the design and analysis of the EA school of thought indicator and taxonomy, which formed the second component of the Daedalus Instrument and were developed within the second internal development cycle of the DSR strategy. The design of the EA school of thought indicator was done to be in line with the research question, objective, purpose, as well as the strategy. In addition, the EA school of thought indicator identified EA factors and architect attributes, and can be used to determine a certain enterprise architect belief system as depicted within Figure 7-O. Figure 7-O represents the classification of the EA schools of thought, which makes use of three distinct options of EA scope and three distinct options for EA purpose.

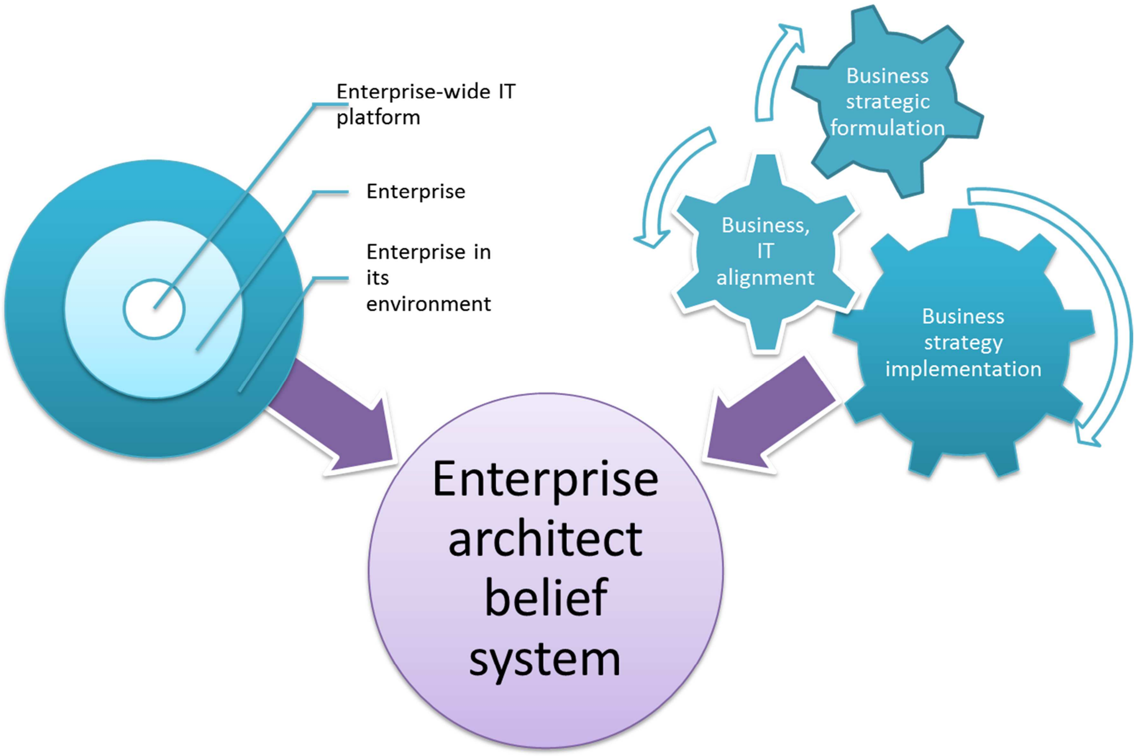



**Figure 7-O: Enterprise architect belief system design**

The construct of the EA schools of thought taxonomy and indicator were created by linking multiple concepts, EA scope, and EA purpose, into an inclusive and complete concept abstract representation. In addition, the relationships between EA factors, architect attributes and the EA schools of thought indicator can be used to determine any preferences or alignment for an architect to a specific EA school of thought depicted within Figure 7-P. Figure 7-P represents the matrix classification of three options for EA scope and three options for EA purpose. On conclusion of the study conducted within **Chapter 5** on the EA schools of thought, it was found that from the theoretical nine EA schools of thought, only seven were found to be relevant.

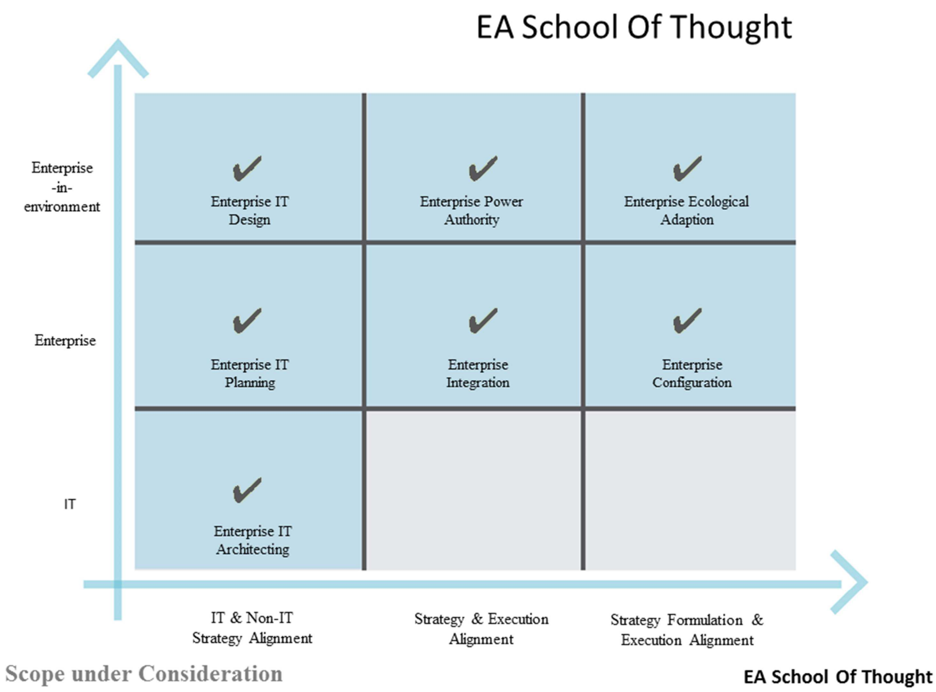



**Figure 7-P: EA schools of thought as a construct**

The relationships between the EA schools of thought, architect belief systems and enterprise architects are described in detail within **Chapter 5** and depicted within Figure 7-Q. Figure 7-Q represents the relationships between concept, construct, theory, and model using the construction method for identifying the EA schools of thought constructs and relationships.

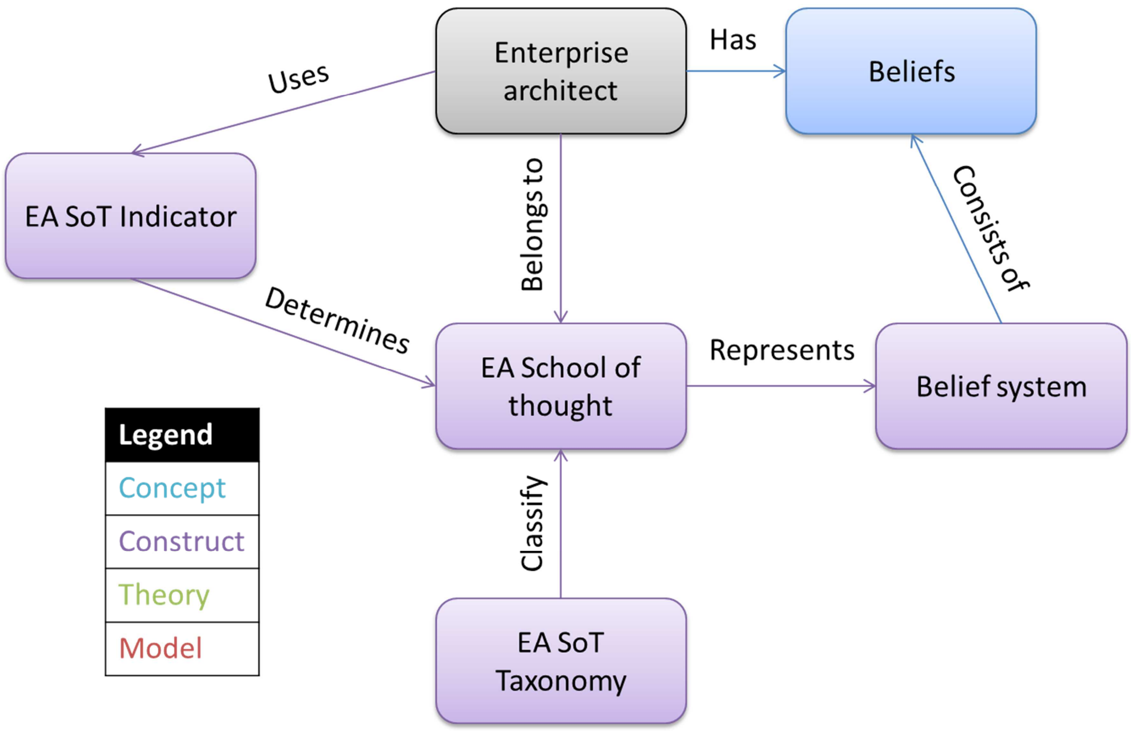



**Figure 7-Q: Enterprise architect, EA SoT relationships**

### 7.3.3 Enterprise architect styles

**Chapter 6** gave the design and analysis of the architect styles indicator and taxonomy, which formed the third component of the Daedalus Instrument and were developed within the third internal development cycle of the DSR strategy. The design of the architect style indicator was done to be in line with the research question, objective, purpose, as well as the strategy depicted within Figure 7-R. Figure 7-R represents the construction of the architect styles classification, which makes use of the EA role and the EA competency concepts.

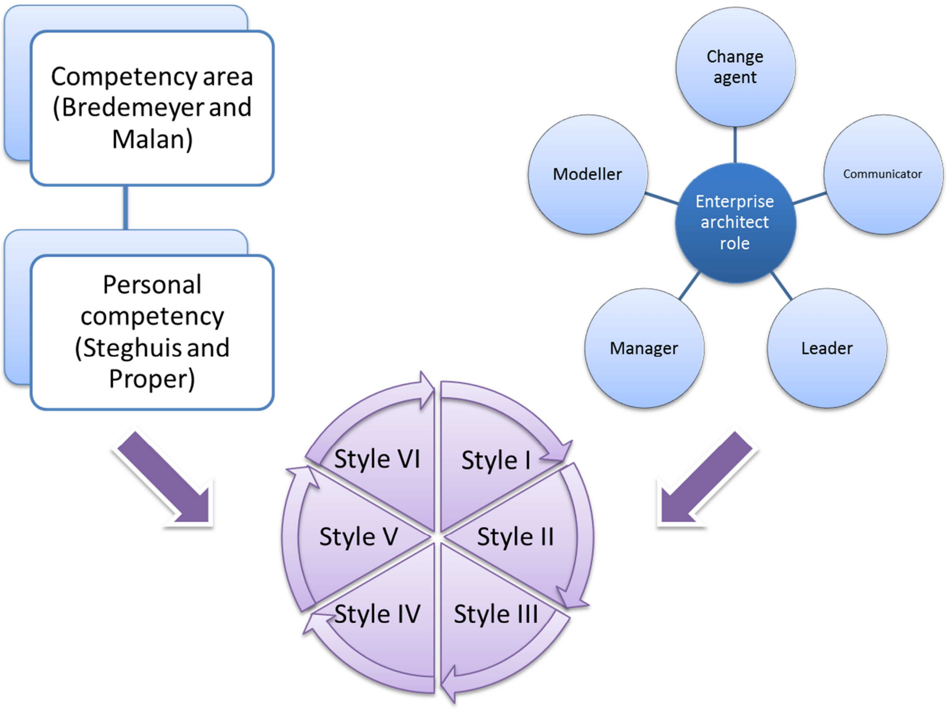



**Figure 7-R: Enterprise architect styles design**

In addition, the architect styles indicator identified architect attributes, which can be used to determine any preferences or alignment for an architect to a specific architect style as depicted within Figure 7-S and described with **Chapter 6**. Figure 7-S represents the matrix classification of architect styles, using five distinct options for EA scope and five distinct options for EA competency. The matrix classification indicated a theoretical 25 possible EA styles; however in the study described within **Chapter 6**, only nine EA styles were found to be applicable.

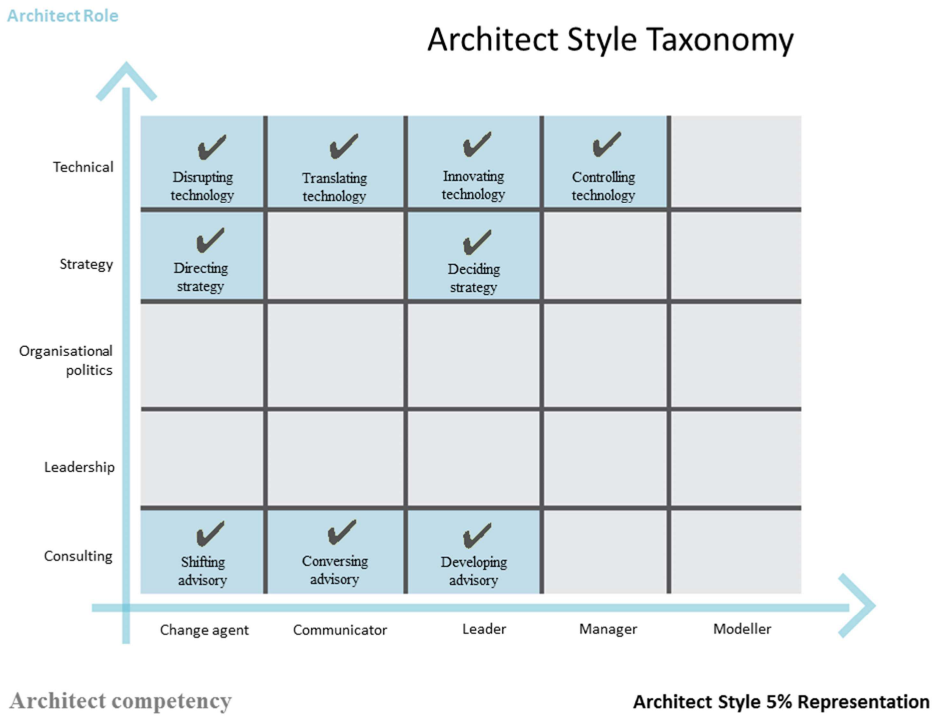



**Figure 7-S: Enterprise architect styles as a construct**

The construct of the enterprise architect styles taxonomy and indicator were created by linking multiple concepts, enterprise architect roles, and enterprise architect competencies attributes, into an inclusive and complete concept abstract representation. The relationships between the architect styles, architect behaviours and enterprise architects are described in detail within **Chapter 6** and depicted within Figure 7-T. Figure 7-T represents the relationships between concepts, constructs, theory, and models by using the construction method to identify the architect styles construct and relationships. Similar to the determining of the enterprise architect belief systems, the enterprise architect styles formed part of the behavioural factors as defined by the social cognitive theory (Bandura, 1986).

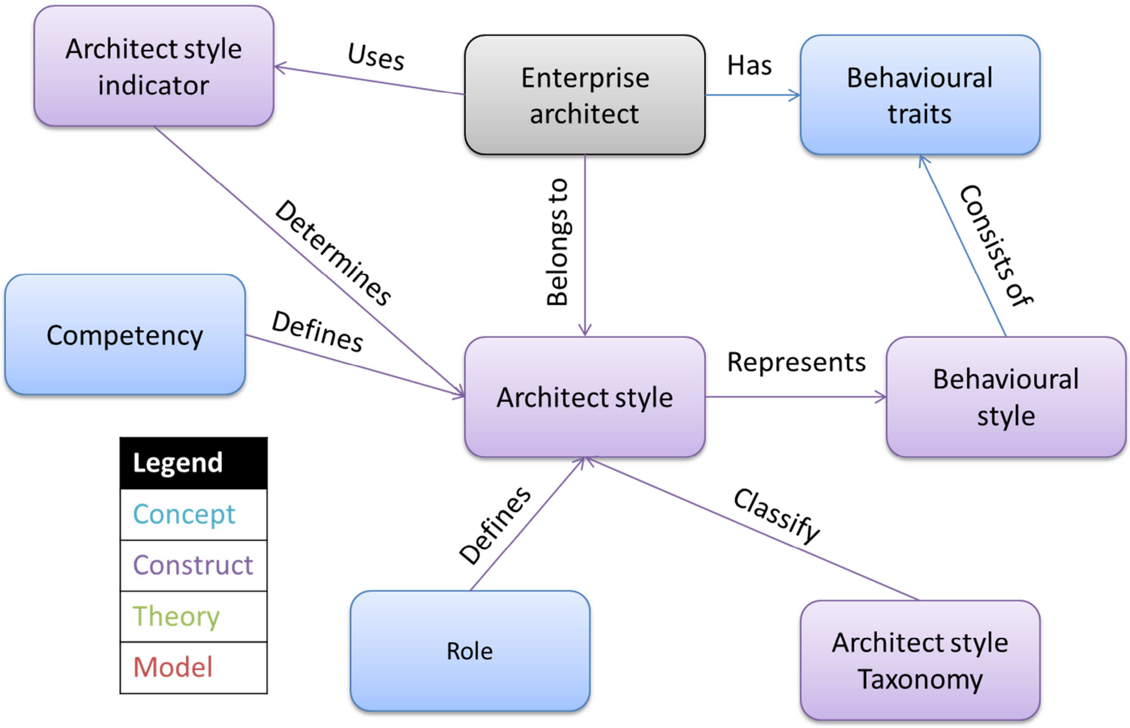



**Figure 7-T: Enterprise architect, architect styles relationships**

## *7.4 Determine theories*

Extending on the understanding of constructs, theories explain relationships between elements, in order to explain a phenomenon or event, while making predictions arising from the theory (Page & Meyer, 2000). Table 7-5 indicates the context of the theory with the alignment to the thesis.

**Table 7-5: Theory context alignment**

| # | Sub-research question | Sub-objective | Challenge | Chapter | DSR Process Step | Deliverable |
|---|---|---|---|---|---|---|
| 4 | How can enterprise architect profiles be developed for the understanding of the enterprise architect? | To develop enterprise architect profiles for the understanding of the enterprise architect. | A view needs to be created to describe the various aspects of an architect as it relates to their enterprise architect styles and EA schools of thought. | Chapter 7 – Enterprise architect profile | [D1.4] | Enterprise architect profiles |

### 7.4.1 Enterprise architect profiles

The design and analysis of the enterprise architect profiles viewpoint formed the fourth component of the Daedalus Instrument and was developed within this development cycle as the fourth internal development cycle of the DSR strategy. The design of the enterprise architect profiles viewpoint was done to be in line with the research question, objective, and purpose, as well as the strategy.

The Daedalus Instrument for Architects (DIA) is loosely based on social cognitive theory, described within section 2.3.1, by considering enterprise architect profiles. Application of the social cognitive theory took into account EA factors and architect attributes, described within **Chapter 4**; the personal factors of the enterprise architect as the EA schools of thought, described within **Chapter 5**; and the behavioural factors as enterprise architect behavioural styles, described in **Chapter 6**.

In addition, the enterprise architect profiles can be used to understand enterprise architects from a specific viewpoint. The design of the enterprise architect profiles is depicted within Figure 7-U. Figure 7-U depicts the construction of the architect profiles, using the EA schools of thought taxonomy, the architect styles taxonomy and the comprehensive list of EA factors and architect attributes. This information, together with the specific answers of a specific architect, determine the architect profile of that architect.

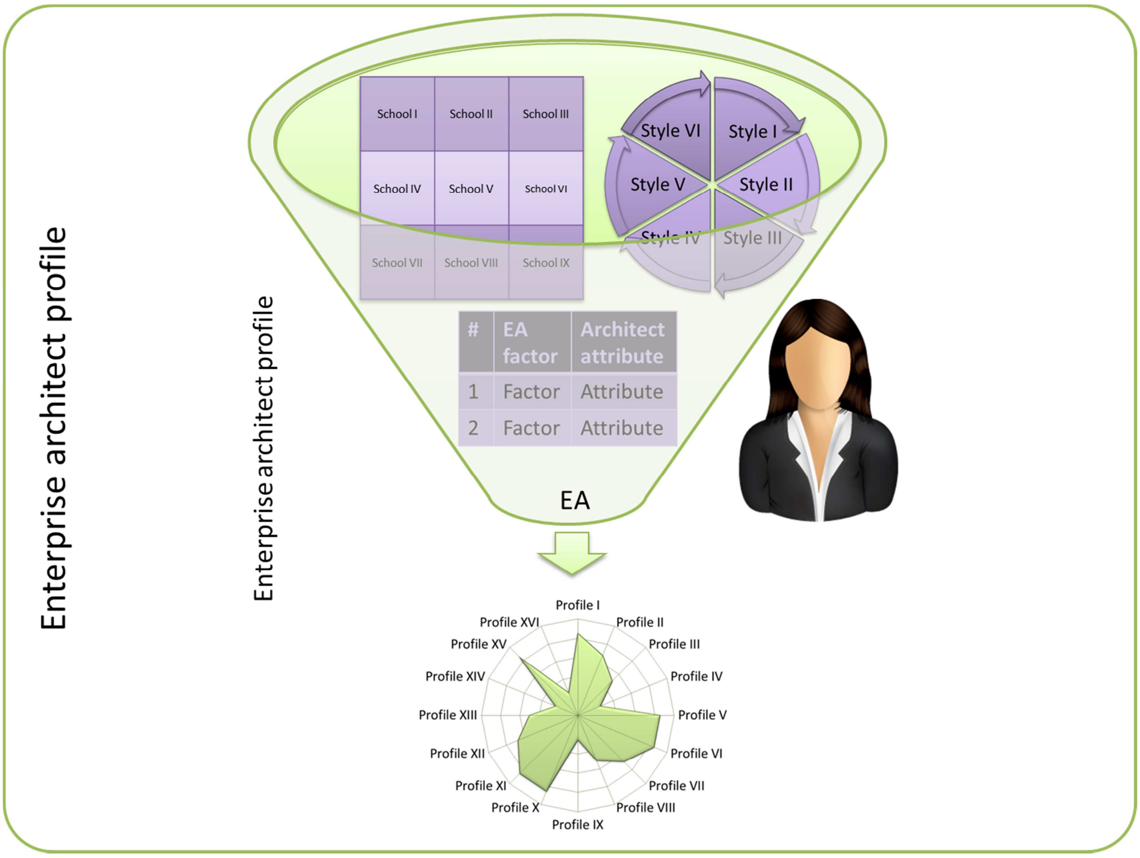



**Figure 7-U: Enterprise architect profile design**

Enterprise architect profiles as a theory extend the understanding of constructs, by explaining the relationships between elements in order to explain a specific phenomenon. The enterprise architect profiles theory was determined by extending the constructs as depicted within Figure 7-V and Figure 7-W. These diagrams depict the formation of the enterprise architect profile theory, using the collection of constructs (comprehensive list of EA factors and architect attributes, EA schools of thought taxonomy, and the enterprise architect styles taxonomy).

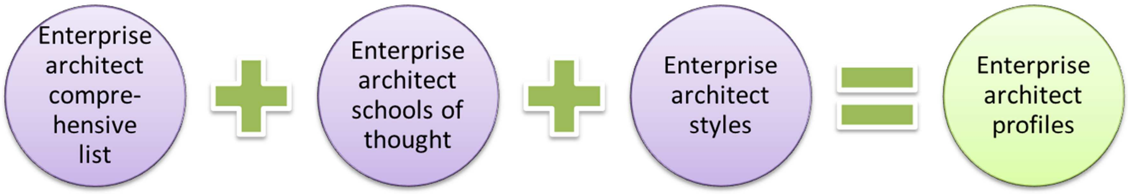



**Figure 7-V: Enterprise architect profile composition**

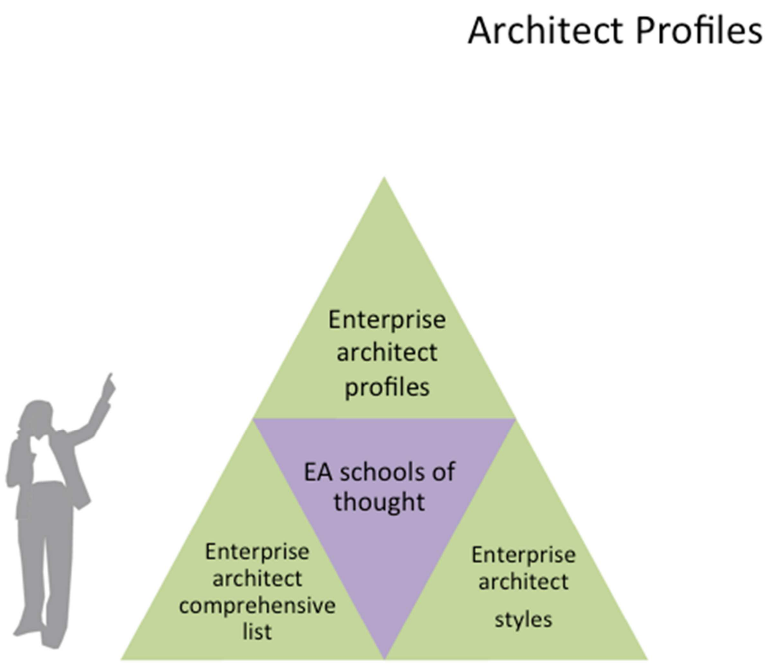



**Figure 7-W: Enterprise architect profiles as theory**

Using the construction method, the relationships between the architect profiles, concepts, constructs, theories and enterprise architects are depicted within Figure 7-X.

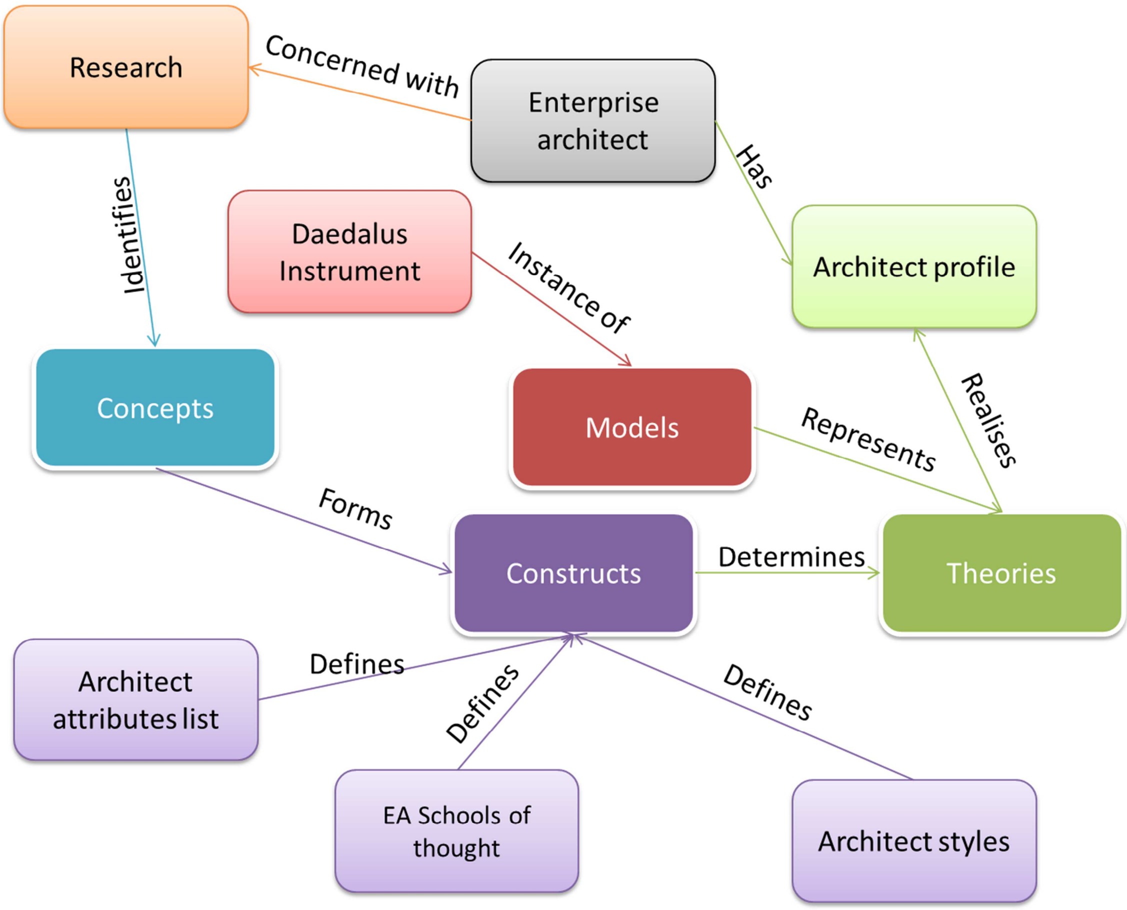



Figure 7-X: Enterprise architect profile relationships

The enterprise architect profiles viewpoint also forms the fourth component of the Daedalus Instrument, depicted within Figure 7-Y.

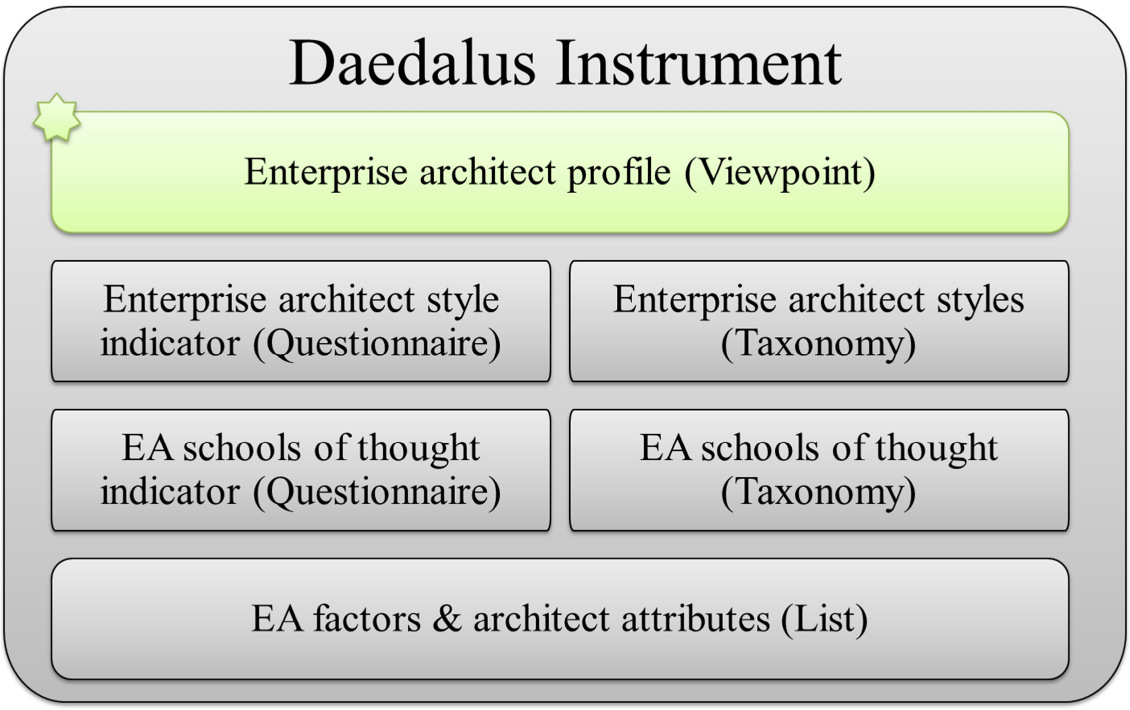



Figure 7-Y: Enterprise architect profile component

The theory on the enterprise architect profiles is described as:

***EA profiles:*** ***The EA profiles of enterprise architects are directly influenced by their belief systems on enterprise architecture as well as their behavioural styles when executing their duties within their working environment.***

## *7.5 Represent models*

A model is "a set of propositions or statements expressing relationships among constructs" (Vaishnavi & Kuechler, 2007, p. 13). Models represent the relationship between the solution components and the research problem with the intent focuses on situated utility. A model is a representation of what the model does, rather than in terms of construct relationships. Models can also be described as profiles, which are original patterns (composition of constructs) of which all things of the same type are representations (Merriam-Webster, 2014). The model of the enterprise architect with respect to enterprise architecture is the composition of the three constructs identified within section 7.2.2.1. Table 7-6 indicates the context of the Daedalus Instrument model with the alignment to the thesis.

**Table 7-6: Models context alignment**

| # | Sub-research question | Sub-objective | Challenge | Chapter | DSR Process Step | Deliverable |
|---|---|---|---|---|---|---|
| 5 | How can an instrument be developed allowing organisations to understand enterprise architects? | To develop an instrument allowing organisations to understand enterprise architects. | An instrument needs to be compiled to allow organisations to consistently gain understanding into the architect as it relates to the various enterprise architect styles. | Chapter 7 – Daedalus Instrument for Architects | [D1] | Daedalus Instrument for Architects |

### 7.5.1 Enterprise architect relationships

Using the construction method, the enterprise architect relationships of concepts, constructs and the theory is depicted within Figure 7-Z.

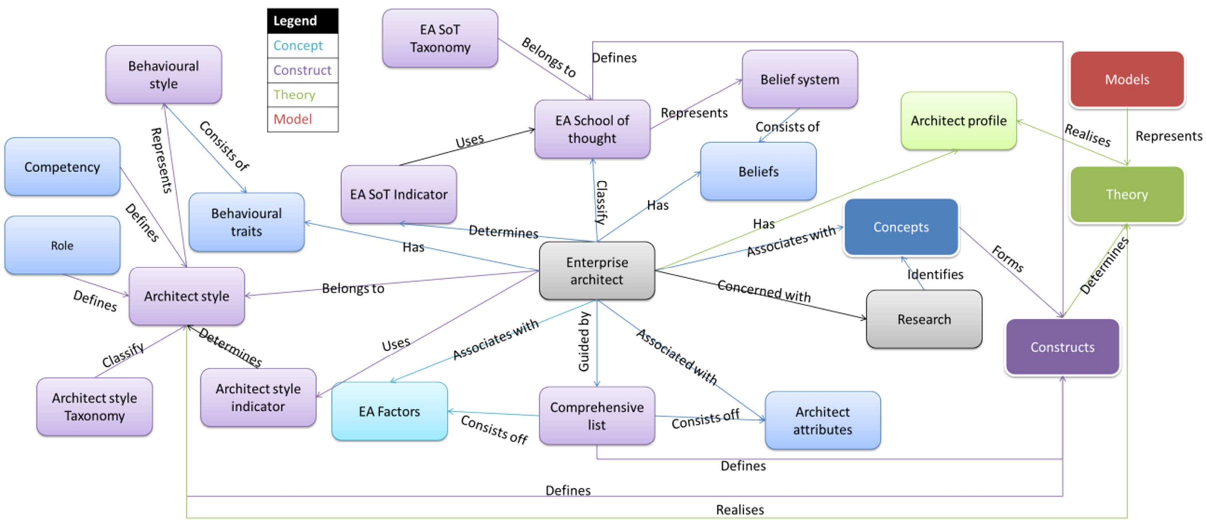



**Figure 7-Z: Enterprise architect relationships**

### 7.5.2 Daedalus Instrument design

The primary development cycle initiated four internal development cycles; each cycle built on the successes of the previous internal development cycle. The primary design and development cycle [D1], considers the four internal development cycles [D1.1, D1.2, D1.3 & D1.4] and their design artefacts, depicted within Figure 7-AA, which are also components of the Daedalus Instrument for the definition and development of the complete and final Daedalus Instrument.

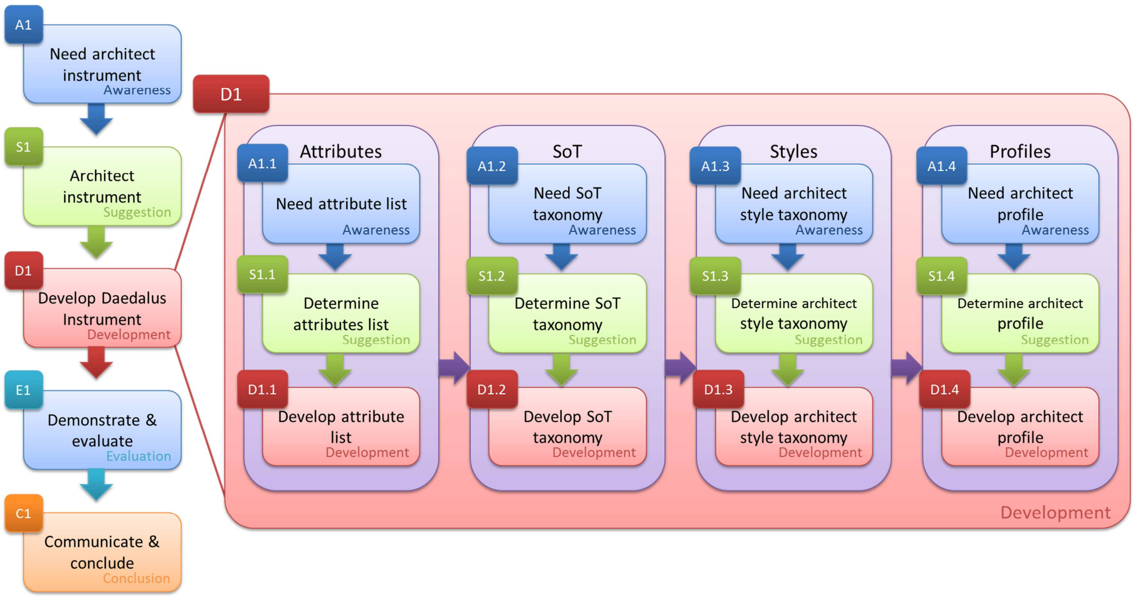



**Figure 7-AA: Complete DSR development cycle [D1]**

The design of the Daedalus Instrument was created to be in line with the research question, objective, and purpose, as well as the strategy, depicted within Figure 7-BB, where the four studies from **Chapter 4**, **5**, **6** and **7** correspond with the four internal development cycles of the DSR methodology and the components of the Daedalus Instrument for Architects.

Lessons learned from the execution of the different studies as each of the internal development cycles, were used and incorporated into the final design of the Daedalus Instrument.

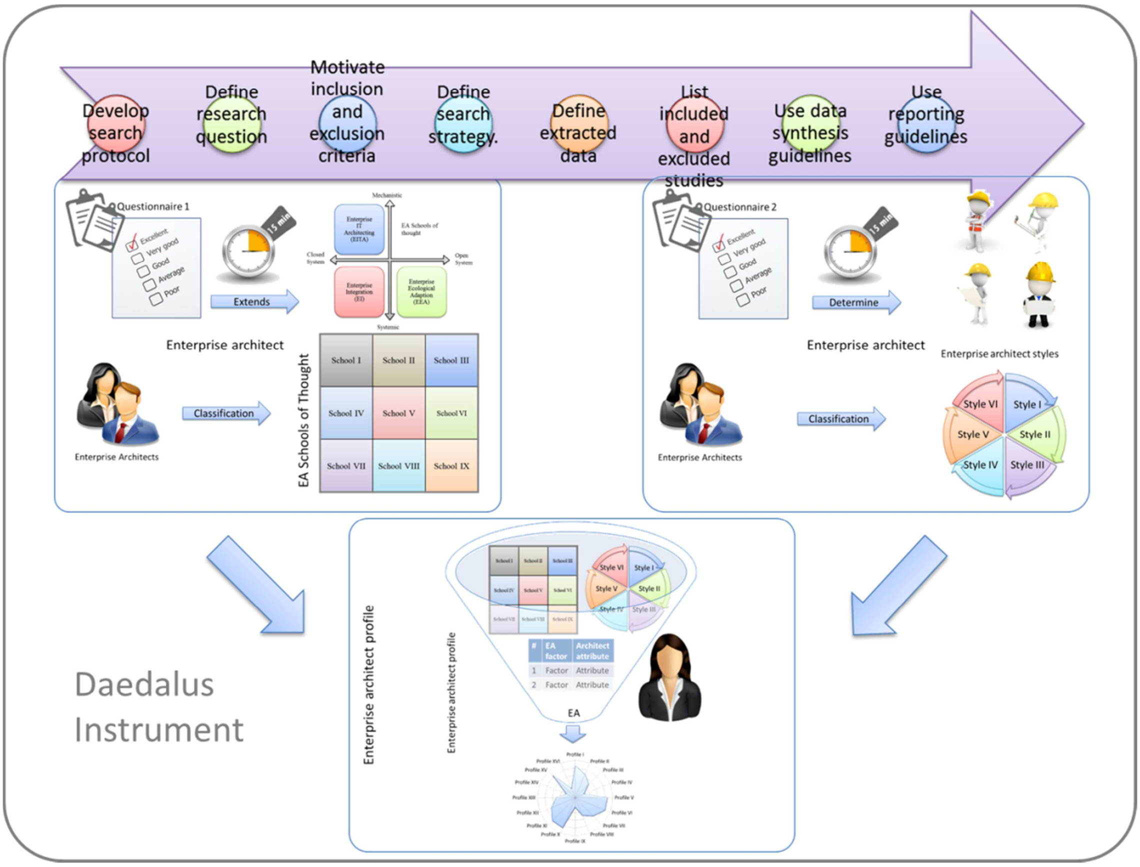



Figure 7-BB: Daedalus Instrument for Architects (DIA) design

## *7.6 Daedalus Instrument for Architects (DIA)*

The Daedalus Instrument for Architects (DIA) is an instrument or set of tools that can be used by a variety of architects and managers to determine the architect profile for a specific individual working with the enterprise architecture practice. The DIA contains four sets of tools, which can be seen as components of the instrument itself.

### 7.6.1 Daedalus Instrument components

The Daedalus Instrument for Architects can be used to better understand the architect in enterprise architecture. The DIA is a set of tools consisting of a comprehensive list of EA factors and architect attributes, the EA schools of thought indicator and taxonomy, the EA styles indicator and taxonomy, and the enterprise architect profile viewpoint as depicted within Figure 7-CC.

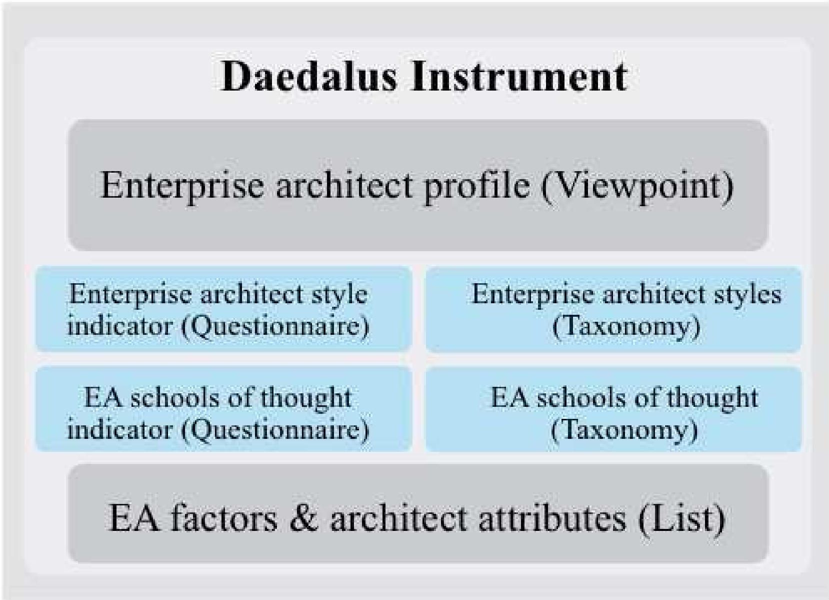



**Figure 7-CC: Daedalus Instrument for Architects (DIA) components**

### 7.6.2 EA factors and architect attributes

The EA factors and architect attributes list is a comprehensive list of factors and attributes frequently associated with enterprise architects. These factors and attributes were identified with the execution of a systematic literature review from 56 primary studies. The comprehensive list was used in the initial drafting of the studies on the EA schools of thought and the EA styles. It also contains the core EA factors and architect attributes used for the EA schools of thought taxonomy and the EA styles taxonomy. The comprehensive list of EA factors and architect attributes are depicted as a word cloud in Figure 7-DD and as a table in Table 7-4.


**Figure 7-DD: EA factors and architect attributes list**

### 7.6.3 EA schools of thought taxonomy and indicator

The EA schools of thought taxonomy, depicted within Figure 7-P, is a matrix classification making use of EA scope and EA purpose as the X and the Y axis of the matrix classification respectively. The EA scope and purpose represent the enterprise architects' understanding or opinion of what they believe the scope and purpose should be of planning an EA initiative or project. Both the EA scope and EA purpose have three distinct perspectives which produce the nine element matrix as the EA schools of thought taxonomy. From the research study of the EA schools of thought, only seven of the nine schools of thought were determined to be valid.

Based on the beliefs of the enterprise architect of the scope and purpose of an EA initiative whilst completing the EA schools of thought indicator, depicted within Figure 7-EE, an enterprise architect is viewed as being part of a specific EA school of thought.

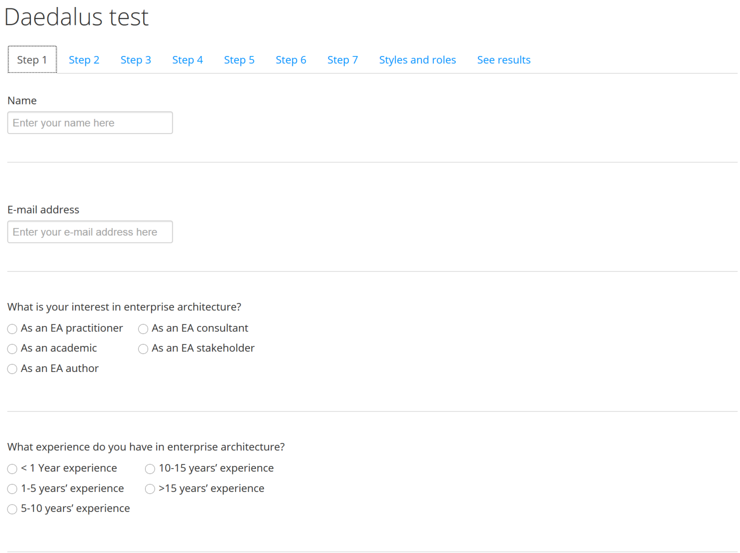



**Figure 7-EE: EA schools of thought indicator**

### 7.6.4 Enterprise architect styles taxonomy and indicator

The EA styles taxonomy, depicted within Figure 7-S, is a matrix classification making use of EA competency and EA role as the X and the Y axis of the matrix classification respectively. The EA competency and role represents the enterprise architects' behavioural style when executing an EA initiative within their EA practices. Both the EA competency and EA role have five distinct perspectives which produce the 25 element matrix as the architect style taxonomy. From the research study of the architect styles, only nine of the 25 architect styles were determined to be valid.

Based on the understanding of the enterprise architect of their competency and role in their respective EA practices, when completing the architect styles indicator depicted within Figure 7-FF, the enterprise architect behavioural style is determined for that architect.

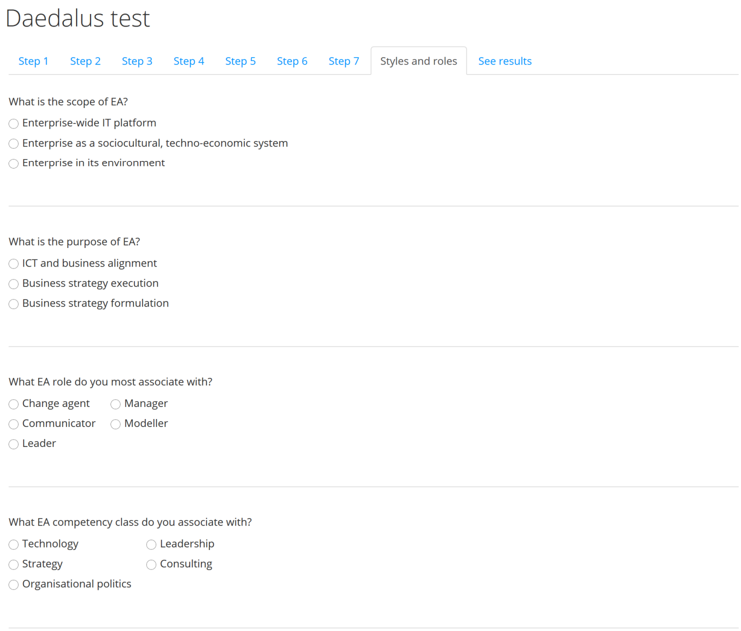



**Figure 7-FF: Architect styles indicator**

### 7.6.5 Enterprise architect profiles viewpoints

The enterprise architect profile of an enterprise architect is determined by considering their respective EA schools of thought, their architect styles and their respective architect attributes, as depicted with Figure 7-V.

The technical implementation of the design artefact is an online website (www.daedalusinstrument.com), which makes use of a web component to guide the participating architect through the indicators to determine their respective architect profile. On completion of the indicators, a viewpoint is created[3], represented as a report detailing the information relevant to the participating enterprise architect. An example of the architect profile viewpoint is depicted within Figure 7-GG. This viewpoint can then be used by the architects themselves or their respective managements to better understand the enterprise architect functioning within their respective EA practices.

[3] At the time of publication, the automatic generation of the viewpoint as a report was not yet implemented.

Thank you from Daedalus Instrument

Thank you for completing the Daedalus Instrument test

If you do not see a specific Architect Style or EA School of Thought, then your selections do not have a Style or School associated with them.

Scroll down to see your results and hit the "submit" button to finish up.

Innovating Technology

We have determined your architect style to be the "**Innovating Technology**" style. Read more...

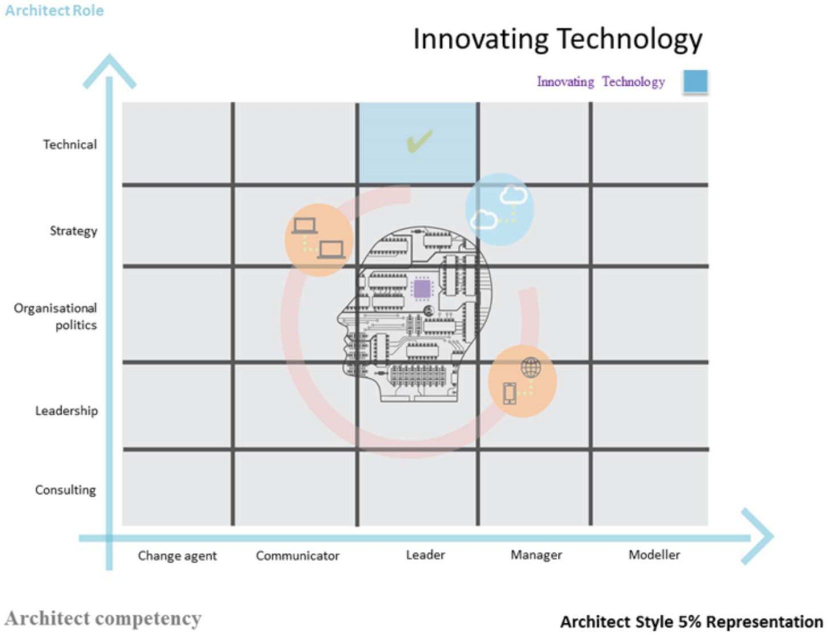


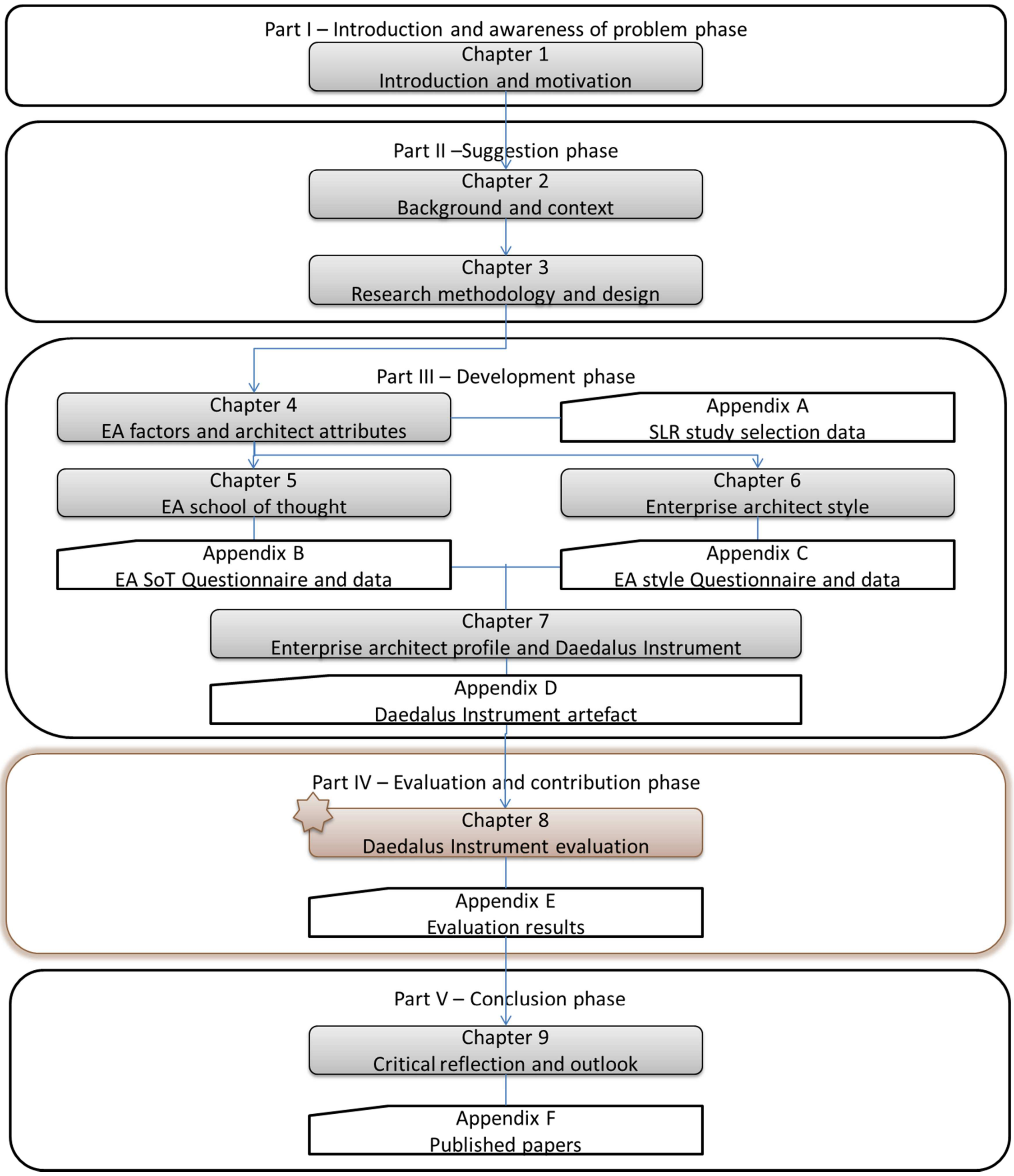

**Figure 7-GG: Enterprise architect profile viewpoint**

## *7.7 Conclusion*

This chapter provided the design and analysis of the enterprise architect profiles viewpoint, which form part of the Daedalus Instrument for Architects, depicted within Figure 5-U. The design of the enterprise architect profiles viewpoint, depicted within **Appendix D**, was done to be in line with the research question, objective, and purpose, as well as the strategy. In addition, the enterprise architect profiles viewpoint can be used to better understand the architect in enterprise architecture and was created as the fourth component of the Daedalus Instrument.

**Chapter 7** also described the composition of the Daedalus Instrument for Architects, depicted within Figure 7-CC. **Chapter 8** describes the demonstration and evaluation of the Daedalus Instrument as a technology-based solution.

# 8 DIA evaluation



## 8.1 Introduction

Part I of the thesis was concerned with the introduction and awareness of the research problem and how it pertains to the need for better understanding of the enterprise architect. Part II of the thesis highlighted the suggestion of a solution to the problem described within Part I, by providing background and contextual information about the problem, as well as listing the research methodology and design with a tentative solution. Part III of the thesis showcased the development of the design artefact and its components. Each component of the artefact, the Daedalus Instrument, was developed using an internal development cycle of the design science research (DSR) strategy.

Part IV of the thesis is concerned with the evaluation and contribution of the design artefact, the Daedalus Instrument. The Daedalus Instrument evaluation chapter, **Chapter 8,** is divided into seven main parts. Section 8.1 introduces the research process, necessity, and an overview is given of the Framework for Evaluation in Design Science Research (FEDS) used for the evaluation of the design artefact (Venable *et al.*, 2014). Sections 8.2, 8.3, 8.4 and 8.5 describe the steps taken as part of planning the evaluation, whereas section 8.6 describes the results of the evaluation episode. Finally, the chapter concludes in section 8.7. The evaluation questions and lessons learned are presented within **Appendix E**. An overview of the chapter is illustrated in Figure 8-A, which also gives the layout of this chapter.

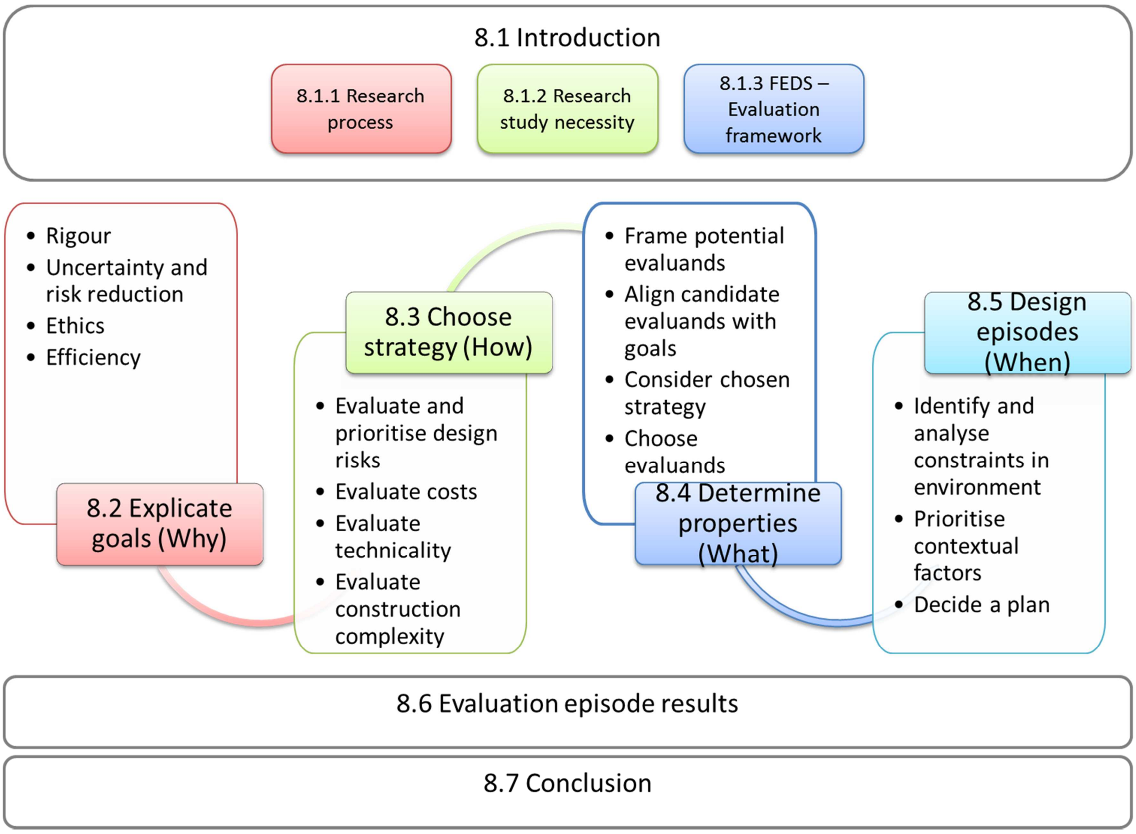



**Figure 8-A: Chapter layout**

This chapter explores and evaluates information pertaining to the enterprise architect in order to answer a specific research question as described within Table 8-1. The evaluation of the design artefact, the Daedalus Instrument, is completed as part of the evaluation and contribution design science research (DSR) phase as depicted within Figure 8-B. The alignment of **Chapter 8 to** that of the thesis is also depicted within Table 8-1.

**Table 8-1: Chapter 8 alignment summary**

| # | Sub-research question | Sub-objective | Challenge | Chapter | DSR Process Step | Deliverable |
|---|---|---|---|---|---|---|
| 6 | How can a technology-based solution be developed allowing organisations to efficiently determine the profiles of enterprise architects? | To develop a technology-based solution allowing organisations to efficiently determine the profiles of enterprise architects. | A technology-based solution needs to be constructed to allow organisations to efficiently determine the profiles of enterprise architects. | Chapter 8 – Daedalus Instrument evaluation | [E1] | Technology-based Daedalus Instrument and evaluation |

## 8.1.1 Research process

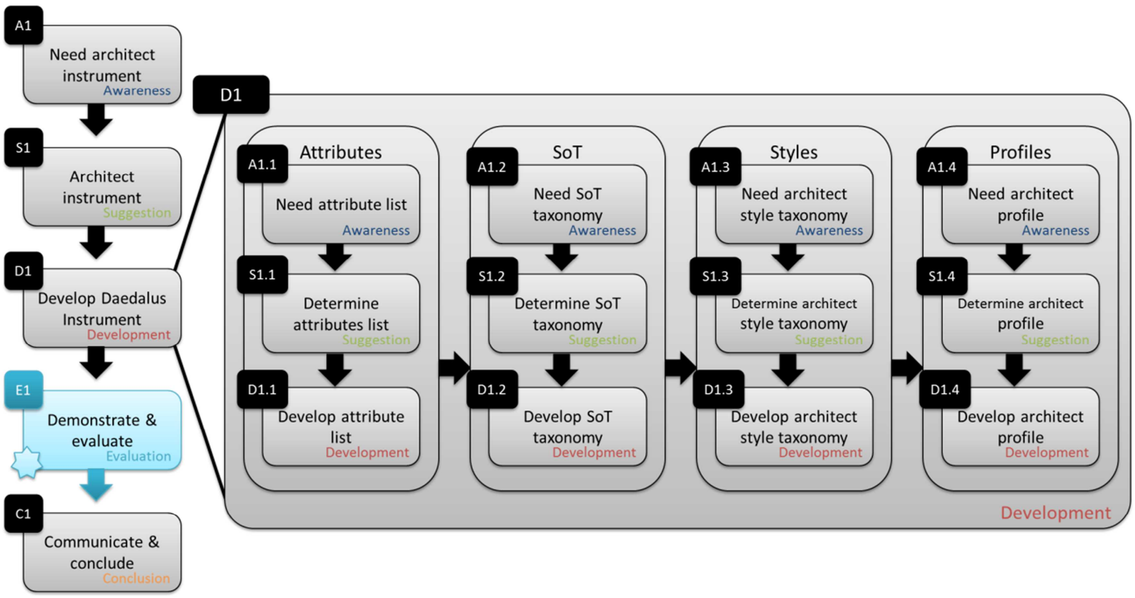



**Figure 8-B: DIA evaluation in relation to the DSR, demonstrate and evaluate step**

The aim of this part of the study was to demonstrate and evaluate the Daedalus Instrument and its components, including the demonstration and evaluation of the technology-based artefact. Evaluation [E1] is the fourth phase or process step of the design science research (DSR) strategy, following the completion and creation of the design artefact, the Daedalus Instrument. The artefact was demonstrated and evaluated according to the metrics or properties (usability, reliability & efficiency) defined within the awareness phase. The evaluation was done using qualitative methods and any deviations from the initial expectations were tentatively explained.

Rooted within the evaluation phase was an analytic sub-phase in which exploratory hypotheses about the behaviour of the artefact were made. Based on the framework for evaluation of design science research (FEDS) (Venable *et al.*, 2014), a focus group was used for the evaluation episode to demonstrate and evaluate the technology-based Daedalus Instrument for Architects, as depicted within Figure 8-C. Feedback was gathered from the focus group on the usability, reliability and efficiency of the technology-based solution.

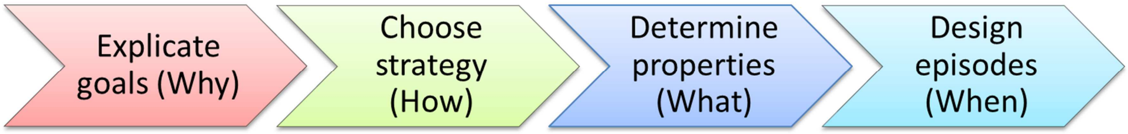



**Figure 8-C: FEDS process (Venable *et al.*, 2014)**

### 8.1.2 Research study necessity

The creation of the Daedalus Instrument was created to allow EA stakeholders to better understand enterprise architects. The Daedalus Instrument consists of various components that describe distinct aspects with regards to the enterprise architect. Although these components each address a certain aspect of the enterprise architect, the strength lies with the integration and consolidation of the components in understanding the different enterprise architect profiles. The Daedalus Instrument consists of indicators (questionnaires), taxonomies (classifications), architect attributes (list) and profiles (viewpoints), which allow for easy evaluation of the enterprise architect. Although the Daedalus Instrument could be implemented as a paper-based solution, a technology-based solution (website) was created to allow for a user-friendly, reliable and efficient use of the solution.

A need existed, not only to evaluate the Daedalus Instrument and its components, but also to evaluate the use of the technology-based solution. This was required to better understand the use of the technology-based solution in its environment, being tested by architects and EA managers, for the intended purpose to obtain a better understanding of enterprise architects. Ensuring simplicity when designing the technology-based solution, a single indicator was to allow enterprise architects to determine their specific EA belief systems and their behavioural styles.

It was therefore fundamental to understand the practical use of the technology-based systems and what the shortfalls of this type of implementation might have been. It was also fundamental to understand what enterprise architects think about the Daedalus Instrument for Architect and what value the architects believe it has or brings to the discipline of enterprise architecture.

### 8.1.3 FEDS – Evaluation framework

The framework for evaluating design science research or FEDS was designed to guide the design of a suitable strategy for conducting the evaluation activities during a DSR study. Included in the framework is a four-step process that guides the researcher on designing a specific evaluation research strategy (Venable *et al.*, 2014).

The FEDS framework was analytically developed to relate the goals of DSR evaluation to the various classifications of extant evaluation methods. These goals represent the varying evaluation objectives while the evaluation methods represent the means. Thus, the FEDS framework creates a bridge between the various evaluation goals and the evaluation strategies (Venable *et al.*, 2014). The framework makes use of an orthogonal matrix taxonomy, which forms the foundation of the framework, where the functional purpose of the evaluation (formative or summative) is categorised against the paradigm of the evaluation (artificial or naturalistic) depicted within Figure 8-D.

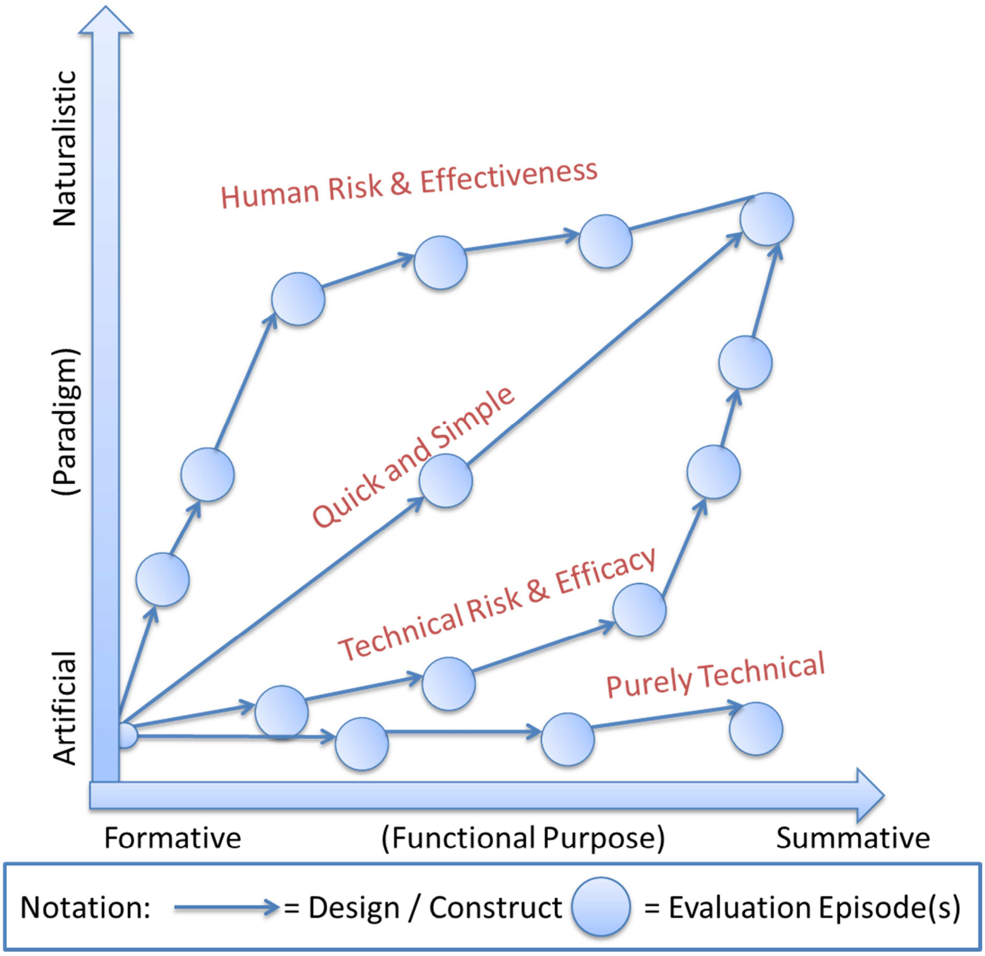



**Figure 8-D: FEDS (Framework for Evaluation in Design Science) (Venable *et al.*, 2014, p. 4)**

The four identified strategies guide researchers on how and when to evaluate and for what purpose to evaluate. The specific strategy pathway pursued may differ according to the resources available and specific necessities required for the DSR study. These strategies represent the "human risk and effectiveness" evaluation strategy, the "quick and simple" evaluation strategy, the "technical risk and efficacy" evaluation strategy, and the "purely technical" evaluation strategy, depicted within Figure 8-D.

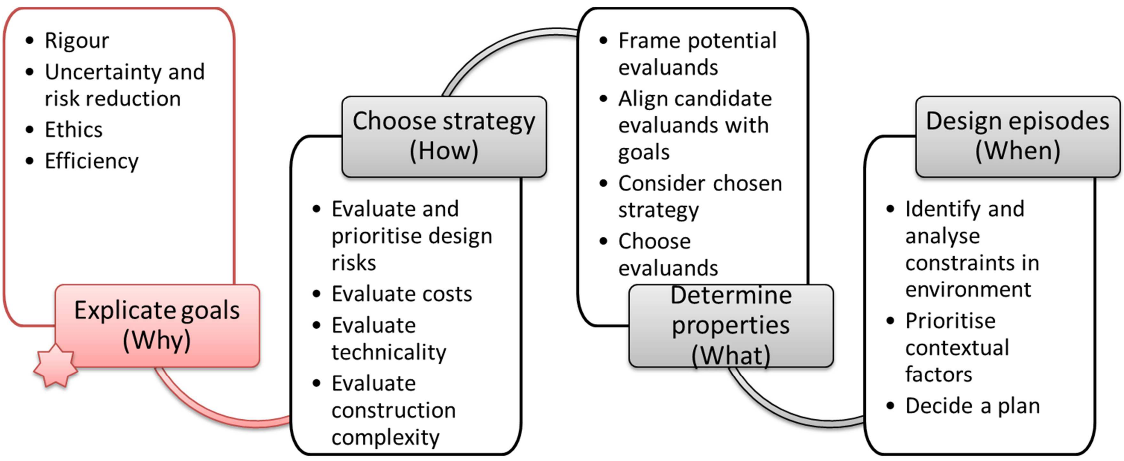
Each of the four identified strategies represent relevant circumstances on when it is most appropriate to follow a specific evaluation strategy (Venable *et al.*, 2014). The circumstances for selecting a specific strategy are detailed within Table 8-2.

**Table 8-2: Circumstances for selecting a DSR evaluation (Venable *et al.*, 2014, p. 6)**

| DSR evaluation strategies | Circumstance selection criteria |
|---|---|
| Quick & Simple | If small and simple construction of design, with low social and technical risk and uncertainty |
| Human Risk & Effectiveness | If the major design risk is social or user-oriented<br>and/or<br>If it is relatively cheap to evaluate with real users in their real context<br>and/or<br>If a critical goal of the evaluation is to rigorously establish that the utility/benefit will continue in real situations and over the long run |
| Technical Risk & Efficacy | If the major design risk is technically oriented<br>and/or<br>If it is prohibitively expensive to evaluate with real users and real systems in the real setting<br>and/or<br>If a critical goal of the evaluation is to rigorously establish that the utility/benefit is due to the artefact, not something else |
| Purely Technical Artefact | If artefact is purely technical (no social aspects) or artefact use will be well in future and not today |

Guided by the FEDS framework showcasing the various evaluation strategies and the circumstances on when best to follow a specific strategy, a four-step process is recommended to select the required evaluation approach for the DSR study. The four-step process, depicted within Figure 8-C, represents explicate goals, choose strategy, determine properties and design episodes and are described in detail within sections 8.2, 8.3, 8.4, and 8.5 respectively.

## *8.2 Explicate goals*



The first step in the process depicts the need to address competing goals. The relevancy of these goals changes depending on the various stages of the DSR study. These competing goals address various different aspects including rigour, uncertainty and risk, ethics, and efficiency (Venable *et al.*, 2014).

Rigorous goals can be viewed from two different sides: efficiency and effectiveness, where efficiency dictates that only the design artefact instance causes the observed outcome, and where effectiveness dictates that the design artefact instance works in a real-world scenario (Venable *et al.*, 2014). The Daedalus Instrument for Architects, as well as its technology-based artefact goals, was created to be rigorous by addressing efficiency and effectiveness, described within Table 8-3.

**Table 8-3: Evaluation episode rigour aligned goals**

| Goals | Daedalus Instrument | Technology-based artefact |
|---|---|---|
| Rigour | Only the use of the Daedalus Instrument should realise the specific architect profile definition. | The technology-based artefact should work in a real situation, where architects use the Daedalus Instrument for Architects to determine their individual architect profile. |

When addressing design uncertainty and reducing risk, it was important to perform formative evaluations early on as part of the DSR study. These risks may have been social, technical, or as an implication socio-technical. Social risks addressed the need that the design artefact fitted well into the desired social context, and where technical risks addressed the need that the design artefact functioned appropriately, depicted within Table 8-4 (Venable *et al.*, 2014).

**Table 8-4: Evaluation episode uncertainty and risk aligned goals**

| Goals | Daedalus Instrument | Technology-based artefact |
|---|---|---|
| Uncertainty and risk | Enterprise architects and EA stakeholders should be able to use the Daedalus Instrument in their operating environment. | The technology-based artefact of the Daedalus Instrument should be able to perform the required functions of allowing enterprise architects to determine their individual architect profile. |

Ethics considerations were important especially when evaluating safety critical solutions and technologies. The evaluation was systemic by addressing all relevant participants affected by the design artefact, including addressing the evaluation activities. It was beneficial to execute formative as well as summative evaluations to best ensure the rigour and reduce risk to the relevant participants, depicted within Table 8-5 (Venable *et al.*, 2014).

**Table 8-5: Evaluation episode ethics aligned goals**

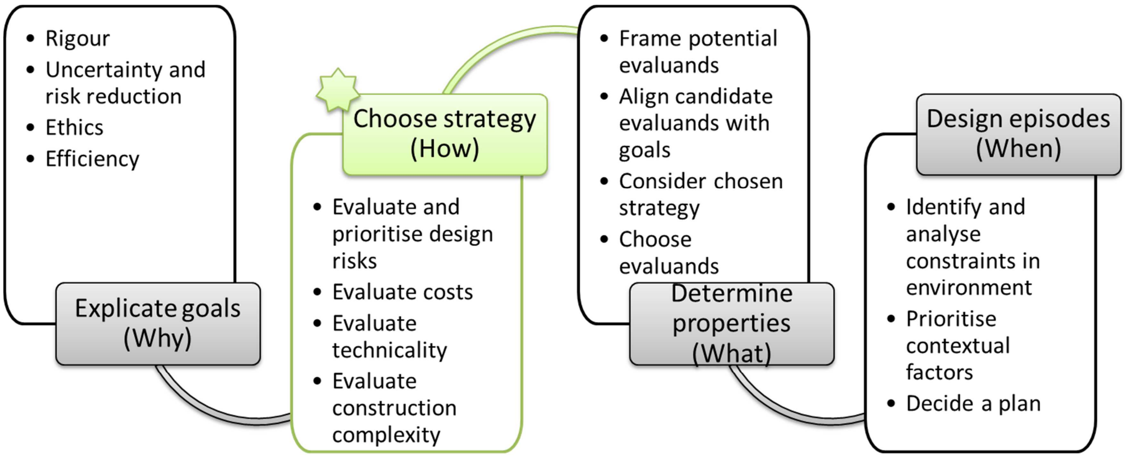
| Goals | Daedalus Instrument | Technology-based artefact |
|---|---|---|
| Ethics | The use of the Daedalus Instrument and its evaluation should be ethical and not have any undesirable consequences affecting any participants. | The use of the technology-based artefact and its evaluation should be ethical and not have any undesirable consequences affecting any participants. |

The evaluation goals addressed efficiency, where the goals were balanced against the available resources (time and money) for the evaluation episode. Formative evaluations significantly reduce the cost incurred in building the design artefacts. Generally, naturalistic evaluation are more costly and may take longer than artificial evaluations, depicted within Table 8-6 (Venable *et al.*, 2014).

**Table 8-6: Evaluation episode efficiency aligned goals**

| Goals | Daedalus Instrument | Technology-based artefact |
|---|---|---|
| Efficiency | The evaluation episode of the Daedalus Instrument should be efficient and consider both costs and duration. | The evaluation episode of the technology-based artefact should be efficient and consider both costs and duration. |

## *8.3 Choose strategy*




Using the evaluation goals that were explicated in section 8.2, a single strategy or a number of evaluation strategies may have been suitable for the evaluation of the design artefact. The four identified evaluation strategies each infers a decisive decision about why, how and when to evaluate the design artefact. When choosing the evaluation strategy, the following methodological approach evaluated and prioritised design risks, evaluated costs, and evaluated the design artefact's technicality, as well as evaluated the design artefact's construction complexity (Venable *et al.*, 2014).

While considering apparent anomalies that the design artefact faced, these anomalies were evaluated and prioritised as risks understanding, on which one of the four identified evaluation strategies was best to mitigate the apparent anomalies or risks. A Human Risk & Effectiveness strategy is well suited for mitigating major social or user-related risks. Alternatively, a Technical Risk & Efficacy strategy is well suited for mitigating major technology or technically oriented risks. Where no major risks were identified as either social or technical, a Quick and Simple strategy was the best evaluation strategy to follow, depicted within Table 8-7 (Venable *et al.*, 2014).

**Table 8-7: Evaluation episode design risks**

| Risks | Daedalus Instrument | Technology-based artefact |
|---|---|---|
| Social | Low – The population group (enterprise architects) have exposure to other types of instruments using indicators, such as personality and team dynamics tests | Low – The population group (enterprise architects) are well acquainted with using websites and survey based tools |
| Technical | None – Can be implemented as a paper-based instrument | Low – The technology-based artefact can be implemented using a website with a survey component |

The cost of the design artefact evaluations was considered carefully. It was best to evaluate the design artefact within the context of its entire socio-technical system. This socio-technical system included actual users, the final solution and a simulated operating environment. The Human Risk & Effectiveness strategy is best suited for when the cost of having actual users evaluate the system in its operating environment is reasonable. In this strategy, evaluation time can be cut by investing in the use of a usability lab. In the scenario where actual users are available for the evaluation but development and other resources are unavailable for the evaluation, a minimum viable product may be evaluated. Alternatively, when it is too costly to evaluate the design artefact in its entire socio-technical system, a Technical Risk & Efficacy strategy is the best option, depicted within Table 8-8 (Venable *et al.*, 2014).

**Table 8-8: Evaluation episode costs**

| Costs | Daedalus Instrument | Technology-based artefact |
|---|---|---|
| Time | Low – The population group (enterprise architects) have exposure to other types of instruments using indicators, such as personality and team dynamics tests | Low – The population group (enterprise architects) are well acquainted with using websites and survey based tools |
| Human resources | None – Can be implemented as a paper-based instrument | Low – The technology-based artefact can be implemented using a website with a survey component |
| Money | Costly economical | |

When the design artefact is purely technical and not directly affecting people, or in the case where the design artefact will not be implemented in the near future or where there is an obvious connection in addressing an existing need, a Purely Technical strategy may be the best evaluation strategy to follow. A Purely Technical strategy may be the best option when a naturalistic evaluation is infeasible, depicted within Table 8-9 (Venable *et al.*, 2014).

**Table 8-9: Evaluation episode technicality**

| Technicality | Daedalus Instrument | Technology-based artefact |
|---|---|---|
| Technical | N/A – A paper-based instrument is used. The focus lies on who uses the instrument and not on any technology | Low – A basic solution is designed; it however required actual participants (enterprise architects) to use the website |

The construction complexity of the design artefact was determined. In the case where the construction of the design artefact was relatively simple and easy, without having identified any major anomalies or risks, a Quick & Simple evaluation strategy was the preferred strategy to follow, depicted within Table 8-10 (Venable *et al.*, 2014).

**Table 8-10: Evaluation episode and design artefact construction complexity**

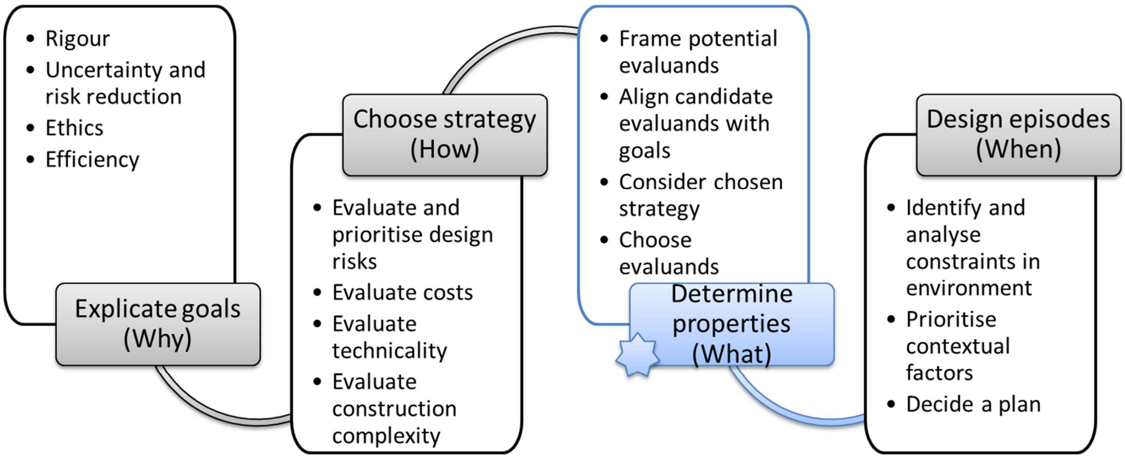
| Complexity | Daedalus Instrument | Technology-based artefact |
|---|---|---|
| Construction | Low – A paper-based instrument is used. The construction only requires a questionnaire based indicator. | Low – A basic solution is designed using existing web-based technology |

The chosen strategy for the evaluation of the design artefact is depicted within Table 8-11.

**Table 8-11: Evaluation episode strategy**

| | Daedalus Instrument | Technology-based artefact |
|---|---|---|
| Strategy | Naturalistic<br>Summative | Naturalistic<br>Summative |

## 8.4 Determine properties




The determine properties evaluation process step refers to what to evaluate the design artefact against. It involved selecting an overall set of features, requirements and goals of the design artefact that were used to measure the design artefact against during the evaluation episodes. The exact evaluation properties were unique to the design artefact as it relates to its purpose and evaluation situation. Several general properties existed that could have been used to evaluate the design artefact. These properties addressed generic criteria and goals on how to evaluate a design artefact. One such a generic property sets is defined by the ISO-9126 standard for measuring system quality in terms of efficiency, functionality, maintainability, portability, reliability and usability. Another generic property set is to align the evaluation properties with the research objectives, in a qualitative evaluation. To determine the property set for the evaluation episodes, framing potential evaluands, aligning the candidate evaluands with the evaluation goals, consider the already determined evaluation strategy and to choose the evaluands, were considered (Venable *et al.*, 2014).

Framing the potential evaluands involved selecting a short-list of evaluands, where evaluands addressed the evaluation system, not the evaluation participants (Venable *et al.*, 2014). These evaluands addressed their own specific goals, which included system granularity (Sun & Kantor, 2006), product lifecycle (Stufflebeam, 2003), design quality (Mathiassen *et al.*, 2000) or rationality and understanding, depicted within Table 8-12 (Smithson & Hirschheim, 1998).

**Table 8-12: Evaluation episode potential evaluands (Venable *et al.*, 2014, p. 8)**

| Evaluands | Evaluation evaluand goals | Generic design artefact properties |
|---|---|---|
| (Mathiassen *et al.*, 2000) | ISO-9126 based. Adapting criteria as design goals | Useable<br>Secure<br>Efficient<br>Correct<br>Reliable<br>Maintainable<br>Testable<br>Flexible<br>Comprehensible |

| Evaluands | Evaluation evaluand goals | Generic design artefact properties |
|---|---|---|
| | | Reusable<br>Portable<br>Interoperable |
| (Smithson & Hirschheim, 1998) | Adapting both rationality and understanding | Rationality-efficiency: Quality assurance<br>**Rationality-effectiveness**: Cost-benefit, User satisfaction, Resource utilisation<br>**Understanding**: Social action, Cognitive psychology |

In the alignment method approach, the potential evaluands were aligned to the goals explicated within section 8.2. Each of the goals was considered against the potential evaluands on how the evaluands met or reached each of the explicated goals, depicted within Table 8-13 (Venable *et al.*, 2014).

**Table 8-13: Candidate evaluands alignment to explicated goals**

| | Goals | Evaluands | |
|---|---|---|---|
| | | (Mathiassen *et al.*, 2000) | (Smithson & Hirschheim, 1998) |
| Uncertainty and risk Rigour | **Daedalus Instrument**: Only the use of the Daedalus Instrument should realise the specific architect profile definition. | Useable<br>Efficient<br>Correct<br>Reliable | **Understanding**: Social action, Cognitive psychology |
| | **Technology-based artefact**: The technology-based artefact should work in a real situation, where architects use the Daedalus Instrument to determine their individual architect profile. | Useable<br>Secure<br>Efficient<br>Reliable<br>Maintainable<br>Portable | **Understanding**: Social action, Cognitive psychology |
| | **Daedalus Instrument**: Enterprise architects and EA stakeholders should be able to use the Daedalus Instrument in their operating environment. | Useable<br>Efficient | **Rationality-effectiveness**: Cost-benefit, User satisfaction, Resource utilisation |
| | **Technology-based artefact**: The technology-based artefact of the Daedalus Instrument should be able to perform the required functions of allowing enterprise architects to determine their individual architect profile. | Useable<br>Correct<br>Reliable<br>Portable | **Rationality-effectiveness**: Cost-benefit, User satisfaction, Resource utilisation |
| Ethics | **Daedalus Instrument**: The use of the Daedalus Instrument and its evaluation should be ethical and not have any undesirable consequences affecting any participants. | Useable | None |
| | **Technology-based artefact**: The use of the technology-based artefact and its evaluation should be ethical and not have any undesirable consequences affecting any participants. | Useable | None |
| Efficiency | **Daedalus Instrument**: The evaluation episode of the Daedalus Instrument should be efficient and consider both costs and duration. | Efficient | Rationality-efficiency: Quality assurance |
| | **Technology-based artefact**: The evaluation episode of the technology-based artefact should be efficient and consider both costs and duration. | Reliable<br>Maintainable<br>Testable<br>Flexible<br>Reusable<br>Portable | Rationality-efficiency: Quality assurance |

While considering the evaluation strategy chosen in section 8.3, alignment of the evaluation strategy with the candidate evaluands, the aim was to ensure the correct evaluands were selected based on the evaluation strategy. A naturalistic paradigm strategy addressed the effectiveness well, where an artificial paradigm strategy addressed the efficiency well. During the formative stage, human risks as well as technical risks were addressed with few evaluands, as opposed to the summative stage where a more comprehensive evaluands set was used, depicted within Table 8-14 (Venable *et al.*, 2014).

**Table 8-14: Chosen strategy alignment with evaluands**

| Strategy / evaluands | (Mathiassen *et al.*, 2000) | (Smithson & Hirschheim, 1998) |
|---|---|---|
| Naturalistic paradigm | Well suited for quick and simple evaluation as it covers the socio-technical system in its entirety | Well suited for naturalistic paradigm, addressing human risk and effectiveness as well as technical risk and efficiency |
| Summative purpose | Well suited for quick and simple evaluation as it covers the socio-technical system in its entirety | Well suited for naturalistic paradigm, addressing human risk and effectiveness as well as technical risk and efficiency |

Taking into account the potential evaluands identified, the alignment of candidate evaluands to the explicated goals described and the chosen strategy alignment to the candidate evaluands, an evaluand was chosen, depicted within Table 8-15 (Venable *et al.*, 2014).

**Table 8-15: Chosen evaluands alignment to goals and strategy**

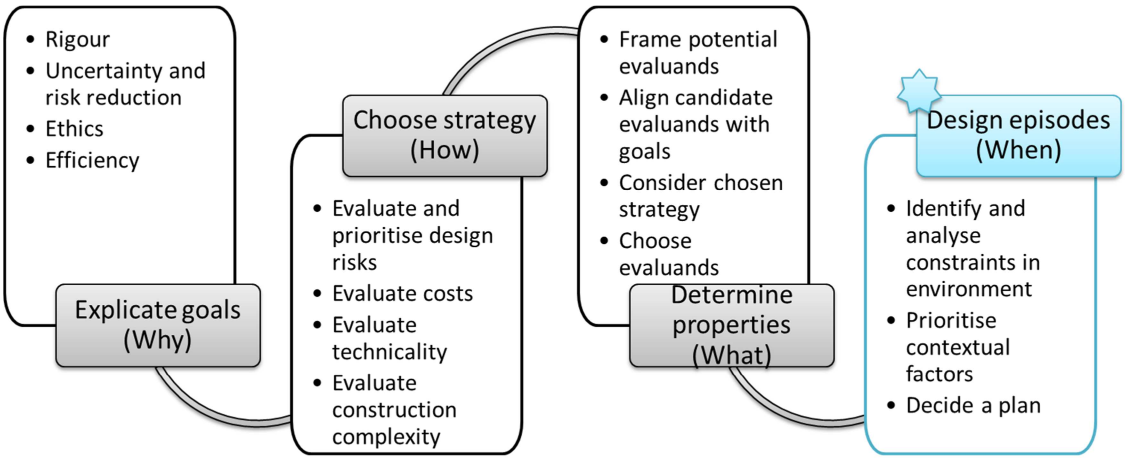
| Goals | Strategy | Evaluands |
|---|---|---|
| Rigour<br>Uncertainty and risk<br>Ethics<br>Efficiency | Naturalistic paradigm<br>Summative purpose | Research objective based |

The chosen evaluand with its set of properties for the evaluation of the design artefact is depicted within Table 8-16.

**Table 8-16: Chosen evaluation episode evaluand properties**

| Evaluand | Evaluation evaluand goals | Generic design artefact properties |
|---|---|---|
| Research objective based | Alignment of evaluation goals to the research objectives and research questions | Alignment of objectives<br>Realisation of design objectives |

## 8.5 Design episodes




On completion of explicating goals in section 8.2, choosing the evaluation strategy in section 8.3 and determining the properties of the design artefact being evaluated within section 8.4, the evaluation episodes are designed. The evaluation episodes, represented as circles in Figure 8-D, were designed and described on what exactly each one of the evaluation episodes involved. The FEDS evaluation framework highlighted four potential strategies to follow, each with a representation on how many, when, and about what each of the evaluation episodes entailed. The FEDS evaluation framework is not prescriptive and as such the number of evaluation episodes was dependent based on the specific environmental system in which the design artefact operated. In designing the evaluation episodes, the constraints in its environment needed to be identified and analysed, contextual factors needed to be prioritised and a plan needed to be decided on detailing the evaluation episodes (Venable *et al.*, 2014).

When designing the evaluation episodes, the constraints were identified and analysed in the environment. This was done to determine what resources were available in terms of time, money, human and other resources. Table 8-17 shows the constraints identified for the evaluation of the DIA, due to the limited available resources

**Table 8-17: Evaluation episode constraints**

| Constraint | Contextual factor |
|---|---|
| Time | Single evolution session<br>Presentation and evaluation of 2 hours |
| Money | Limited budget |
| Human resources | Limited availability of enterprise architects to participate in evaluation |
| Venue | Convenient and available venue to host the evaluation |

The contextual factors identified and analysed were prioritised to determine their importance. Table 8-18 summarises the decision to use an interest focus group to evaluate the DIA and its technology implementation.

**Table 8-18: Evaluation episode contextual factors prioritisation**

| Contextual factor | Decision | Importance |
|---|---|---|
| Single evolution session<br>Presentation and evaluation of 2 hours | Prepare short presentation | Essential |
| Limited budget | Development of a minimum viable product | Nice to have |
| Limited availability of enterprise architects to participate in evaluation | Organise a special interest focus group | More important |
| Convenient and available venue to host the evaluation | Organise the focus group at the university | Less important |

Following the identification and analysis of the evaluation episode constraints in the environment and the prioritisation of the evaluation episode's contextual factors, an evaluation plan was decided on, depicted within Table 8-19.

The alignment of the research questions and objectives to that of the evaluation objectives was used as a model for the selection criteria of the evaluation properties, depicted within

Table 8-20.

**Table 8-19: Evaluation episode plan**

| # | Evaluation episode | Functional purpose | Paradigm | Strategy | Evaluation properties |
|---|---|---|---|---|---|
| 1 | Single evaluation conducted as a focus group | Summative | Naturalistic | Quick and simple | Alignment of research objectives and evaluation objectives |

**Table 8-20: Evaluation episode alignment**

| # | Sub-research question | Sub-objective | Challenge | Deliverable | Evaluation question |
|---|---|---|---|---|---|
| 1 | What enterprise architect associated EA factors and architect attributes are described in literature? | To determine which enterprise architect associated EA factors and architect attributes are described within literature. | A systematic study needs to be completed on existing literature concerning the enterprise architect. | List of EA factors and architect attributes | How well do the list of EA factors and architect attributes address different aspects of enterprise architects? |
| 2 | How can an EA schools of thought indicator be developed for the consistent classification of EA schools of thought? | To develop an EA schools of thought indicator for the consistent classification of EA schools of thought. | An instrument and classification needs to be created to allow an organisation to determine the specific EA school of thought an architect would align to. | EA school of thought indicator + classification | How well do the EA schools of thought address the EA belief system of enterprise architects? |
| 3 | How can an enterprise architect style indicator be developed for the consistent classification of enterprise architect behavioural styles? | To develop an enterprise architect style indicator for the consistent classification of the enterprise architect styles. | An instrument and classification needs to be created to allow an organisation to determine the specific enterprise architect style of an architect. | Enterprise architect styles + classification | How well do the architect styles address the EA behavioural styles of enterprise architects? |
| 4 | How can enterprise architect profiles be developed for the understanding of the enterprise architect? | To develop enterprise architect profiles for the understanding of the enterprise architect. | A view needs to be created to describe the various aspects of an architect as they relate to their enterprise architect styles and EA schools of thought. | Enterprise architect profiles | How well do the architect profiles address the understanding of enterprise architects? |
| 5 | How can an instrument be developed allowing organisations to understand enterprise architects? | To develop an instrument allowing organisations to understand enterprise architects. | An instrument needs to be compiled to allow organisations to consistently gain understanding into the architect as it relates to the various enterprise architect styles. | Daedalus Instrument for Architects | How valuable is the use of the Daedalus Instrument in an EA practice? |
| 6 | How can a technology-based solution be developed allowing organisations to efficiently determine the profiles of enterprise architects? | To develop a technology-based solution allowing organisations to efficiently determine the profiles of enterprise architects. | A technology-based solution needs to be constructed to allow organisations to efficiently determine the profiles of enterprise architects. | Technology-based Daedalus Instrument and evaluation | How efficient is the technology-based solution in allowing organisations to determine the architect profiles of enterprise architects? |

## 8.6 Evaluation episode results

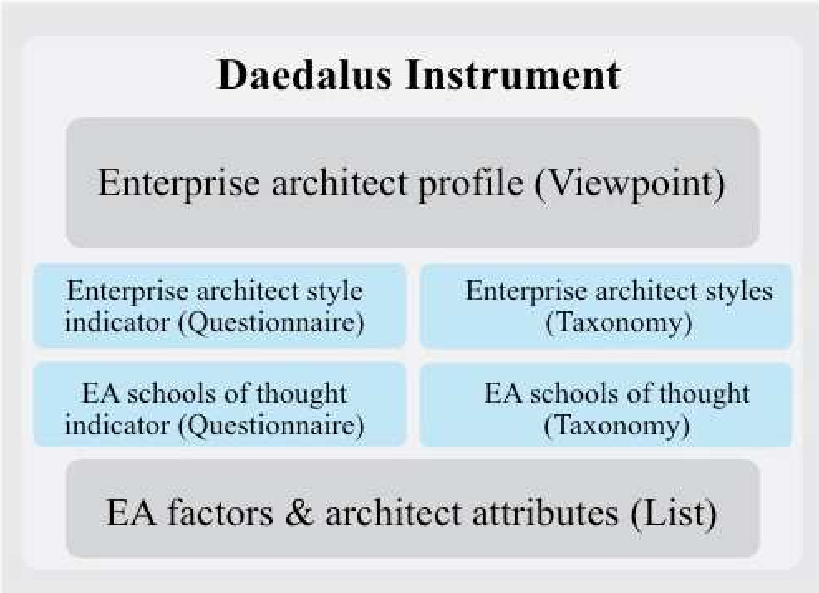



**Figure 8-E: Daedalus Instrument for Architects (DIA) as technology-based solution**

A focus group evaluation was used to gain qualitative evaluation feedback on the design, implementation and the use of the Daedalus Instrument for Architects, as well as the technology-based solution of the Daedalus Instrument for Architects, depicted within Figure 8-E. The focus group consisted of five evaluation members (n=5), representing industry and academia, with two members being EA practitioners, two academics with interest in EA and another academic with interest in the research topic. The composition of the focus group had diverse interest in the topic of enterprise architecture as well as the results of the research studies and the composition of the design artefact. This diversity in members represented different levels in formal education, industry work experience, position levels and age groups.

A comprehensive presentation was provided of the research studies completed, the results of those studies, the research design and methodology as well as the creation of the design artefacts. Upon completion of the research presentation, a short demonstration was provided of the technology-based design artefact. This was followed by a question and answer session, which provided a discussion opportunity on the evaluation of the design artefact as well as the technology-based solution implementation of the design artefact. A summary of the evaluation results are depicted within Table 8-21.

### 8.6.1 Evaluation questions and answers

**Table 8-21: Daedalus Instrument for Architects (DIA) evaluation results summary**

| # | Evaluation question | Evaluand 1 answer | Evaluand 2 answer | Evaluand 3 answer | Evaluand 4 answer | Evaluand 5 answer |
|---|---|---|---|---|---|---|
| EQ1 | How well does the list of EA factors and architect attributes address different aspects of enterprise architects? | The list appears to be comprehensive, with no new EA factors or architect attributes being identified | The list is comprehensive indicating EA factors and architect attributes not widely known or considered by practising architects | A systematic research study was followed, as such one can expect a great deal of identified architect attributes and EA factors | Unsure | It seems to be complete |
| EQ2 | How well do the EA schools of thought address the EA belief system of enterprise architects? | It is difficult to say as the EA schools of thought is an unknown concept with regards to EA | The EA schools of thought is based on the concepts of scope and purpose, which is frequently used in existing EA definitions and frameworks, such as TOGAF | It is based on existing literature, where the study went to test the idea and eventually extended its classification and understanding | Unsure | The understanding of how EA scope and purpose influences the architect's belief system is not that clear |
| EQ3 | How well do the architect styles address the EA behavioural styles of enterprise architects? | It is difficult to say as architect styles are an unknown concept with regards to EA | It is difficult to say as the idea of using role and competency as a style is a new construct | The concept of behaviour styles would include environment, which is featured but not a great deal of emphasis is placed on it | Unsure | Again, the understanding of how architect competency and role influences the architect's behavioural style is not that clear |
| EQ4 | How well do the architect profiles address the understanding of enterprise architects? | Fairly well as it represents, roles, competencies, EA scope and purpose | Based on the underlying theory, fairly well | With the use of the social cognitive theory, the understanding of architect profiles should have a solid foundation for understanding | No indication was given for the understanding or the testing of architect profiles. It should be indicated as a future research topic | Solid application of underlying theory; the influence of the environmental aspect needs to be considered in more detail |
| EQ5 | How valuable is the use of the Daedalus Instrument in an EA practice? | It would be great to better understand the practising enterprise architects | It can be of great use if it is understood correctly | Unknown | Unsure | N/A |
| EQ6 | How efficient is the technology-based solution in allowing organisations to determine the architect profiles of enterprise architects? | Excellent tool, which can be used using a web browser or a mobile device. The current version states the answers of the questions first and then the question, which is difficult to follow | Fairly effective, the number of questions are just excessive | It is implemented as a web site, which makes it accessible and intuitive. Consider indicating how the results were determined | The questionnaires should be broken down into smaller more manageable sections to be easier to follow and complete | The list of questions on the site is excessive. It should be shortened or even spilt, having separate questionnaires for separate target audiences, such as managers and architects |

On answering evaluation question 1 (EQ1), the evaluands indicated that the list of 40 EA factors and architect attributes appear to be comprehensive, complete and based on a well-structured systematic literature review, as described within **Chapter 4**. One evaluand did not provide any indication of how well the list of EA factors and architect attributes addresses different aspects of enterprise architects. Although the list of 40 EA factors and architect attributes is comprehensive and based on a SLR study, it is doubtful that the entire list is applicable or even relevant. This view is also in line with the subsequent studies in **Chapters 5** and **6**.

On answering evaluation question 2 (EQ2), the evaluands specified that the construct of EA schools of thought was mostly a new and unknown construct and that it is not frequently found or used by practising enterprise architects or being taught to enterprise architects. Considering that the EA schools of thought foundation, described within **Chapters 5**, is based on the enterprise architects' beliefs around the scope and purpose for planning an EA initiative, it can be seen to be relevant as those EA factors are often used for planning an EA initiative as well as for the understanding of what exactly needs to be done.

On answering evaluation question 3 (EQ3), the evaluands proclaimed that the construct of EA styles, described within **Chapter 6**, is a new construct that is not known to the greater EA community. The idea that behavioural styles can be defined on architects' roles and competencies when executing their respective duties is interesting, especially how it is influenced by the environment the enterprise architects operate within. As with traditional human behavioural styles where people's behaviour can change with their environment changing, so the environment influences the EA behavioural styles. One evaluand specified that the construct of EA styles is not clear and that it needs to be described in more simplistic terms to be clear.

On answering evaluation question 4 (EQ4), the evaluands stated that the construct of EA profiles, described within **Chapter 7**, is not just a new idea but that it is based on the enterprise architects' understanding of EA scope and purpose as the EA schools of thought as well as EA role and competency as EA styles. The view was raised that no testing of the EA profiles were done to determine if there is a practical limit to the number of EA profiles or that any enterprise architects representing a specific EA school of thought also have similar EA styles. It was noted and listed as a possible new direction for further research studies. The enterprise architect profiles also made use of an underlying theory to ensure that the construct has a solid foundation and is based on research principles.

On answering evaluation question 5 (EQ5), the evaluands stated that from practising enterprise architects' perspectives, it would be valuable to understand the enterprise architects better, not unlike other disciplines where organisations and management have tools for the better understanding of leaders and managers. On whether the DIA would be useful to ensure a more harmonious working environment or assist organisations in having an effective EA practise, is unknown. Future research should test the DIA to determine if there is any correlation between using the DIA to understand enterprise architects and the effective implementation of EA initiatives.

On answering evaluation question 6 (EQ6), the evaluands noted that the use of web and mobile technology made the use of the DIA simple, but that there were concerns regarding the layout of the questions, the number of questions used to determine the enterprise architect's profile, as well as the indicator not being specific to a specific EA population group or segment. Some of the suggestions were to improve the way people interact and complete the indicator to determine the profile of a specific enterprise architect.

Additional comments and suggestions were provided within the evaluation session, which were included in the evaluation of the DIA and its technical implementation as the design artefact. The discussion session identified valuable insights into the use of the design artefact and its technology-based solution. The insights are listed below in no specific order or priority:

- Design artefact – Daedalus Instrument
    - Consider having a separate questionnaire for senior management that asks only a few core questions to determine the architect profile for EA managers and executives.
    - Consider providing a viewpoint of which EA schools of thought works well with certain architect styles as to indicate and provide a better representation of architect profiles.
- Technology-based design artefact – Website
    - 69 questions are too many; consider splitting the questionnaire into sections or pages.
    - Categorise the questions of the questionnaire into sections for better understanding, where each section represents a specific areas being addressed, e.g. EA factors and architect attributes, EA schools of thought, architect styles and the architect profiles
    - Reverse answers and questions on the site. Currently the answers are displayed prior to the questions.
    - Showcase the result of a test and how the architect profile is determined from the EA schools of thought and the architect styles.
    - Website articles or pages
        - Describe how the Daedalus Instrument for Architects can be used in an organisation.
        - Describe where the EA function should fit within the organisation depending on the results and architect profiles of the architects within the organisation.

- Customise the website articles for different EA population groups, such as executives, architects and EA stakeholders.

## *8.7 Conclusion*

This chapter described the design and results of the Daedalus Instrument and the technology-based artefact evaluation. The evaluation [E1] formed part of the primary DSR process to evaluate and gain feedback on the result of building the design artefact. The FEDS – evaluation framework – was used to guide the development and execution of the evaluation episode. From the four identified evaluation strategies, the quick and simple strategy was followed. This was done as the level of human or technology risk was low for the evaluation of the design artefact as well as the evaluation itself. The risk was sufficiently low that the evaluation of the design artefact did not require a normative or an artificial evaluation prior to the summative naturalistic evaluation. A single evaluation was done making use of a focus group of enterprise architects, EA stakeholders and academics. The evaluation questions and lessons learned from the evaluation are described in **Appendix E**. A summary of the evaluation episodes plan describing the purpose, paradigm, strategy and artefacts, is described within Table 8-22.

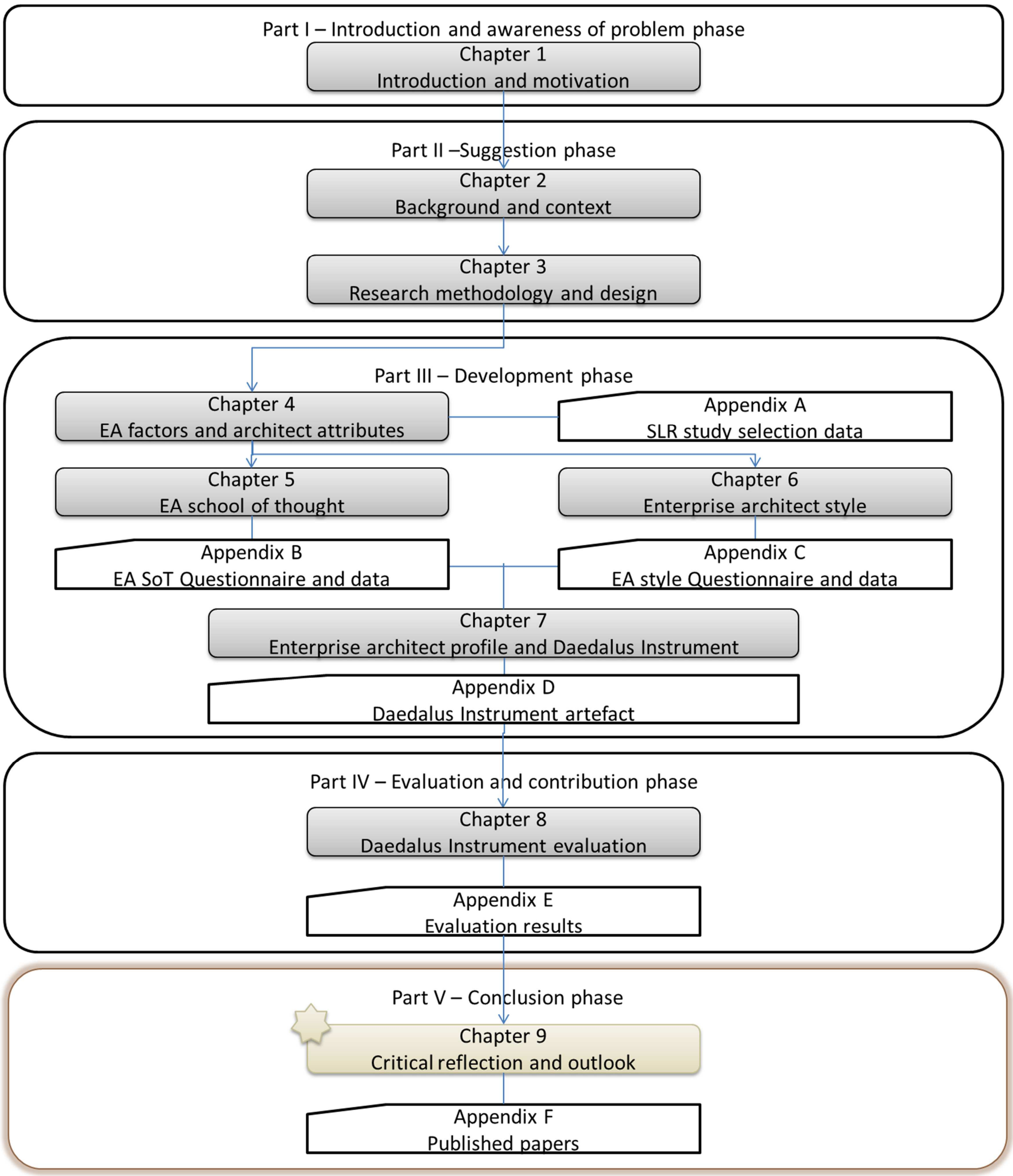
**Table 8-22: Evaluation episode plan summary**

| # | Evaluation episode | Goal | Functional purpose | Paradigm | Strategy | Design Artefact properties |
|---|---|---|---|---|---|---|
| 1 | Single evaluation conducted as a focus group | Evaluation of the design artefact as well as its technology-based solution | Summative | Naturalistic | Quick and simple | Alignment of research objectives and design artefact evaluation |

The focus group provided valuable insights into future research considerations, the design artefact as well as its technology-based implementation. The majority of feedback gained was centred on showcasing the research, how it is relevant, where it can be used, and the actual use of the technology-based implementation of the design artefact.

**Chapter 9** describes the communication and outcome of the Daedalus Instrument design artefact. Findings from the awareness of the problem, tentative design suggestion, the design and evaluation of the Daedalus Instrument are summarised, highlighting the contributions the thesis is making to EA practitioners, EA stakeholders and researchers. The thesis is also concluded in **Chapter 9**.

# 9 Critical reflection and outlook



## *9.1 Introduction*

Enterprise architects are concerned with understanding the enterprise as a social-technical system. The enterprise or organisation as a socio-technical system is an every changing system, which is distinct from mechanistic systems such as a buildings, trains or planes. To truly comprehend the entire socio-technical system, one needs to understand all the interconnected components of this system of people, process and technology. This thesis was concerned with the understanding of the architect in enterprise architecture, where the enterprise architect forms part of the socio-technical system. Understanding the architect within enterprise architecture (EA) allows organisations to have greater insight into the complexities of enterprise architecture. Using Bandura's social cognitive theory (Bandura, 1986), it was decided to focus on belief systems and behaviour styles.

Part I of the thesis was concerned with the introduction and awareness of the research problem and how it pertains to the need for better understanding of the enterprise architect. Part II of the thesis highlighted the suggestion of a solution to the problem described within Part I, by providing background and contextual information about the problem as well as listing the research methodology and design with a tentative solution. Part III of the thesis showcased the development of the design artefact and its components. Each component of the artefact, the Daedalus Instrument, was developed using an internal development cycle of the design science research (DSR) strategy. Part IV of the thesis was concerned with the evaluation and contribution of the design artefact, the Daedalus Instrument.

Finally, Part V of the thesis is concerned with providing a critical reflection and overview of the research. The critical reflection and overview chapter, **Chapter 9,** is divided into five main sections. Section 9.1 introduces the function and structure of the conclusion chapter, this section. Section 9.2, provides a summary of the research, while section 9.3 provides a discussion of the lessons that were learnt. Section 9.4 provides recommendations on the research application and any future research work. Section 9.5 concludes the final chapter.

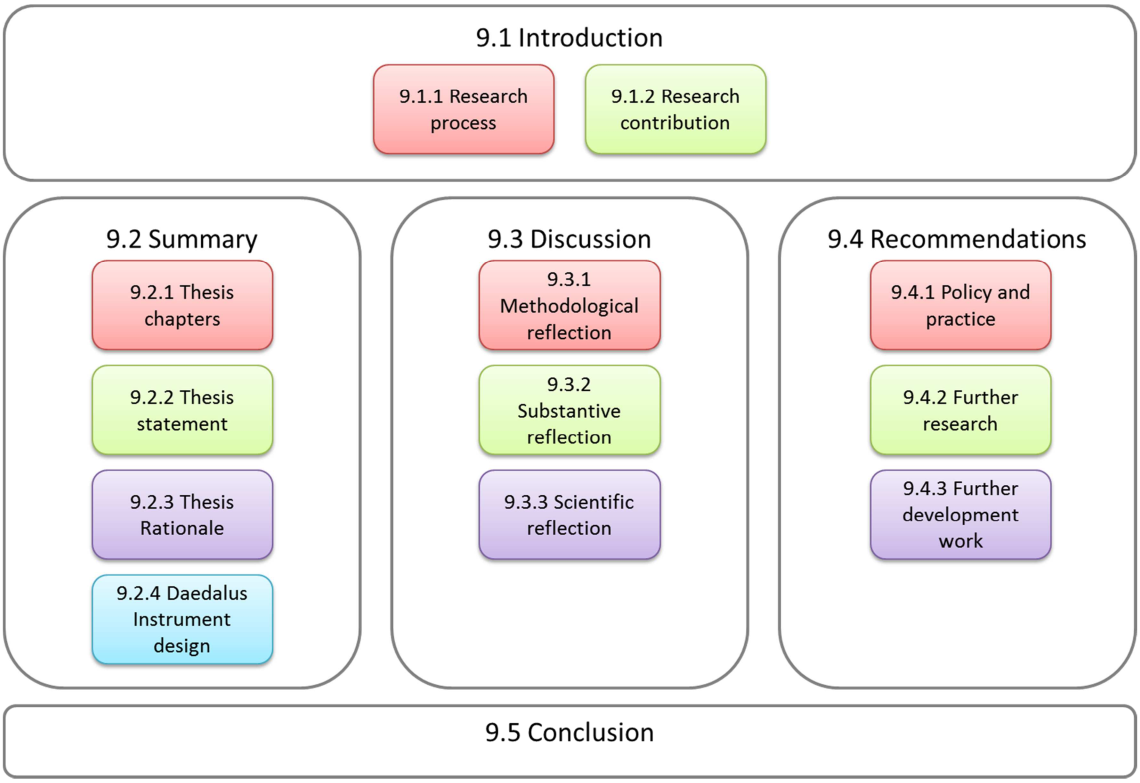



**Figure 9-A: Chapter layout**

The research contributions and outcomes are discussed in this final chapter, as depicted within Figure 9-A. Findings from the awareness of the problem, tentative design suggestion, the design, and evaluation of the Daedalus Instrument are summarised, highlighting the contributions the thesis is making to EA practitioners, EA stakeholders and academics alike. The chapter is concluded by providing recommendations on the use of the research and further research work is discussed.

### 9.1.1 Research process

The communication and conclusion of the research and the design artefact, the Daedalus Instrument, are completed as part of the communicate and conclude design science research (DSR) phase as depicted within Figure 9-B.

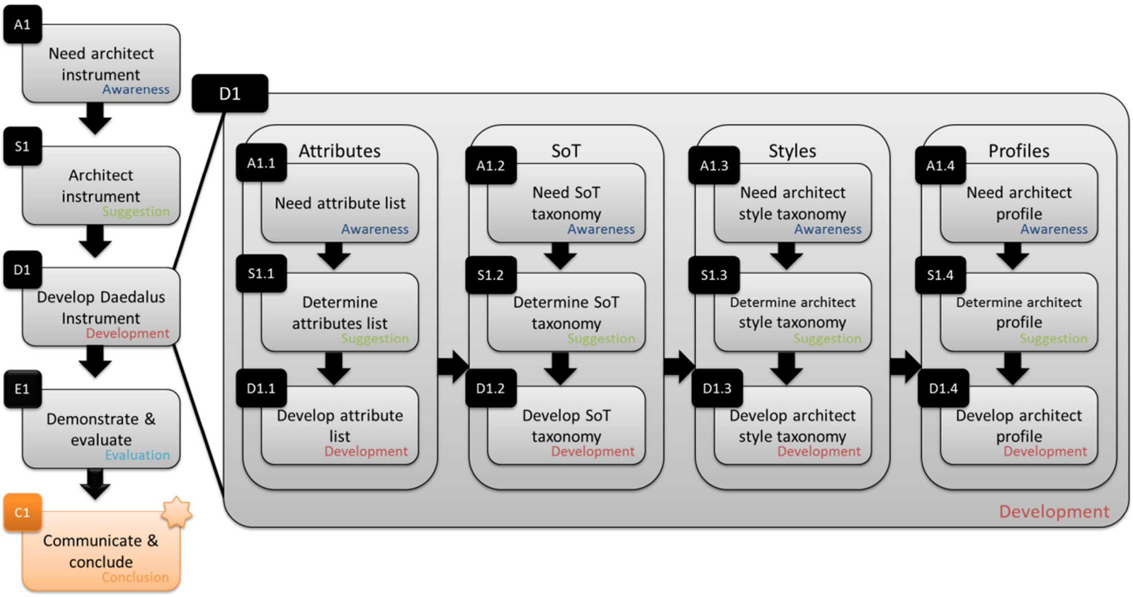



**Figure 9-B: DIA overview in relation to the DSR, communicate and conclude step**

### 9.1.2 Thesis contribution

Enterprise architecture has received a fair amount of attention from researchers, standards bodies, practitioners, and governmental organisations over the last few years. The research focused on EA frameworks, methodologies, critical success factors, challenges, concerns and effectiveness (Armour *et al.*, 2012, 2007; Van Steenbergen, 2011). The efficiency and success of EA is especially influenced by the enterprise architect who resides in various roles within an organisation.

A concern exists that no universal understanding exists of what exactly enterprise architecture is. As a result of the lack of universal understanding, certain limitations become relevant in the teaching and training of future architects as well as the universally adopted EA frameworks, definitions, methodologies and techniques. Rather than trying to obtain consensus of EA concepts, this research focused on the understanding of enterprise architect profiles.

Little research focuses on the enterprise architect itself. The goal of the research study was to create an enterprise architect instrument, which will allow organisations to understand their enterprise architects. This was done by considering and extending an existing classification of enterprise architect belief systems; proposed a way by which architects can be classified into schools of thought; reviewed different enterprise architect behavioural styles and created a mechanism to understand a specific architect profile based on EA belief systems and enterprise architect behavioural styles. This provided a view allowing for better understanding of the enterprise architect.

The aim was to create an enterprise architect instrument to complement existing EA frameworks and methodologies, such as TOGAF but not limited to TOGAF, by allowing organisations to understand the people aspect of the socio-technical organisational system.

The results of the research were the creation of the Daedalus Instrument, which allows architects and organisations alike to determine enterprise architects' specific architect profiles. The notion of architect profiles has its foundation in social cognitive theory (Bandura, 1986), explaining the characteristics individuals such as architects have. These profiles represent the various EA factors and architect attributes an architect may associate with; their aligned EA schools of thought, which represents their specific EA belief system, as well as their architect styles, which represents the specific behavioural style an architect has when operating within the working environment.

The Daedalus Instrument consists of a set of tools addressing the EA factors and architect attributes, EA schools of thought, architect styles, and architect profiles, depicted within Figure 9-C.

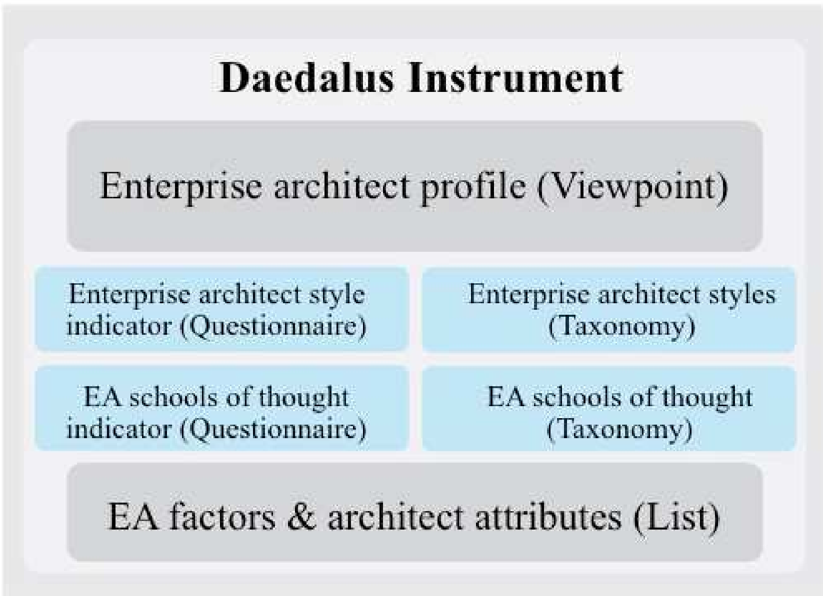



**Figure 9-C: Daedalus Instrument for Architects (DIA)**

The technology-based solution and implementation of the design artefact are depicted within Figure 9-D and available online for use at http://www.DaedalusInstrument.com/.

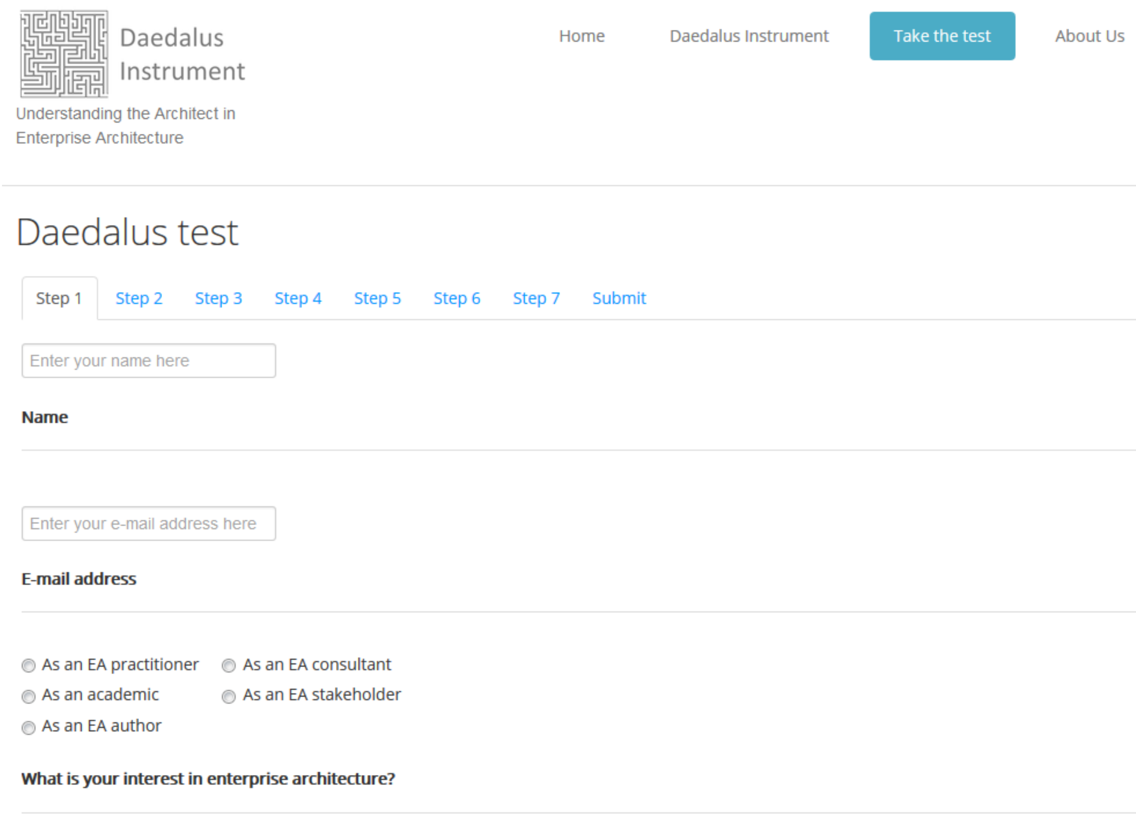



**Figure 9-D: DIA as a technology-based solution http://www.daedalusinstrument.com/**

## *9.2 Summary*

This section, section 9.2, summarises the research. A summary is provided of the thesis chapters, the thesis statement, thesis rationale, the Daedalus Instrument design as well as the applicability of the Daedalus Instrument.

### 9.2.1 Thesis chapters

The thesis consists of nine chapters and six appendixes. **Chapter 1** dealt with the introduction and motivation for the thesis. The chapter described the research statement, questions and objectives, listing the expected contribution, delineations and an outlook on future research.

**Chapter 2** dealt with the background and context of the research problem. The research problem and tentative design were placed into context using the open group architecture framework (TOGAF) as an example. The chapter also explains the understanding of enterprise architects' characteristics using social cognitive theory (Bandura, 1986) as a foundation.

**Chapter 3** provided a detailed description of the research methodology and design. The chapter provided an in-depth description of the available research methodologies, the research methodology components selected for this research study and how each of the research methodology components were applicable to this research study. The study explains the use of design science research as well as the use of the social cognitive theory as the basis for understanding enterprise architects.

**Chapter 4** gave a comprehensive and in-depth systematic literature review on various concepts related to the enterprise architect. The chapter resulted in the creation of a comprehensive list of concepts (EA factors and architect attributes). The comprehensive list of EA factors and architect attributes formed the first construct and input into the architect profile theory.

**Chapter 5** described the identification and definition of the EA school of thought indicator and taxonomy as constructs. The EA school of thought taxonomy was based on the initial enterprise architect school of thought taxonomy (Lapalme, 2012a), which represents enterprise architects' belief systems as they relate to enterprise architecture. A research study was executed and resulted in the creation of the EA schools of thought indicator. The EA schools of thought (taxonomy & indicator) formed the second construct and input into the architect profile theory.

**Chapter 6** identified the enterprise architect style construct, consisting of the enterprise architect style indicator and taxonomy. Enterprise architect styles represent the various behavioural styles enterprise architects epitomise within their working environment. A second study was executed using the data from the first study as well as data from a second study of enterprise architects within South African organisations practising enterprise architecture management. Findings from the research studies resulted in the creation of the enterprise architect styles construct, which represented the second construct and input into the architect profile theory.

**Chapter 7** describes the creation of the architect profile theory based on the creation of the identified concepts determined within **Chapter 4**, the constructs created within **Chapters 4**, **5** and **6**, and the use of social cognitive theory as a foundation for understanding enterprise architects. Architect profiles represent a view or perspective of the enterprise architect considering EA belief systems and EA behavioural styles. **Chapter 7** also describes the creation of the Daedalus Instrument as a set of tools to better understand the enterprise architect within their environment.

**Chapter 8** described the demonstration and evaluation of the Daedalus Instrument as well as its technology-based implementation, which acted as the design artefact. The assessment was conducted using a focus group to evaluate the usability, reliability and efficiency of the proposed technology-based Daedalus Instrument.

This chapter, **Chapter 9**, provides the communication, conclusion and summary of the research studies and thesis. The research contributions and outcomes are reported in this final chapter. Findings from the awareness of the problem, tentative design suggestion, the design and evaluation of the Daedalus Instrument are summarised, highlighting the contributions the thesis is making to EA practitioners, EA stakeholders and researchers.

The six appendixes to the thesis includes: **Appendix A** – the SLR study selection data as an appendix to **Chapter 4**, EA factors and architect attributes. **Appendix B** – the EA schools of thought questionnaire and data as an appendix to **Chapter 5**, EA schools of thought. **Appendix C** – the EA styles questionnaire and data as an appendix to **Chapter 6**, Enterprise architect styles. **Appendix D** – the Daedalus Instrument artefact as an appendix to **Chapter 7**, Enterprise architect profile and Daedalus Instrument. **Appendix E** – the evaluation results as an appendix to **Chapter 8**, Daedalus Instrument evaluation. **Appendix F** – the published papers as an appendix to **Chapter 9**, Critical reflection and outlook.

### 9.2.2 Thesis statement

As enterprise architects hail from different backgrounds, have different education, work in different environments and have different interpretations on what EA really is, these architects will have different opinions on how to execute an EAM initiative, resulting in very different designs based on the same initial requirements. Regardless of a common EA definition, EA framework or EA toolset used within their working environment, these architects will have different perspectives on what EA is, how to go about EAM, and why EAM is being done within an organisation.

The thesis concentrated on the creation of an architect instrument, which allows an organisation to better understand the enterprise architects within their organisation. Several research challenges emanated:

1. A systematic study needed to be completed on existing literature concerning the enterprise architect.
2. An instrument and classification needed to be created to allow an organisation to determine the specific EA school of thought an architect would align to.
3. An instrument and classification needed to be created to allow an organisation to determine the specific enterprise architect style of an architect.
4. A view needed to be created to describe the various aspects of an architect as they relate to their enterprise architect styles and EA schools of thought. This view represented the specific profile an architect has.
5. An instrument needed to be compiled to allow organisations to consistently gain understanding of the architect as it relates to the various enterprise architect styles.
6. A technology-based solution needed to be constructed to allow organisations to efficiently determine the profiles of enterprise architects.

### 9.2.3 Thesis rationale

The rationale or foundation of this research is that similarly to people having different personality types, different beliefs, and different cultures, so do enterprise architects. Enterprise architects might have different beliefs about what enterprise architecture is to them, how they would go about performing enterprise architecture management and why they believe EA should be done within an organisation. The motivation is centred on the understanding that a system considers people, process and technology; and to understand the entire system, the people forming part of the system need to be understood. The aim of the research was to understand enterprise architects, their belief systems, their opinions and what EA factors or architect attributes influence their behavioural styles.

The research was guided by the primary research question to determine:

- How can an instrument be designed for the understanding of the enterprise architect?

Six secondary research questions were used to answer specific research objectives and address the identified research challenges. Secondary research questions were then validated by linking the secondary research questions to thesis chapters, DSR process steps, and deliverable. These deliverables then also formed subcomponents of the design artefact. The secondary research questions were:

1. What enterprise architect associated EA factors and architect attributes are described in literature?
2. How can an EA schools of thought indicator be developed for the consistent classification of EA schools of thought?
3. How can an enterprise architect style indicator be developed for the consistent classification of enterprise architect behavioural styles?
4. How can enterprise architect profiles be developed for the understanding of the enterprise architect?
5. How can an instrument be developed allowing organisations to understand enterprise architects?
6. How can a technology-based solution be developed allowing organisations to efficiently determine the profiles of enterprise architects?

### 9.2.4 Daedalus Instrument for Architects (DIA) design

The research methodology and design made use of the design science research strategy. Each step of the research DSR phases made use of specific techniques as a foundation, e.g. the internal development cycles made use of a systematic literature review, qualitative questionnaires, and the social cognitive theory as foundational techniques.

The alignment of the thesis concepts and constructs were ensured by aligning the thesis title, research purpose, research objectives, primary research question and the research contribution, as described within Table 9-1.

**Table 9-1: Thesis alignment**

| | |
|---|---|
| Title | Understanding the architect in enterprise architecture: the Daedalus Instrument for architects |
| Research purpose | To design an instrument that would allow an organisation to understand the architects within the organisation |
| Research objective | To design an enterprise architect instrument |
| Research question | How can an instrument be designed for the understanding of the enterprise architect? |
| Contribution | Create an enterprise architect instrument to complement existing EA frameworks and methodologies by allowing organisations to understand the people aspect of the enterprise socio-technical system. |

The alignment of the thesis components ensured that the end deliverables validated the secondary research questions and ultimately the contribution made by the thesis. A summary of the thesis alignment of its subcomponents are described within Table 9-2.

**Table 9-2: Thesis summary**

| # | Sub-research question | Sub-objective | Challenge | Chapter | DSR Process Step | Technique | Deliverable |
|---|---|---|---|---|---|---|---|
| 1 | What enterprise architect associated EA factors and architect attributes are described in literature? | To determine which enterprise architect associated EA factors and architect attributes are described within literature. | A systematic study needs to be completed on existing literature concerning the enterprise architect. | Chapter 4 – Systematic literature review | [D1.1] | Systematic literature review | List of EA factors and architect attributes |
| 2 | How can an EA schools of thought indicator be developed for the consistent classification of EA schools of thought? | To develop an EA schools of thought indicator for the consistent classification of EA schools of thought. | An instrument and classification needs to be created to allow an organisation to determine the specific EA school of thought an architect would align to. | Chapter 5 – EA schools of thought | [D1.2] | Qualitative questionnaire | EA school of thought indicator + classification |
| 3 | How can an enterprise architect style indicator be developed for the consistent classification of enterprise architect behavioural styles? | To develop an enterprise architect style indicator for the consistent classification of the enterprise architect styles. | An instrument and classification needs to be created to allow an organisation to determine the specific enterprise architect style of an architect. | Chapter 6 – Enterprise architect style | [D1.3] | Qualitative questionnaire | Enterprise architect styles + classification |
| 4 | How can enterprise architect profiles be | To develop enterprise architect profiles for the | A view needs to be created to describe the various aspects | Chapter 7 – Enterprise architect profile | [D1.4] | social cognitive theory | Enterprise architect profiles |

| # | Sub-research question | Sub-objective | Challenge | Chapter | DSR Process Step | Technique | Deliverable |
|---|---|---|---|---|---|---|---|
| | developed for the understanding of the enterprise architect? | understanding of the enterprise architect. | of an architect as it relates to their enterprise architect styles and EA schools of thought. | | | | |
| 5 | How can an instrument be developed allowing organisations to understand enterprise architects? | To develop an instrument allowing organisations to understand enterprise architects. | An instrument needs to be compiled to allow organisations to consistently gain understanding into the architect as it relates to the various enterprise architect styles. | Chapter 7 – Daedalus Instrument for Architects | [D1] | Research construction | Daedalus Instrument for Architects |
| 6 | How can a technology-based solution be developed allowing organisations to efficiently determine the profiles of enterprise architects? | To develop a technology-based solution allowing organisations to efficiently determine the profiles of enterprise architects. | A technology-based solution needs to be constructed to allow organisations to efficiently determine the profiles of enterprise architects. | Chapter 8 – Daedalus Instrument evaluation | [E1] | Framework for the evaluation of design science (FEDS) | Technology-based Daedalus Instrument and evaluation |

An overview of the DSR strategy followed and the alignment to design deliverables and chapters is depicted within Figure 9-E.

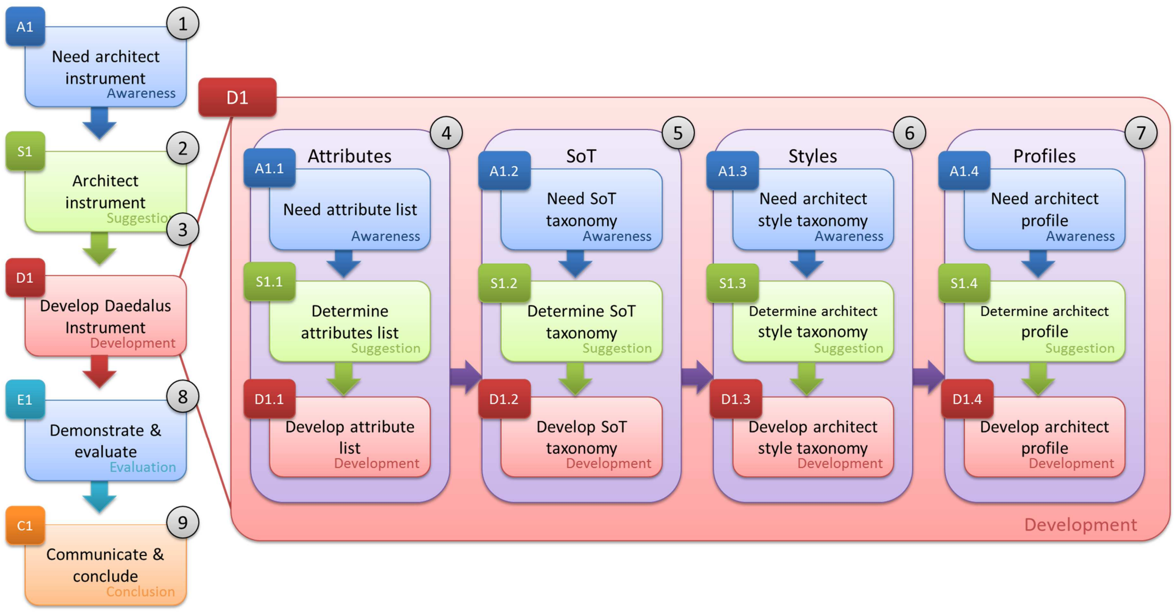



**Figure 9-E: Design science research strategy for the design of the DIA**

The research methodology and design made use of the research onion as a structure. Each layer of the onion represents a different design consideration, ensuring the design of the research is well structured and in alignment. The methodology and design of the research are depicted within Figure 9-F.

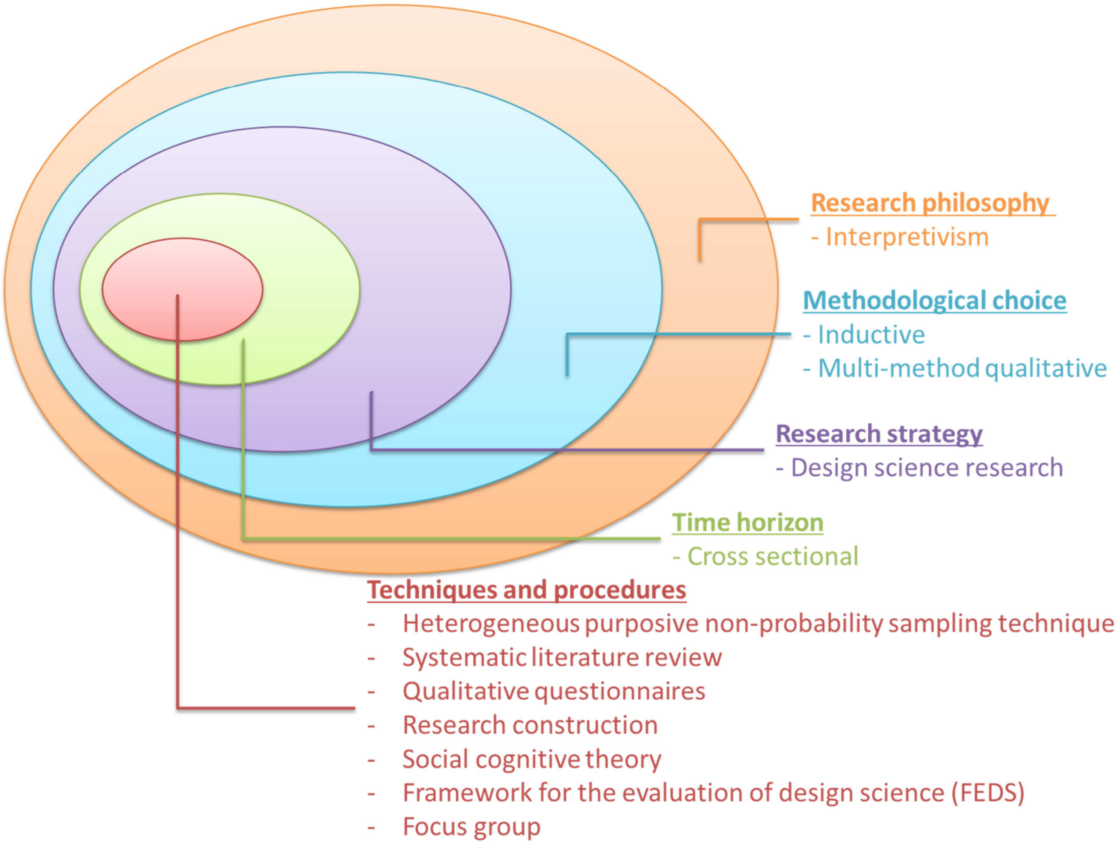



**Figure 9-F: Research methodology and design (Saunders & Tosey, 2012)**

## 9.3 Discussion

This section reflects on this thesis through discussion from three distinct perspectives: methodological reflection, substantive reflection and scientific reflection as sections 9.3.1, 9.3.2 and 9.3.3 respectively.

### 9.3.1 Methodological reflection

Methodological reflection refers to the extent the research approach influenced the results determined in this thesis. The research studies and this thesis followed a well-structured design. The research design followed the research onion model and the design science research strategy. Each component of the thesis is in alignment to the others ensuring the deliverables and outcomes of the research validates the original research objectives and research questions as described within Table 9-1 and Table 9-2. The design of the Daedalus Instrument followed the primary cycle of problem awareness and motivation, tentative design suggestion, design artefact development, design artefact demonstration and evaluation, and finally the communication and conclusion. The artefact development followed four internal development cycles, each cycle addressing a specific component of the design artefact as well as following a specific and appropriate research technique.

Ensuring that the design science research is effective, the research followed the seven guidelines as proposed by Hevner *et al.* (2004) as described within **Chapter 3**. Table 3-9 depicts the verification of the research strategy followed in this thesis, utilising these seven guidelines as a foundation by providing a reflection on the Daedalus Instrument as an outcome of the design science research process. The research approach on these guidelines are depicted within Table 9-3.

**Table 9-3: Research approach based on the design research guidelines**

| # | Guideline | Description | Applicability of the guideline | Reference chapter |
|---|---|---|---|---|
| 1 | Design as an artefact | Design science research must produce a viable artefact in the form of a construct, a model, a method, or an instantiation | Develop the proposed Daedalus Instrument (A technology-based toolset for understanding the enterprise architect) | Chapter 7 |
| 2 | Problem relevance | The objective of design science research is to develop technology-based solutions to important and relevant business problems | A lack of universal understanding in enterprise architecture manifests itself in the numerous different definitions, frameworks, methodologies and techniques. Rather than trying to gain universal understanding of EA, the research aims to understand architects' perspective on EA. Similarly to people having different personality types, different beliefs and different cultures, so do enterprise architects. Enterprise architects might have different beliefs, styles and profiles about what enterprise architecture is to them, how they go about performing enterprise architecture management and why they believe EA is done within an organisation. The motivation is centred on the understanding that a system considers people, process and technology; and to understand the entire system, the people forming part of the system need to be understood. The aim of the research is to understand enterprise architects, their believe systems, their behavioural styles and what EA factors or architect attributes influence the architect profiles by delivering a technology-based solution that can assist organisations in determining their architect's profile. | Chapter 2 |
| 3 | Design evaluation | The utility, quality, and efficacy of a design artefact must be rigorously demonstrated via well-executed evaluation methods | An assessment is conducted in an enterprise architect focus group to evaluate the use and efficiency of the proposed technology-based Daedalus Instrument. | Chapter 8 |
| 4 | Research contributions | Effective design science research must provide clear and verifiable contributions in the areas of the design artefact, design foundations or design methodologies | The Daedalus Instrument contributes to the discipline of EA by providing:<br>An enterprise architect technology-based instrument to complement existing EA frameworks and methodologies by allowing organisations to understand the people aspect of the enterprise socio-technical system. | Chapter 9 |
| 5 | Research rigour | Design science research relies upon the application | A variation of methods are employed during the execution of the research study: | Chapters 4 - 8 |

| # | Guideline | Description | Applicability of the guideline | Reference chapter |
|---|---|---|---|---|
| | | of rigorous methods in both the construction and evaluation of the design artefact | Systematic literature review<br>Internet-mediated questionnaires<br>Design and development of the Daedalus Instrument<br>Observational evaluation of the Daedalus Instrument through a focus group. | |
| 6 | Design as a search process | The search for an effective artefact requires utilising available means to reach desired ends while satisfying laws in the problem environment | The process of designing the Daedalus Instrument artefact is fundamentally modular and characterised through the "build and evaluate" cycle. This artefact is constructed through the addition of sub-components as the design for the artefact evolves. Initially the sub-components are independent to a certain extent, which are then combined at the end for a toolset of components organisations can use to understand the enterprise architect. | Chapter 4 - 7 |
| 7 | Communication of research | Design science research must be presented effectively to both technology-oriented and management-oriented audiences | This research study is presented to both enterprise architect practitioners and stakeholders through academic publications. At the time of this print, one peer-reviewed article based on this research was published:<br>Du Preez, J.A., Van der Merwe, A. & Matthee, M.C., 2014. Enterprise Architecture Schools of Thought: An Exploratory Study. In 2014 IEEE 18th International Enterprise Distributed Object Computing Conference Workshops and Demonstrations. International Enterprise Distributed Object Computing Conference Workshops and Demonstrations. Ulm, Germany: IEEE Computer Society, pp. 3–12.<br>The final research was also presented to a focus group of academics and EA practitioners. | Chapter 1 – 9, Appendix F |

### 9.3.2 Substantive reflection

Substantive reflection compares the results of the research with similar or related research on the same research topic. It includes how the research relates to other explicit knowledge on the same research topic as well as a discussion on existing literature.

The interest in the research topic came about by the observation of fellow architects, EA stakeholders and discussions with academics in the discipline of EA on their opinions of how to go about performing EAM. It became evident that no standard EA definition, EA framework, EA methodology or EA techniques exist and that the role of the enterprise architect would change depending on the circumstances of the organisation (Strano & Rehmani, 2007), such as the organisation size, organisation type or organisational governance (Shah & Kourdi, 2007). Depending on the role of the architect, the architect will make use of different techniques to fulfil the specific role resulting in different benefits and success rates (Van Steenbergen *et al.*, 2011).

The concern was that enterprise architects do not think the same about what EA is and how to do EAM, essentially not agreeing on the definitions of EA as a result of the silo type understanding of what exactly enterprise architecture is (Mentz, 2014). As a consequence of this difference in opinions, it led to a disagreement about language and terminology

(Schöenherr, 2009) as well as the lack of clarity in the conceptual foundations of EA (Mentz, 2014). Without common understanding, enterprise architects struggle to agree on a standardised EA definition or the use of a single EA framework, methodology and set of techniques. To truly comprehend EA and the enterprise architect, architects and EA stakeholders needed to better understand the motivation architects have for performing EAM in a specific manner.

The social cognitive theory (Bandura, 1986) formed the foundation of understanding enterprise architect characteristics, which includes the understanding of EA factors and architect attributes, enterprise architect belief systems and behavioural styles. A systematic literature review identified 56 primary research papers, focusing on EA factors and architect attributes which were associated with enterprise architects. From the 56 primary research papers 40 EA factors and architect attributes were identified, including EA scope and EA purpose, which form the foundation for the understanding of EA schools of thought (Lapalme, 2012a) and EA belief systems as well as enterprise architect role (Strano & Rehmani, 2007) and enterprise architect competency (Steghuis & Proper, 2008), which form the foundation for the understanding of enterprise architect behavioural styles.

The research on the enterprise architect was limited, where the focus was on specific aspects such as role (Aier, 2013; Akenine, 2008; Bredemeyer & Malan, 2004; Chung *et al.*, 2009; Gøtze, 2013), not taking into account the motivation of enterprise architects and why they perform EAM in a certain manner regardless of organisational role or position.

To date, no research was done on the holistic understanding of enterprise architect profiles, which includes belief systems and behavioural styles.

### 9.3.3 Scientific reflection

Scientific reflection refers to the thesis contribution to the 'scientific body of knowledge', as to what was gained through the research conducted, including what was learnt regarding the product, process and methodology.

A research gap was identified indicating a concern that no universal understanding of what enterprise architecture is, exists. While some authors tried to address this concern of diversification by proposing a solution framework for the consistent classification of EA terms (Langenberg & Wegmann, 2004), others argued that the definition and description of EA terms are technically correct, but that enterprise architects do not use these terms in a technical correct manner, i.e. Enterprise architects' understanding of the EA terms differ (Goethals, 2005). Taking a people perspective in trying to understand the lack of agreement on EA terms, Kappelman *et al.* state that the lack of agreement is due to the different interpretations of what the word 'enterprise' means and what the word 'architecture' means (Kappelman *et al.*, 2008), where the understanding of enterprise implies scope, and the understanding of architecture implies purpose.

As the EA discipline still has no universally agreed definition for EA, even though it was highlighted as a concern more than two decades ago by Rood (1994), not having an agreed definition has some implications for the field and the discipline of EA.

The absence of a universally acceptable EA definition or commonality regarding the description of EA frameworks and EA terms, leads to unintended consequences or implications for developing the EA discipline (Boucharas *et al.*, 2010). As a result of the core EA literature being undefined, it makes it difficult for new researchers to enter the EA discipline (Mykhashchuk *et al.*, 2011)

A research gap was identified, which indicated that the majority of research on enterprise architecture focused primarily on EA process, methodologies, tools and techniques. Little research exists on the understanding of the enterprise architect, unlike other professions like entrepreneurs (De Vries, 1977), executives (Miller & Toulouse, 1986) or teachers (Murray *et al.*, 1990). The understanding of the enterprise architect completes the triad of socio-technical system components as people, process and technology for the discipline of enterprise architecture. Where a great deal of EA research addresses **what** and **how** EA process, methodology, framework, tools and techniques should be used, little research explains **why** enterprise architects work in a certain manner.

The Daedalus Instrument and the technology-based solution provides a set of tools allowing architects and organisations alike to better understand enterprise architects' belief systems and behavioural styles. The technology-based solution is implemented using a website featuring the questionnaires enterprise architects complete in order to determine their individual architect profiles.

The Daedalus Instrument contributes to the field of Informatics by providing insight into the various EA belief systems and behavioural styles architects have while operating within their working environment. The Daedalus Instrument also adds to the discipline of Enterprise Architecture by providing enterprise architects and EA stakeholders with an instrument that can supplement existing EA frameworks such as TOGAF in understanding the enterprise architect, thereby addressing not only what needs to be done and how, but also why the architect performs EA in a specific manner. The Daedalus Instrument adds value by:

- providing a comprehensive list of EA factors and architect attributes associated with the enterprise architect, described within **Chapter 4** and **Appendix A**
- providing an indicator and taxonomy for understanding the different enterprise architect belief systems and which EA schools of thought an architect would be-long to, described within **Chapter 5** and **Appendix B**
- providing an indicator and taxonomy for understanding the different enterprise architect behavioural styles, described within **Chapter 6** and **Appendix C**
- providing the definition and identification of enterprise architect profiles and what influences the architect profiles, described within **Chapter 7** and **Appendix D**

In essence, the Daedalus Instrument provides a set of tools for understanding different enterprise architect belief systems and behavioural styles. The Daedalus Instrument was realised using a technology-based solution as a website with a simple to follow test, allowing enterprise architects to determine their respective enterprise architect profiles.

## *9.4 Recommendations*

This section reflects on recommendations for the research from three distinct perspectives: policy and practice, future research, and further development work as sections 9.4.1, 9.4.2 and 9.4.3 respectively.

### 9.4.1 Policy and practice

No standard EA framework, methodology, definition, technique or tool set exists, although a handful of EA frameworks are widely adopted within organisations around the globe. These EA frameworks and methodologies address what to use and how to go about performing EAM. A shift should be made by organisations to not only address process and technology, but also to address people in the realisation of their EA practice. It is therefore recommended to make use of an instrument such as the Daedalus Instrument to supplement existing EA frameworks and methodologies in addressing the need to understand the enterprise architect.

### 9.4.2 Future research

The Daedalus Instrument defines the methods, techniques and tools in determining the enterprise architect belief systems and behavioural styles, leading to the understanding of the different enterprise architect profiles.

Possible future research directions include considering the link between the enterprise architect profiles and their personality types as well as team dynamics and organisational culture. Several areas can be addressed when considering the architect profiles and the different personality types, team roles and organisational culture. These areas could be clustered together to form a more comprehensive enterprise architect archetype and could include:

1. What personality types do architects represent?
2. What communication styles do architects have?
3. What conflict styles do architects use?
4. What are the decision-making styles most used by architects?
5. What team roles are represented by the architects?
6. How do the different enterprise architect profiles influence the effectiveness of an EAM initiative?
7. How does organisational culture influence the different enterprise architect profiles?

### 9.4.3 Research limitations

The limitations of the research are listed as follows:

1. Generalisability: Relationships between concepts and constructs were indicated based on the research studies executed and the number of participants in each study. No statistical significance exists for the identification of these relationships and as such generalisability of the results is limited.
2. The research studies should be seen as exploratory and additional research is required to confirm the relationships and categorisation of the EA concepts.
3. The number of participants in the second questionnaire on the EA styles necessitated the author to cross reference and make use of the results from the first research study on the architect attributes. The participants in both the studies were different, but as both the questionnaires asked exactly the same questions on EA role and competency, a cross reference could be made, which allowed for the data in the first study to be used with the data of the second study.
4. The evaluation group had a limited number of EA practitioners, as a great deal of enterprise architects are interested in EA frameworks, methodologies and techniques, rather than trying to understand enterprise architect profiles. Future research should have multiple evaluation episodes.

### 9.4.4 Further development work

Additional research is required to determine the impact of understanding the different enterprise architect profiles and how enterprise architects on the same EA team, or working within the same EA practice interact, with each other. Another aspect that needs to be further developed is to determine the number of EA profiles, questioning the possibility that certain enterprise architect belief systems may also lean toward a certain enterprise architect behavioural styles.

## *9.5 Conclusion*

This chapter gave a critical reflection and overview of the research on the understanding of the enterprise architect by referring back to the research questions, objectives and concerns, as well as providing a description on thesis contribution. With the profession of the enterprise architect developing and becoming more mainstream within organisations across the globe, organisations will need to understand not only the complexities of EA and EAM but also the intricacies of the enterprise architects performing EAM within the organisation. Similar to the literature on the professional archetypes of entrepreneurs (De Vries, 1977), executives (Miller & Toulouse, 1986) and teachers (Murray *et al.*, 1990), so to do organisations need to understand enterprise architects.

A list of publications on this research is provided in **Appendix F**.

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# Appendix A. SLR study selection data

## A.1 Initial study selection

The Systematic Literature Review (SLR) search in itself is executed and all the obtained studies are listed for further evaluation.

## A.2 Data source selection execution

**Table A-1: Data source selection execution**

| Data source | Data source metadata | Data source results |
|---|---|---|
| Additional sources | Name of database | N/A |
| | Search strategy for each database | Additional sources of known authors on aspects of the enterprise architect included |
| | Date of search | 24/02/2015 |
| | Years covered by search | All dates |
| | Number of publications | 5 |
| ABI/Inform (ProQuest) | Name of database | Proquest ABI / Inform |
| | Search strategy for each database | Online database search using search terms on all fields except full text |
| | Date of search | 24/02/2015 |
| | Years covered by search | All dates |
| | Number of publications | 81 |
| Compendex Ei Engineering Village | Name of database | Compendex Ei Engineering Village |
| | Search strategy for each database | Online expert search using search terms |
| | Date of search | 24/02/2015 |
| | Years covered by search | 1969 – 2015 |
| | Number of publications | 25 |
| Ebsco Host | Name of database | Ebsco Host (Academic Search Complete, Business source Complete, E-Journal, Library & Information Science Source, Library & Information Science Technology Abstracts, MasterFile Premier) |
| | Search strategy for each database | Ebsco Host Web search using search terms for selected databases |
| | Date of search | 24/02/2015 |
| | Years covered by search | 1969 – 2015 |
| | Number of publications | 12 |
| Emerald | Name of database | Emerald Insight |
| | Search strategy for each database | Emerald Insight search using search terms for title, abstract, keyword for articles and chapters |
| | Date of search | 24/02/2015 |
| | Years covered by search | All dates |
| | Number of publications | 13 |
| Gale Databases | Name of database | Gale Databases (Academic OneFile) |
| | Search strategy for each database | Gale Databases search using search terms for meta-data only |
| | Date of search | 24/02/2015 |
| | Years covered by search | All dates |

| Data source | Data source metadata | Data source results |
|---|---|---|
| | Number of publications | 185 |
| IEEE Xplore | Name of database | IEEE Xplore |
| | Search strategy for each database | IEEE Xplore digital library search using search terms for metadata only |
| | Date of search | 24/02/2015 |
| | Years covered by search | All dates |
| | Number of publications | 128 |
| Science Direct | Name of database | Science Direct (Computer Science, Engineering, Social Science) |
| | Search strategy for each database | Science direct databases search using search terms on abstract, title, keywords |
| | Date of search | 24/02/2015 |
| | Years covered by search | All dates |
| | Number of publications | 15 |
| Thompson Reuters Web of Science | Name of database | Thompson Reuters Web of science (All databases) |
| | Search strategy for each database | Thompson Reuters Web of science databases search using search terms |
| | Date of search | 24/02/2015 |
| | Years covered by search | All dates |
| | Number of publications | 20 |
| Scopus | Name of database | Scopus |
| | Search strategy for each database | Scopus database search using search terms on abstract, title, keywords |
| | Date of search | 24/02/2015 |
| | Years covered by search | All dates |
| | Number of publications | 97 |
| Springer Link | Name of database | Springer Link |
| | Search strategy for each database | Springer Link database search using search terms exclude preview-only content |
| | Date of search | 24/02/2015 |
| | Years covered by search | All dates |
| | Number of publications | 699 |
| CiteSeer | Name of database | CiteSeer |
| | Search strategy for each database | CiteSeer database search using search terms on abstract, title, keywords |
| | Date of search | 24/02/2015 |
| | Years covered by search | All dates |
| | Number of publications | 25 |

## A.3 Qualitative critical review forms

**Table A-2: Qualitative critical review study (Nikpay *et al.*, 2013)**

| Study identification | Nikpay, F. *et al.*, 2013. A review of critical success factors of enterprise architecture implementation. In Proceedings - 2013 International Conference on Informatics and Creative Multimedia, ICICM 2013. pp. 38–42. |
|---|---|
| Study methodology | Literature review |
| Study scope | A review of the Critical Success Factors (CSF) which influences successful EA implementation |
| Study limitations | Each EA project has particular characteristics which need to find specific factors |
| EA factors / | Governance, Cognition, Management, Planning, Documentation, Programming, Communication |

| | |
|---|---|
| Study identification | Nikpay, F. *et al.*, 2013. A review of critical success factors of enterprise architecture implementation. In Proceedings - 2013 International Conference on Informatics and Creative Multimedia, ICICM 2013. pp. 38–42. |
| architect attribute | Support, Stakeholder Participation, Process, Scope, Economic Pressure, Culture, Skill of Architect, Tools / Methodology, Coverage, Rules & EA process, EA model / Artefact, Business Driven Approach, Assessment / Evaluation, Training / Education |

**Table A-3: Qualitative critical review study (Farwick *et al.*, 2014)**

| | |
|---|---|
| Study identification | Farwick, M. *et al.*, 2014. A situational method for semi-automated Enterprise Architecture Documentation. Software & Systems Modeling, pp.1–30. |
| Study methodology | Systematic literature review |
| Study scope | EAM documentation automation |
| Study limitations | Limited number of techniques identified to automate EAM documentation |
| EA factors / architect attribute | EA team structure, organisational structure & culture, role, challenge, stakeholder |

**Table A-4: Qualitative critical review study (Akenine, 2008)**

| | |
|---|---|
| Study identification | Akenine, D., 2008. A Study of Architect Roles by IASA Sweden. The Architecture Journal, (15). |
| Study methodology | Case study |
| Study scope | IT architecture and architect roles |
| Study limitations | Presents one way of aligning business to IT by collaboration in distinct and clear architect roles |
| EA factors / architect attribute | role, position, position level, challenge |

**Table A-5: Qualitative critical review study (Lu & Lin, 2012)**

| | |
|---|---|
| Study identification | Lu, H.K. & Lin, P.C., 2012. A study of competence of enterprise architects in higher education. In ICSESS 2012 - Proceedings of 2012 IEEE 3rd International Conference on Software Engineering and Service Science. pp. 551–554. |
| Study methodology | Field research |
| Study scope | Identify the core competences of enterprise architects in higher education |
| Study limitations | |
| EA factors / architect attribute | Framework, [competency (Personal traits, General skills, Professional skills, Industrial knowledge, Project management skills, Communication & negotiation skills, Team management skills)] |

**Table A-6: Qualitative critical review study (Lindström *et al.*, 2006)**

| | |
|---|---|
| Study identification | Lindström, Å. *et al.*, 2006. A survey on CIO concerns - do enterprise architecture frameworks support them? Information Systems Frontiers, 8(2), pp.81–90. |
| Study methodology | Survey |
| Study scope | The issues and constraints of the CIO role in Swedish companies |
| Study limitations | Limited geographic scope |
| EA factors / architect attribute | Framework, Business units, Position, Position level, Discipline, Concern |

**Table A-7: Qualitative critical review study (Foorthuis *et al.*, 2015)**

| | |
|---|---|
| Study identification | Foorthuis, R. *et al.*, 2015. A theory building study of enterprise architecture practices and benefits. Information Systems Frontiers, pp.1–24. |
| Study methodology | theory-building survey study |
| Study scope | EAM benefits |
| Study limitations | measured perceptions of individual respondents instead of objective facts; objective measures were not feasible in our study because of their fundamental shortcomings |
| EA factors / architect attribute | model, organisational culture, outcome, business objective, benefit, stakeholder |

**Table A-8: Qualitative critical review study (Van Steenbergen *et al.*, 2011)**

| | |
|---|---|
| Study identification | Van Steenbergen, M. *et al.*, 2011. Achieving Enterprise Architecture Benefits: What Makes the Difference? In Enterprise Distributed Object Computing Conference Workshops (EDOCW), 2011 15th IEEE International. IEEE, pp. 350–359. |
| Study methodology | Survey |
| Study scope | The relations between EA techniques used and EA benefits perceived, as well as the influence of contextual factors. |
| Study limitations | Perceptions of the use of EA techniques and the benefits EA engenders |

| | |
|---|---|
| Study identification | Van Steenbergen, M. *et al.*, 2011. Achieving Enterprise Architecture Benefits: What Makes the Difference? In Enterprise Distributed Object Computing Conference Workshops (EDOCW), 2011 15th IEEE International. IEEE, pp. 350–359. |
| EA factors / architect attribute | governance, organisational culture, technique, benefit |

**Table A-9: Qualitative critical review study (Nakakawa *et al.*, 2011)**

| | |
|---|---|
| Study identification | Nakakawa, A., Van Bommel, P. & Proper, H.A., 2011. Applying soft systems methodology in enterprise architecture creation workshops. In Proceedings of the 4th International Workshop on Enterprise Modelling and Information Systems Architectures, EMISA 2011. pp. 37–50. |
| Study methodology | Field study |
| Study scope | An SSM adaptation to supplement the design of the collaboration process with support for triggering discussions and creating a shared understanding and vision among EA stakeholders. |
| Study limitations | The repeatability and predictability of the script is yet to be determined |
| EA factors / architect attribute | framework, domain, scope, purpose, level of detail, goal |

**Table A-10: Qualitative critical review study (Walrad *et al.*, 2014)**

| | |
|---|---|
| Study identification | Walrad, C.C. *et al.*, 2014. Architecting a Profession. IT Professional, 16(1), pp.42–49. |
| Study methodology | Case study |
| Study scope | An EA roadmap as a baseline of knowledge or standards to ensure consistent service. |
| Study limitations | Not an academic study |
| EA factors / architect attribute | scope, skill, competency, position, certification, position level, role, standard |

**Table A-11: Qualitative critical review study (Armour *et al.*, 1999)**

| | |
|---|---|
| Study identification | Armour, F.J., Kaisler, S.H. & Liu, S.Y., 1999. Building an Enterprise Architecture Step by Step. IT Professional, 1(4), pp.31–39. |
| Study methodology | N/A |
| Study scope | The article shows how to scope the EA project, set up the development team, and form a target architecture vision |
| Study limitations | Not an academic study |
| EA factors / architect attribute | definition, framework, view, business unit, business objective, position, stakeholder |

**Table A-12: Qualitative critical review study (Zimmermann *et al.*, 2011)**

| | |
|---|---|
| Study identification | Zimmermann, A. *et al.*, 2011. Capability Diagnostics of Enterprise Service Architectures using a dedicated Software Architecture Reference Model. In Services Computing (SCC), 2011 IEEE International Conference on. IEEE, pp. 592–599. |
| Study methodology | Case study |
| Study scope | Extend existing enterprise and software architecture reference models and maturity frameworks to accord with a sound meta-model approach. |
| Study limitations | The results of these assessments need to be interpreted in the context of company specific strategies and use cases. As a consequence they cannot provide vendor rankings of any kind. |
| EA factors / architect attribute | framework, domain, maturity, governance, type, business unit |

**Table A-13: Qualitative critical review study (Chuang & Van Loggerenberg, 2010)**

| | |
|---|---|
| Study identification | Chuang, C.-H. & Van Loggerenberg, J., 2010. Challenges Facing Enterprise Architects: A South African Perspective. In Proceedings of the 43rd Hawaii International Conference on System Sciences - 2010. 43rd Hawaii International Conference on System Sciences. Hawaii: IEEE, pp. 1-10. |
| Study methodology | Interpretive study |
| Study scope | The relationship between enterprise architecture and its service delivery process in an organisational context. |
| Study limitations | issues such as the support and the maintenance of EA have largely been excluded from the study |
| EA factors / architect attribute | framework, domain, view, business unit, organisational culture, challenge, stakeholder |

**Table A-14: Qualitative critical review study (Nakakawa *et al.*, 2010)**

| | |
|---|---|
| Study identification | Nakakawa, A.A., Van Bommel, P.P. & Proper, H.A.E., 2010. Challenges of involving stakeholders when creating enterprise architecture. In 5th SIKS/BENAIS Conference on Enterprise Information Systems. pp. 43–55. |
| Study methodology | Exploratory survey |
| Study scope | Investigating challenges that enterprise architects face when they involve organizational stakeholders during enterprise architecture creation. |
| Study limitations | No theory or method exist to address the challenges in collaborative architecture creation. |
| EA factors / architect attribute | governance, view, business objective, concern, stakeholder, challenge, CSF |

**Table A-15: Qualitative critical review study (Niemietz & De Kinderen, 2013)**

| | |
|---|---|
| Study identification | Niemietz, H. & De Kinderen, S., 2013. Communication breakdowns in architecture driven transformations: The result of cultural diversity? a theoretical grounding of findings from qualitative interviews. In Proceedings - 2013 IEEE International Conference on Business Informatics, IEEE CBI 2013. pp. 298–305. |
| Study methodology | Literature review |
| Study scope | How cultural differences within an organisation contribute to the struggling/failure of EA guided enterprise transformations. |
| Study limitations | The focus on the enterprise architects' perspective is a limitation for our study. |
| EA factors / architect attribute | framework, business unit, organisational culture, technique, CSF, position, challenge (Communication) |

**Table A-16: Qualitative critical review study (Steghuis & Proper, 2008)**

| | |
|---|---|
| Study identification | Steghuis, C. & Proper, E., 2008. Competencies and responsibilities of enterprise architects: A jack-of-all-trades? In 4th International Workshop CIAO, and 4th International Workshop EOMAS, held at CAiSE 2008, June 16, 2008 - June 17, 2008. Lecture Notes in Business Information Processing. Springer Verlag, pp. 93–107. |
| Study methodology | Survey |
| Study scope | The study is concerned with the professionals who are responsible for the creation of the products and the execution of the associated processes: the enterprise architects. |
| Study limitations | Only Capgemini's architects were surveyed. |
| EA factors / architect attribute | framework, governance, view, certifications, organisational culture, role, competency, skills |

**Table A-17: Qualitative critical review study (Bubak, 2006)**

| | |
|---|---|
| Study identification | Bubak, O., 2006. Composing a course book for system and enterprise architecture education. In System of Systems Engineering, 2006 IEEE/SMC International Conference on. SMC 2006. Los Angeles, CA, USA: IEEE, pp. 230–235. |
| Study methodology | Literature review |
| Study scope | Outlining an advanced student text for system and enterprise architecting. |
| Study limitations | Limited in the review of literature |
| EA factors / architect attribute | framework, discipline, competency, domain, stage |

**Table A-18: Qualitative critical review study (Espinosa & Boh, 2009)**

| | |
|---|---|
| Study identification | Espinosa, J.A. & Boh, W.F., 2009. Coordination and Governance in Geographically Distributed Enterprise Architecting: An Empirical Research Design. In 42nd Hawaii International Conference on System Sciences. HICSS 2009. Hawaii, USA: IEEE, pp. 1–10. |
| Study methodology | Interpretive |
| Study scope | the challenges associated with the "architecting" effort |
| Study limitations | Limited to 29 participants |
| EA factors / architect attribute | framework, standard, maturity, governance, view, model, segment, business unit, outcome, challenge, role, position level, stakeholder |

**Table A-19: Qualitative critical review study (Hendrickx *et al.*, 2011)**

| | |
|---|---|
| Study identification | Hendrickx, H.H.M. *et al.*, 2011. Defining the Business Architecture profession. In 13th IEEE International Conference on Commerce and Enterprise Computing. CEC 2011. Kirchberg, Luxembourg: IEEE Computer Society, pp. 325–332. |
| Study methodology | Field study |

| | |
|---|---|
| Study identification | Hendrickx, H.H.M. *et al.*, 2011. Defining the Business Architecture profession. In 13th IEEE International Conference on Commerce and Enterprise Computing. CEC 2011. Kirchberg, Luxembourg: IEEE Computer Society, pp. 325–332. |
| Study scope | A need for a new role, the Business Architect |
| Study limitations | The paper is a preliminary result |
| EA factors / architect attribute | definition, methodology, standard, domain, certification, organisational culture, CSF, business objective, role, position, position level, skills, stakeholder, scope, experience |

**Table A-20: Qualitative critical review study (Ouriaghli & Nsubuga, 2012)**

| | |
|---|---|
| Study identification | Ouriaghli, A. & Nsubuga, W.M., 2012. Enterprise Architect's Roles in a Proactive Enterprise Development Context - PED model for understanding the role of an Enterprise Architect in a Proactive Enterprise Development context. Masters: IT Management. Gothenburg, Sweden: University of Gothenburg |
| Study methodology | Empirical study |
| Study scope | The Enterprise Architect's role in a proactive enterprise development context |
| Study limitations | The role and responsibilities of an Enterprise Architect in the context of a proactive enterprise development |
| EA factors / architect attribute | level of detail, business unit, stage, organisational culture, CSF, business objective, goal, role, skills, stakeholder, scope, experience |

**Table A-21: Qualitative critical review study (Van Den Berg and Van Vliet, 2014)**

| | |
|---|---|
| Study identification | Van den Berg, M. & Van Vliet, H., 2014. Enterprise architects should follow the money. In Proceedings - 16th IEEE Conference on Business Informatics. CBI 2014. Geneva, Switzerland: IEEE, pp. 135–142. |
| Study methodology | Systematic literature review |
| Study scope | Insights into how IT decision-making actually takes place and what that means for them. |
| Study limitations | Exclude grey literature (web logs, white papers). Bias in the selection of studies to include and exclude, bias of<br>the field(s) studying decision making, and bias in data extraction. |
| EA factors / architect attribute | definition, framework, deliverable, organisational culture, business objective |

**Table A-22: Qualitative critical review study (Hjort-Madsen & Pries-Heje, 2009)**

| | |
|---|---|
| Study identification | Hjort-Madsen, K. & Pries-Heje, J., 2009. Enterprise Architecture in Government: Fad or Future? In System Sciences, 2009. HICSS'09. 42nd Hawaii International Conference on. Hawaii International Conference on System Sciences. Hawaii: IEEE, pp. 1–10. |
| Study methodology | Field study |
| Study scope | The use and adoption of the EA concept in the Danish central government. |
| Study limitations | Unknown how long a fashion like EA will stay fashionable in government or even how long it will take to become unfashionable again. |
| EA factors / architect attribute | framework, competency, position, position level |

**Table A-23: Qualitative critical review study (Simon *et al.*, 2013b)**

| | |
|---|---|
| Study identification | Simon, D., Fischbach, K. & Schoder, D., 2013. Enterprise architecture management and its role in corporate strategic management. Information Systems and e-Business Management, pp.1–38. |
| Study methodology | Design science |
| Study scope | Relatively small sample of interviewees and limited time in the interviews to achieve a full understanding of EA. |
| Study limitations | Few interview statements that reveal difficulties in grasping the concept of EA or initial perceptions of an architectural approach to corporate strategic management being too model-based |
| EA factors / architect attribute | framework, model, level of detail, business unit, CSF, business objective, discipline |

**Table A-24: Qualitative critical review study (Wagter *et al.*, 2012)**

| | |
|---|---|
| Study identification | Wagter, R., Proper, H.A. & Witte, D., 2012. Enterprise architecture: A strategic specialism. In Proceedings of the 2012 IEEE 14th International Conference on Commerce and Enterprise Computing, CEC 2012. pp. 1–8. |
| Study methodology | Survey |
| Study scope | The competencies of the professionals who are responsible for the creation of an enterprise |

| | |
|---|---|
| Study identification | Wagter, R., Proper, H.A. & Witte, D., 2012. Enterprise architecture: A strategic specialism. In Proceedings of the 2012 IEEE 14th International Conference on Commerce and Enterprise Computing, CEC 2012. pp. 1–8. |
| | architecture, i.e. the enterprise architects themselves. |
| Study limitations | Surveys at Dutch speaking consulting companies in Netherland and Belgium |
| EA factors / architect attribute | organisational culture, role, competency |

**Table A-25: Qualitative critical review study (Barnes *et al.*, 2014)**

| | |
|---|---|
| Study identification | Barnes, J.M., Garlan, D. & Schmerl, B., 2014. Evolution styles: foundations and models for software architecture evolution. Software & Systems Modeling, 13(2), pp.649–678. |
| Study methodology | Case study |
| Study scope | An approach for planning and reasoning about architecture evolution |
| Study limitations | The software engineering method approach is less appealing for small-scale evolutions |
| EA factors / architect attribute | domain, position level |

**Table A-26: Qualitative critical review study (Hauder *et al.*, 2014)**

| | |
|---|---|
| Study identification | Hauder, M. *et al.*, 2014. Examining adaptive case management to support processes for enterprise architecture management. In Proceedings - IEEE International Enterprise Distributed Object Computing Workshop, EDOC. pp. 23–32. |
| Study methodology | Design science |
| Study scope | Adaptive Case Management (ACM) as an emerging paradigm to support agile, lean, and collaborative processes for EA management (EAM). |
| Study limitations | A larger empirical basis and further case studies in organisations are necessary to validate the approach. |
| EA factors / architect attribute | framework, governance, model, stage, experience |

**Table A-27: Qualitative critical review study (MacLennan & Van Belle, 2014)**

| | |
|---|---|
| Study identification | MacLennan, E. & Van Belle, J.-P., 2014. Factors affecting the organizational adoption of service-oriented architecture (SOA). Information Systems and e-Business Management, 12(1), pp.71–100. |
| Study methodology | Survey |
| Study scope | Organisational SOA adoption in South Africa |
| Study limitations | Limited to enterprise architects in South Africa |
| EA factors / architect attribute | business unit, organisational culture, CSF |

**Table A-28: Qualitative critical review study (Tambouris *et al.*, 2012)**

| | |
|---|---|
| Study identification | Tambouris, E. *et al.*, 2012. Fostering enterprise architecture education and training with the enterprise architecture competence framework. International Journal of Training and Development, 16(2), pp.128–136. |
| Study methodology | Literature review |
| Study scope | Training uses of the Enterprise Architecture Competence Framework (EA-CF). |
| Study limitations | EA-CF implementation in real-world conditions and their evaluation with established assessment models |
| EA factors / architect attribute | framework, domain, maturity, business objective, competency, stakeholder, skill, certification, role, stage, position. |

**Table A-29: Qualitative critical review study (Iacob *et al.*, 2014)**

| | |
|---|---|
| Study identification | Iacob, M.E. *et al.*, 2014. From enterprise architecture to business models and back. Software & Systems Modeling, 13(3), pp.1059–1083. |
| Study methodology | Case study |
| Study scope | Important IT change processes affecting an organization's enterprise architecture are also mirrored by a change in the organisation's business model |
| Study limitations | Relating the ArchiMate and BMC concepts and not their relationships. |
| EA factors / architect attribute | framework, domain, model, schools of thought |

**Table A-30: Qualitative critical review study (Boster *et al.*, 2000)**

| | |
|---|---|
| Study identification | Boster, M., Liu, S. & Thomas, R., 2000. Getting the most from your enterprise architecture. IT Professional, 2(4), pp.43–51. |
| Study methodology | A five step process to build an enterprise architecture. |

| | |
|---|---|
| Study identification | Boster, M., Liu, S. & Thomas, R., 2000. Getting the most from your enterprise architecture. IT Professional, 2(4), pp.43–51. |
| Study scope | Failure to grasp what makes an architecture valuable can thwart the best of plans |
| Study limitations | Non Academic study |
| EA factors / architect attribute | framework, standard, business objectives, position, position level |

**Table A-31: Qualitative critical review study (Safari *et al.*, 2014)**

| | |
|---|---|
| Study identification | Safari, H., Faraji, Z. & Majidian, S., 2014. Identifying and evaluating enterprise architecture risks using FMEA and fuzzy VIKOR. Journal of Intelligent Manufacturing, pp.1–12. |
| Study methodology | Case study |
| Study scope | Using failure mode and effect analysis (FMEA) for evaluating EA risks |
| Study limitations | Limited to a single Iranian company. Risks based on literature review and experts within said company. |
| EA factors / architect attribute | framework, organisational culture, technique, skills |

**Table A-32: Qualitative critical review study (Bauer *et al.*, 2013)**

| | |
|---|---|
| Study identification | Bauer, M. *et al.*, 2013. IoT Architectural Reference. In Enabling Things to Talk. Springer, pp. 163–211. |
| Study methodology | Design science |
| Study scope | Definition of an Internet of Things Reference Architecture |
| Study limitations | The IoT Reference Architecture is rather abstract |
| EA factors / architect attribute | framework, methodology, domain, view, modelling notation, level of detail |

**Table A-33: Qualitative critical review study (Foorthuis *et al.*, 2010)**

| | |
|---|---|
| Study identification | Foorthuis, R. *et al.*, 2010. On course, but not there yet: Enterprise architecture conformance and benefits in systems development. In ICIS 2010 Proceedings - Thirty First International Conference on Information Systems. |
| Study methodology | Survey |
| Study scope | Benefits that Enterprise Architecture (EA) delivers |
| Study limitations | Measuring perceptions of respondents instead of objective results. Usual limitations of causal analysis based on observational rather than experimental data. |
| EA factors / architect attribute | model, organisational culture, benefit, stakeholder, technique, schools of thought |

**Table A-34: Qualitative critical review study (Wegmann, 2003)**

| | |
|---|---|
| Study identification | Wegmann, A., 2003. On the Systemic Enterprise Architecture Methodology (SEAM). In Published at the International Conference on Enterprise Information Systems. SEAM. Citeseer, pp. 483 – 490. |
| Study methodology | Case study |
| Study scope | Design of an original methodology for Enterprise Architecture |
| Study limitations | Limitations on the applicability of using the SEAM |
| EA factors / architect attribute | framework, methodology, modelling notation, challenge, role |

**Table A-35: Qualitative critical review study (Nakakawa *et al.*, 2009)**

| | |
|---|---|
| Study identification | Nakakawa, A., Van Bommel, P. & Proper, H.A.E., 2009. Quality enhancement in creating enterprise architecture: Relevance of academic models in practice. In Advances in Enterprise Engineering II. Lecture Notes in Business Information Processing. pp. 109–133. |
| Study methodology | Design science |
| Study scope | Development of a collaboration process to facilitate the steps in the formulated approach |
| Study limitations | The theoretical underpinnings of CEEADA, an approach focusing on quality enhancement in creating enterprise architecture. |
| EA factors / architect attribute | framework, domain, scope, purpose, business objective, CSF, deliverable, concern, stakeholder |

**Table A-36: Qualitative critical review study (Hämäläinen & Markkula, 2009)**

| | |
|---|---|
| Study identification | Hämäläinen, N. & Markkula, J., 2009. Question framework for architectural description quality evaluation. Software Quality Journal, 17(2), pp.215–228. |
| Study methodology | Field study |
| Study scope | A question framework for architecture design quality evaluation |

| | |
|---|---|
| Study identification | Hämäläinen, N. & Markkula, J., 2009. Question framework for architectural description quality evaluation. Software Quality Journal, 17(2), pp.215–228. |
| Study limitations | A limited number of replies by the focus group members may have affected the reliability of the results. |
| EA factors / architect attribute | framework, view, modelling notation, level of detail, business objective, stakeholder, purpose, scope |

**Table A-37: Qualitative critical review study (Sidorova & Kappelman, 2011)**

| | |
|---|---|
| Study identification | Sidorova, A. & Kappelman, L., 2011. Realizing the benefits of enterprise architecture: An actor-network theory perspective. In Proceedings of the 2nd International Conference on Complex Systems Design and Management. CSDM 2011. Paris, France: Springer Verlag, pp. 317–333. |
| Study methodology | ANT |
| Study scope | The socio-political and socio-technical aspects of EA work in the context of complex organization situations. |
| Study limitations | The degree of accessibility to different parts of the EA repository in terms of appropriate practices regarding security, intellectual property, privacy, as well as competitive and other propriety matters |
| EA factors / architect attribute | framework, methodology, challenge, competency, skill, benefit |

**Table A-38: Qualitative critical review study (Zimmermann *et al.*, 2012)**

| | |
|---|---|
| Study identification | Zimmermann, O., Miksovic, C. & Küster, J.M., 2012. Reference architecture, metamodel, and modeling principles for architectural knowledge management in information technology services. Selected papers from the 2011 Joint Working IEEE/IFIP Conference on Software Architecture (WICSA 2011), 85(9), pp.2014–2033. |
| Study methodology | Field study |
| Study scope | Capturing and sharing design knowledge such as architectural decisions |
| Study limitations | Applying the approach to business domains outside IT services |
| EA factors / architect attribute | framework, level of detail, business unit, CSF, position, position level, domain, challenge, scope |

**Table A-39: Qualitative critical review study (Vinoski, 2008)**

| | |
|---|---|
| Study identification | Vinoski, S., 2008. Serendipitous reuse. IEEE Internet Computing, 12(1), pp.84–87. |
| Study methodology | N/A |
| Study scope | EA application integration |
| Study limitations | Non-academic study |
| EA factors / architect attribute | definition, framework, standard, domain, governance, benefit, schools of thought, challenge, domain |

**Table A-40: Qualitative critical review study (Solano, 2011)**

| | |
|---|---|
| Study identification | Solano, M.A., 2011. SoSE architecture principles for net-centric multi-int fusion systems. In System of Systems Engineering (SoSE), 2011 6th International Conference on. SoSE 2011. Albuquerque, NM: IEEE, pp. 61–66. |
| Study methodology | Design science |
| Study scope | Key issues innate to Net-Centric Multi-Int Fusion Systems, and offers SoSE principles for a top-down analysis of functional requirements and guidelines for reconciling design trade-offs. |
| Study limitations | Building a one-of-a-kind (specialised) SoSE is fiscally untenable |
| EA factors / architect attribute | Framework, abstraction, position, position level, role, concern |

**Table A-41: Qualitative critical review study (Steen *et al.*, 2004)**

| | |
|---|---|
| Study identification | Steen, M.W.A. *et al.*, 2004. Supporting viewpoint-oriented enterprise architecture. In Enterprise Distributed Object Computing Conference, 2004. EDOC 2004. Proceedings. Eighth IEEE International. EDOC 2004. Monterey, California, USA: IEEE, pp. 201–211. |
| Study methodology | Design science |
| Study scope | Design of a tool environment for viewpoint-oriented enterprise architecture |
| Study limitations | The tool environment caters for two unintegrated prototypes |
| EA factors / architect attribute | framework, methodology, view, modelling notation, level of detail |

**Table A-42: Qualitative critical review study (Espinosa & Boh, 2009)**

| | |
|---|---|
| Study identification | Espinosa, J.A. & Boh, W.F., 2009. Coordination and Governance in Geographically Distributed Enterprise Architecting: An Empirical Research Design. In 42nd Hawaii International Conference on System Sciences. HICSS 2009. Hawaii, USA: IEEE, pp. 1–10. |
| Study methodology | Case study |
| Study scope | Team knowledge helps to coordinate the architecting effort to achieve this alignment |
| Study limitations | The study does not comprise a thorough empirical validation |
| EA factors / architect attribute | standard, maturity, purpose, governance, model, business unit, benefit, role, position, position level, goal |

**Table A-43: Qualitative critical review study (Harmon, 2005)**

| | |
|---|---|
| Study identification | Harmon, K., 2005. The systems nature of enterprise architecture. In IEEE Systems, Man and Cybernetics Society, Proceedings - 2005 International Conference on Systems, Man and Cybernetics, October 10, 2005 - October 12, 2005. Conference Proceedings - IEEE International Conference on Systems, Man and Cybernetics. SMC 2005. Waikoloa, HI, USA: IEEE, pp. 78–85. |
| Study methodology | Unknown |
| Study scope | Enterprise as a system and the "systems" nature of Enterprise architecture |
| Study limitations | unknown |
| EA factors / architect attribute | standard, domain, competency, discipline, role, challenge, position, position level |

**Table A-44: Qualitative critical review study (Gøtze, 2013)**

| | |
|---|---|
| Study identification | Gøtze, J., 2013. The changing role of the enterprise architect. In 17th IEEE International Enterprise Distributed Object Computing Conference Workshops, EDOCW 2013. Proceedings - IEEE International Enterprise Distributed Object Computing Workshop, EDOCW. EDOCW 2013. Vancouver, BC: IEEE, pp. 319–326. |
| Study methodology | Literature review |
| Study scope | The role of enterprise architects and the importance of the enterprise architects' understanding of boundary issues in their practice. |
| Study limitations | Unknown |
| EA factors / architect attribute | standard, domain, competency, discipline, role, challenge, position, position level, type |

**Table A-45: Qualitative critical review study (Van Der Raadt *et al.*, 2010)**

| | |
|---|---|
| Study identification | Van der Raadt, B. *et al.*, 2010. The relation between EA effectiveness and stakeholder satisfaction. Journal of Systems and Software, 83(10), pp.1954–1969. |
| Study methodology | Case study |
| Study scope | EA stakeholder satisfaction and EA effectiveness relationship |
| Study limitations | Limited number of respondents in single organisation. Untested the construct and discriminant validity of the measurement model. Incompatible data collection comparison. |
| EA factors / architect attribute | framework, governance, level of detail, reporting line, business unit, CSF, business objective, stakeholder, concern, goal |

**Table A-46: Qualitative critical review study (Espinosa *et al.*, 2011)**

| | |
|---|---|
| Study identification | Espinosa, J.A., Armour, F. & Boh, W.F., 2011. The role of group cognition in enterprise architecting. In System Sciences (HICSS), 2011 44th Hawaii International Conference on. HICSS 2011. Kauai, HI: IEEE, pp. 1–10. |
| Study methodology | Empirical study |
| Study scope | Understanding the coordination challenges and best practices leading to EA success |
| Study limitations | Unknown |
| EA factors / architect attribute | framework, standard, maturity, governance, model, segment, business unit, goal, role, position, position level, stakeholder |

**Table A-47: Qualitative critical review study (Aier, 2014)**

| | |
|---|---|
| Study identification | Aier, S., 2014. The role of organisational culture for grounding, management, guidance and effectiveness of enterprise architecture principles. Information Systems and e-Business Management, 12(1), pp.43–70. |
| Study methodology | Survey |
| Study scope | The role of organisational culture for the mechanisms and effects of EA principles |

| | |
|---|---|
| Study identification | Aier, S., 2014. The role of organisational culture for grounding, management, guidance and effectiveness of enterprise architecture principles. Information Systems and e-Business Management, 12(1), pp.43–70. |
| Study limitations | Not a representative sample. German-speaking countries. Reliance on single informants per organisation |
| EA factors / architect attribute | framework, standard, model, business unit, organisational culture, CSF, goal, experience, stakeholder |

**Table A-48: Qualitative critical review study (Strano & Rehmani, 2007)**

| | |
|---|---|
| Study identification | Strano, C. & Rehmani, Q., 2007. The role of the enterprise architect. Information Systems and eBusiness Management, 5(4), pp.379-396. |
| Study methodology | Interpretive study |
| Study scope | The role of the enterprise architect as viewed by subject matter experts within the executive branch of the US Federal Government. |
| Study limitations | Addresses only the executive branch of the US Federal Government. Criteria that were used for selecting the data. Data was based on self-reporting. |
| EA factors / architect attribute | standard, role, position, position level, experience, discipline |

**Table A-49: Qualitative critical review study (Lapalme, 2012a)**

| | |
|---|---|
| Study identification | Lapalme, J., 2012. Three Schools of Thought on Enterprise Architecture. IT Professional, 14(6), pp.37–43. |
| Study methodology | Literature review |
| Study scope | EA definitions and EA schools of thought |
| Study limitations | Limited literature review |
| EA factors / architect attribute | definition, framework, schools of thought, scope, purpose, skill, concern, challenge, objective |

**Table A-50: Qualitative critical review study (The Open Group, 2009)**

| | |
|---|---|
| Study identification | The Open Group, 2009. TOGAF Version 9.1: A Manual 9.1 ed., Van Haren Publishing. |
| Study methodology | Narrative |
| Study scope | Enterprise Architecture Framework |
| Study limitations | Limited information on EA tools and enterprise architects |
| EA factors / architect attribute | definition, framework, methodology, standard, domain, maturity, scope, purpose, governance, view, modelling notation, segment, deliverable, type, level of detail, reporting line, segment, business unit, organisational culture, CSF, business objective, concern, role, discipline, skills category, stakeholder |

**Table A-51: Qualitative critical review study (Rehkopf & Wybolt, 2003)**

| | |
|---|---|
| Study identification | Rehkopf, T.W. & Wybolt, N., 2003. Top 10 Architecture Land Mines. IT Professional, 5(6), pp.36–43. |
| Study methodology | Unknown |
| Study scope | Contribution of enterprise architecture to business organisation success. EA anti-patterns |
| Study limitations | Non-academic study |
| EA factors / architect attribute | methodology, standard, business unit, business objective, challenge |

**Table A-52: Qualitative critical review study (Naranjo *et al.*, 2014)**

| | |
|---|---|
| Study identification | Naranjo, D., Sanchez, M. & Villalobos, J., 2014. Towards a unified and modular approach for visual analysis of enterprise models. In Proceedings - IEEE International Enterprise Distributed Object Computing Workshop, EDOC. EDOCW 2014. Ulm, Germany: IEEE, pp. 77–86. |
| Study methodology | Case study |
| Study scope | Automated structural and domain-specific analysis methods of an Enterprise Model |
| Study limitations | The development of the EA analysis approach is based on a fictional case study |
| EA factors / architect attribute | framework, model, level of detail, skill, role, stakeholder, competency, challenge |

**Table A-53: Qualitative critical review study (Jacobs *et al.*, 2009)**

| | |
|---|---|
| Study identification | Jacobs, D., Kotze, P. & Van Der Merwe, A., 2009. Towards an enterprise repository framework. In Joint Proceedings of the 4th International Workshop on Technologies for Context-Aware Business Process Management, TCoB 2009. AT4WS 2009. AER 2009. MDMD 2009. In Conjunction with ICEIS 2009. ICEIS 2009. Milan, Italy: Inst. for Syst. and Technol. of Inf. Control and Commun., pp. 77–89. |
| Study methodology | Analogical reasoning |
| Study scope | The theoretical foundation of the data warehouse domain to contribute to the definition of an enterprise repository framework |
| Study limitations | Unknown |
| EA factors / architect attribute | definition, domain, view, CSF |

**Table A-54: Qualitative critical review study (Fraga & Llorens, 2007)**

| | |
|---|---|
| Study identification | Fraga, A. & Llorens, J., 2007. Training initiative for new Software/Enterprise architects: an ontological approach. In The Working IEEE/IFIP Conference on Software Architecture. WICSA '07. Mumbai, India: IEEE, pp. 19–22. |
| Study methodology | Literature review |
| Study scope | A methodology based on ontological structures and reinforcement learning for enterprise architects |
| Study limitations | Unknown |
| EA factors / architect attribute | domain, role, discipline, certification |

**Table A-55: Qualitative critical review study (Chung *et al.*, 2009)**

| | |
|---|---|
| Study identification | Chung, L. *et al.*, 2009. Understanding the Role of Enterprise Architecture towards Better Institutionalization. In 10th ACIS International Conference on Software Engineering, Artificial Intelligences, Networking and Parallel/Distributed Computing. SNPD '09. Daegu: IEEE, pp. 316–320. |
| Study methodology | Narrative |
| Study scope | The role of enterprise architecture from a Requirements Engineering perspective |
| Study limitations | No metrics to determine the degree of institutionalisation |
| EA factors / architect attribute | framework, organisational culture, business objective, benefit, goal, role, challenge, concern |

**Table A-56: Qualitative critical review study (Woods & Rozanski, 2005)**

| | |
|---|---|
| Study identification | Woods, E. & Rozanski, N., 2005. Using architectural perspectives. In Software Architecture, 2005. WICSA 2005. 5th Working IEEE/IFIP Conference on. WICSA 2005. Pittsburgh, PA, USA: IEEE, pp. 25–35. |
| Study methodology | Design |
| Study scope | Using the architectural perspective to provide an architect with practical guidance as to how to ensure that their system exhibits the right set of quality properties |
| Study limitations | Limited number of architectural perspectives is listed |
| EA factors / architect attribute | definition, framework, standard, governance, view, stage, objective, concern, challenge, goal, technique, benefit, role, experience, skill, stakeholder |

**Table A-57: Qualitative critical review study (Bredemeyer & Malan, 2004)**

| | |
|---|---|
| Study identification | Bredemeyer, D. & Malan, R., 2004. What it takes to be a great enterprise architect. Enterprise Architecture-Cutter Consortium, 7(8), p.25. |
| Study methodology | Narrative |
| Study scope | The necessary qualities for great enterprise architects |
| Study limitations | Non-academic study |
| EA factors / architect attribute | competency, role, scope, position |

## A.4 SLR data results

**Table A-58: SLR data results**

| Abstraction | Area | Topic class | Topic | # of Studies |
|---|---|---|---|---|
| How | Enterprise Architecture Management | EA factor | Level of detail | 10 studies |
| What | Enterprise Architecture | EA factor | Architecture Segment | 03 studies |
| What | Enterprise Architecture | EA factor | Certification | 04 studies |
| What | Enterprise Architecture | EA factor | Configuration | 19 studies |
| What | Enterprise Architecture | EA factor | Definitions | 08 studies |
| What | Enterprise Architecture | EA factor | Deliverables | 03 studies |
| What | Enterprise Architecture | EA factor | Domains | 16 studies |
| What | Enterprise Architecture | EA factor | Frameworks | 38 studies |
| What | Enterprise Architecture | EA factor | Governance | 13 studies |
| What | Enterprise Architecture | EA factor | Maturity stage | 07 studies |
| What | Enterprise Architecture | EA factor | Methodologies | 07 studies |
| What | Enterprise Architecture | EA factor | Modelling Notation | 05 studies |
| What | Enterprise Architecture | EA factor | Models | 17 studies |
| What | Enterprise Architecture | EA factor | Profile (Organisation, UML) | 06 studies |
| What | Enterprise Architecture | EA factor | Purpose | 06 studies |
| What | Enterprise Architecture | EA factor | Scope | 09 studies |
| What | Enterprise Architecture | EA factor | Standards | 13 studies |
| What | Enterprise Architecture | EA factor | Views | 11 studies |
| Where | Enterprise Architecture Practise | EA factor | Organisational Segment (Business unit) | 16 studies |
| Where | Enterprise Architecture Practise | EA factor | Reporting Line | 02 studies |
| Who | Enterprise Architect | Architect attribute | Competencies | 11 studies |
| Who | Enterprise Architect | Architect attribute | Discipline | 08 studies |
| Who | Enterprise Architect | Architect attribute | Experience | 05 studies |
| Who | Enterprise Architect | Architect attribute | Position Levels | 14 studies |
| Who | Enterprise Architect | Architect attribute | Positions | 18 studies |
| Who | Enterprise Architect | Architect attribute | Roles | 20 studies |
| Who | Enterprise Architect | Architect attribute | School of thought | 04 studies |
| Who | Enterprise Architect | Architect attribute | Skills Category | 11 studies |
| Who | Enterprise Architect | Architect attribute | Stakeholders | 19 studies |
| Who | Enterprise Architect | Architect | Type | 03 |

| Abstraction | Area | Topic class | Topic | # of Studies |
|---|---|---|---|---|
| | | attribute | | studies |
| Why | EA Motivation | Architect attribute | Benefits | 08 studies |
| Why | EA Motivation | Architect attribute | Business objectives | 17 studies |
| Why | EA Motivation | Architect attribute | Challenges and problems | 15 studies |
| Why | EA Motivation | Architect attribute | Concerns | 09 studies |
| Why | EA Motivation | Architect attribute | Critical success factors | 13 studies |
| Why | EA Motivation | Architect attribute | Goals | 08 studies |
| Why | EA Motivation | Architect attribute | Organisational culture | 16 studies |
| Why | EA Motivation | Architect attribute | Outcomes | 02 studies |
| Why | EA Motivation | Architect attribute | Politics (Power) | 16 studies |
| Why | EA Motivation | Architect attribute | Techniques | 05 studies |

# Appendix B. EA schools of thought questionnaire and data

## B.1 Questionnaire attributes and compliance

**Table B-1: Questionnaire attributes and compliance (Saunders *et al.*, 2009, p. 358)**

| Questionnaire attribute | Internet mediated questionnaire | Compliance |
|---|---|---|
| Population characteristics suitability | Computer-literate individuals | Enterprise architects |
| Confidence that right person responded | High if using email | Notification via email and EA forums |
| Likelihood of contamination or distortion of respondents answers | Low | Electronically captured |
| Size of sample | Large | Architects globally |
| Likely response rate | Variable, 11% using internet | 33% estimated |
| Feasible length of questionnaire | Fewer screens advisable | 8 pages total. 6 pages core |
| Suitable types of questionnaires | Simple closed questions. Questions must be in interest of participants | Simple open ended questions. Mix of interesting questions |
| Time taken to complete collection | 2 – 6 weeks from distribution | Survey was open for 3 months |
| Main financial resource implications | Web page design | Used a free and dedicated online research methods site |
| Role of the interviewer | None | None |
| Data input | Automated | Automated |

## B.2 Data requirements table

**Table B-2: Data requirements table (Saunders *et al.*, 2009, p. 364)**

| Research type | Exploratory | | | | |
|---|---|---|---|---|---|
| Research question | How can the EA school of thought of an enterprise architect be determined in a consistent manner? | | | | |
| Research objective | To determine in which EA school of thought an enterprise architect would belong. | | | | |
| # | Investigative questions | Variable(s) required | Detail in which data measured | Data variables (opinion, behaviour, attribute) | Source |
| 1 | What architecture position do you most associate with? | Participant attribute as architecture position | Analyst<br>System engineer / architect<br>Systems / solutions architect<br>Enterprise architect / Chief EA<br>Other (Specify) | Attribute | (Bredemeyer & Malan, 2004; Ellinger, 2009) |
| 2 | What experience do you have in enterprise architecture? | To determine if there is a link between EA experience and a specific EA school of thought | < 1 Year experience<br>1-5 years' experience<br>5-10 years' experience<br>10-15 years' experience<br>>15 years' experience | Attribute | N/A |
| 3 | In what educational discipline are you formally trained? | To determine if there is a link between educational discipline a specific EA school of thought | None<br>Humanities<br>Social Sciences<br>Natural Sciences<br>Formal Sciences<br>Professional and Applied Sciences<br>Other (Specify) | Attribute | Wikipedia |
| 4 | What is your | To determine if | Secondary education | Attribute | International |

| | | | | | |
|---|---|---|---|---|---|
| Research type | Exploratory | | | | |
| | highest level of education obtained? | there is a link between education level and a specific EA school of thought | Post-secondary non tertiary education<br>Short cycle tertiary education<br>Bachelor or equivalent<br>Masters or equivalent<br>Doctoral or equivalent<br>Other (Specify) | | Standard Classification of Education |
| 5 | What enterprise architecture certification have you obtained to date? | To determine if there is a link between enterprise architecture certification and a specific EA school of thought | None<br>Open Group - TOGAF<br>Zachman International - Zachman Framework<br>Open Group - Certified Architect<br>FEAC Institute - Certified Enterprise Architect<br>EA COE Certified<br>USA CIO Certificate Program<br>Commercial Vendor Specific<br>IASA - Certified IT Architect<br>Other (Specify) | Attribute | Web search |
| 6 | What is the scope of EAM? | To determine in which EA school of thought an architect would be | IT<br>Entire enterprise<br>Enterprise in environment<br>Other (Specify) | Opinion | (Bredemeyer & Malan, 2004; Lapalme, 2012a) |
| 7 | What is the purpose of EAM? | To determine in which EA school of thought an architect would be | IT business alignment<br>Strategy execution<br>Strategy Formulation<br>Other (Specify) | Opinion | (Lapalme, 2012a) |
| 8 | What architecture definition would you most associate with? | To determine in which EA school of thought an architect would be | MIT CISR<br>EARF<br>FEAF<br>The Open Group<br>Archimate Foundation<br>IEAD<br>ISO/IEC/IEEE 42010<br>Gartner<br>Other (Specify) | Opinion | Web search |
| 9 | What EA role do you most associate with? | To determine if there is a link between a specific EA role and a specific EA school of thought | Change agent<br>Communicator<br>Leader<br>Manager<br>Modeller<br>Other (Specify) | Behaviour | (Strano & Rehmani, 2007) |
| 10 | What enterprise architect position level do you currently hold? | To determine if there is a link between position level and a specific EA school of thought | Junior level<br>Mid-level<br>Senior level<br>Chief level<br>Executive level<br>Other (Specify) | Attribute | N/A |
| 11 | What enterprise architecture segment do you work on? | To determine if there is a link between enterprise architecture segment and a specific EA school | Component level<br>Solutions level<br>Segment / Domain Level<br>Enterprise Level<br>Other (Specify) | Opinion | (Strano & Rehmani, 2007) |

| Research type | Exploratory | | | | |
|---|---|---|---|---|---|
| | | of thought | | | |
| 12 | What enterprise architecture domain do you associate with? | To determine if there is a link between enterprise architecture domain and a specific EA school of thought | Business<br>Information<br>Data<br>Application<br>Technology<br>Security<br>Solutions<br>Integration<br>Other (Specify) | Opinion | Wikipedia |
| 13 | What organisational segment is most affected by the architecture effort you work on? | To determine if there is a link between the affected organisational segment and a specific EA school of thought | Corporate<br>Business<br>Functional<br>Operational<br>Technical<br>Other (Specify) | Behaviour | N/A |
| 14 | What level of detail do you perform in the architecture effort? | To determine if there is a link between the enterprise architecture work level of detail and a specific EA school of thought | Low level of detail<br>Medium level of detail<br>High level of detail<br>Various levels of detail | Opinion | N/A |
| 15 | What stakeholder perspectives do you focus on for the architecture function? | To determine if there is a link between the Zachman architectural representations and a specific EA school of thought | Contextual perspective (Executive)<br>Conceptual perspective (Business management)<br>Logical perspective (Architect)<br>Physical perspective (Engineer)<br>Assembly perspective (Technician)<br>Instantiable (Enterprise) | Behaviour | (Zachman, 2007) |
| 16 | What architecture abstractions do you focus on? | To determine if there is a link between the Zachman architectural representations and a specific EA school of thought | Inventory / data<br>Process / function<br>Distributions / network / location<br>Responsibilities / people<br>Timing<br>Motivation | Opinion | (Zachman, 2007) |
| 17 | What architecture models do you create? | To determine if there is a link between enterprise architecture models architects use and specific EA school of thought | Primitive models<br>Composite models (viewpoints)<br>Don't know | Opinion | (Zachman, 2007) |
| 18 | What stage of maturity do you believe the architecture effort has obtained? | To determine if there is a link between the enterprise architecture maturity level and a specific EA | Creating EA Awareness<br>Building the EA Management Foundation<br>Developing the EA<br>Completing the EA<br>Leveraging the EA to | Opinion | (US GAO, 2002) |

| Research type | Exploratory | | | | |
|---|---|---|---|---|---|
| | | school of thought | Manage Change | | |
| 19 | What CSF or success attributes have the architecture effort realised? | To determine if there is a link between the enterprise architecture maturity level and a specific EA school of thought | Demonstrates Commitment<br>Provides Capability to Meet Commitment<br>Demonstrates Satisfaction of Commitment<br>Verifies Satisfaction of Commitment | Opinion | (US GAO, 2002) |
| 20 | What EAM frameworks do you align most with? | To determine if there is a link between the use of an EA framework and a specific EA school of thought | IAF<br>ARIS<br>EABOK<br>GEA<br>GWEA<br>GERAM<br>Zachman<br>TOGAF<br>PEAF<br>FEAF<br>TEAF<br>DoDAF<br>MoDAF<br>Vendor Specific<br>Using an adapted EA framework<br>Internal or own developed EA framework<br>Other (Specify) | Opinion | (Schekkerman, 2004) |
| 21 | Which stakeholders do you interact with? | To determine if there is a link between specific EA stakeholders and a specific EA school of thought | Analysts<br>Architects<br>Programme / project managers<br>Executives<br>Line managers<br>Competency leads<br>Other (Specify) | Opinion | (Bredemeyer & Malan, 2004) |
| 22 | What governance structure do you interact with? | To determine if there is a link between specific EA governance structures and a specific EA school of thought | Committees<br>Boards<br>Authorities<br>Other (Specify) | Opinion | N/A |
| 23 | What modelling notations do you most often use in your current role? | To determine if there is a link between EA modelling notation and a specific EA school of thought | UML<br>BPMN<br>Archimate<br>SOMF<br>DEMO<br>ABACUS<br>ACME<br>EPC<br>Custom<br>Other (Specify) | Opinion | Web search |
| 24 | What skills category do you most often use as an architect? | To determine if there is a link between enterprise architect skill category and a specific EA school of thought | Generic skills<br>Business skills and methods<br>EA skills<br>PM skills<br>IT general knowledge skills<br>Technical IT skills | Opinion | (The Open Group, 2009) |

| Research type | Exploratory | | | | |
|---|---|---|---|---|---|
| | | | Legal environment<br>Other (Specify) | | |
| 25 | What enterprise architecture competency do you most associate with? | To determine if there is a link between an EAM competency and a specific EA school of thought | Credible expert<br>Strategist<br>Organisational<br>Politician<br>Leader<br>Consultant<br>Other (Specify) | Opinion | (Bredemeyer & Malan, 2004) |
| 26 | What value do you add to the enterprise architecture effort? | To determine if there is a link between an EAM value and a specific EA school of thought | An articulation of the strategic requirements of the enterprise<br>Models of the future state, which illustrate what the enterprise should look like across all EA viewpoints in support of the business strategy<br>A roadmap of the change initiatives required to reach that future state<br>The requirements, principles, standards, and guidelines that will steer the implementation of change initiatives<br>Other (Specify) | Opinion | (FEA PMO, 2014) |
| 27 | What outcomes do you try to achieve by delivering on the EAM effort? | To determine if there is a link between EAM outcomes and a specific EA school of thought | Improvements to the effectiveness, efficiency, and agility of the enterprise<br>Innovations in the structure of an organisation<br>Improvements in the capability of continuous organisational innovation and change competency<br>The rational centralisation or federation of business processes<br>Improvements to the quality and timeliness of business information<br>Clarification and articulation of business rules<br>Alignment of spending so that money spent on business initiatives and systems actually delivers on the strategic intent<br>Other (Specify) | Behaviour | (FEA PMO, 2014) |
| 28 | What enterprise architecture | To determine if there is a link | Meeting quality requirements | Opinion | (Buckl *et al.*, 2010a, 2010c; Jain *et al.*, |

Research type Exploratory

| | | | | | |
|---|---|---|---|---|---|
| | concerns do you have in your current role? | between EAM concerns and a specific EA school of thought | Meeting budgets<br>Meeting delivery deadlines<br>Meeting business objectives<br>Solving business problems<br>Delivering on ICT solutions<br>Realising business value<br>Ensuring good governance practises<br>Communicating the value of enterprise architecture<br>Providing future ICT direction<br>Providing future business strategic direction<br>Managing the architecture effort<br>Leading the architecture team<br>Driving change through the organisation<br>Ensuring regulatory or statutory compliance<br>Other (Please specify) | | 2009; Lindström *et al.*, 2006) |
| 29 | What enterprise architecture challenges do you have in your current role? | To determine if there is a link between EAM challenges and a specific EA school of thought | Factors hindering effective collaboration<br>Methods used in practice to support collaborative tasks<br>Strengths and weaknesses of methods currently used<br>Evaluation of enterprise architecture design alternatives<br>Acceptance<br>Success factors for enterprise architecture creation<br>Other (Please specify) | Opinion | (Armour *et al.*, 2012, 2007; Chuang & Van Loggerenberg, 2010; Isomäki & Liimatainen, 2008; Kaisler & Armour, 2005; Nakakawa *et al.*, 2010) |
| 30 | What enterprise architecture goals do you try to achieve in your current role? | To determine if there is a link between EAM goals and a specific EA school of thought | Business-IT alignment<br>Cost reduction<br>Standardisation / consolidation<br>Governance or transformation / IT management<br>Agility<br>Business support (e.g. risk management and business continuity management)<br>Transparency<br>Complexity management<br>Innovation<br>Regulatory compliance | Opinion | (Boucharas *et al.*, 2010; Buckl *et al.*, 2010b; Lange & Mendling, 2011; Penttinen & Isomäki, 2010) |

| | | | | | |
|---|---|---|---|---|---|
| Research type | Exploratory | | | | |
| | | | Other (Please specify) | | |
| 31 | What enterprise architecture techniques do you use within your current role? | To determine if there is a link between EAM techniques and a specific EA school of thought | EA being formally approved<br>Choices in EA are explicitly linked to business goals<br>Projects are being explicitly assessed on their degree of compliance with EA<br>Knowledge is being exchanged in an organised manner between different types of architects<br>Knowledge is being exchanged in an organised manner between architects and other employees participating in projects that have to conform to EA<br>Assistance is being offered in order to stimulate conformance to EA<br>Projects make use of a project start architecture<br>Document templates are being used to stimulate conformance to EA<br>Financial rewards and disincentives are being used in order to stimulate conformance to EA<br>Imposing penalties in case of deviations from EA<br>Other (Please specify) | Opinion | (Buckl, Matthes & Schweda 2010a; Van Steenbergen *et al.* 2011) |
| 32 | What organisational culture best describes the enterprise architecture function within your organisation? | To determine if there is a link between organisational culture and a specific EA school of thought | Group culture<br>Development culture<br>Hierarchical culture<br>Rational culture<br>Other (Please specify) | Opinion | (Aier, 2013) |
| 33 | To whom does the enterprise architecture function report? | To determine if there is a link between EAM reporting line and a specific EA school of thought | CEO<br>CIO<br>CFO<br>CTO<br>ICT manager<br>Business manager<br>Board of directors<br>Other (Please specify) | Attribute | (Matthee *et al.*, 2007) |
| 34 | What enterprise architecture benefits do you | To determine if there is a link between EAM | Accomplish enterprise-wide goals instead of (possibly | Opinion | (Van Steenbergen *et al.*, 2011) |

| Research type | Exploratory | | | | |
|---|---|---|---|---|---|
| | believe you bring in your current role? | benefits and a specific EA school of thought | contradictory) local optimisations<br>Provide insight into the complexity of the organisation<br>Integrate, standardise or de-duplicate related processes and systems<br>Depict a clear image of the desired future situation<br>Enable different stakeholders to communicate with each other effectively<br>Make enterprise architecture, in general, to be a good instrument<br>Other (Please specify) | | |
| 35 | What business objectives do you try to achieve in your current role? | To determine if there is a link between business objectives and a specific EA school of thought | Effectively enable the enterprise strategy<br>Support IT planning and reduce costs<br>Enable business<br>Effectively implement the enterprise strategy<br>Support organisational coherence<br>Innovate and adapt<br>Support organisational coherence<br>Encourage system-in-environment coevolution<br>Other (Please specify) | Opinion | (Lapalme, 2012a) |

## B.3 EA classifications

**Table B-3: EA schools of thought classification – Step 1**

| | | | |
|---|---|---|---|
| | # of responses<br>% value | # of responses<br>% value | # of responses<br>% value |
| | # of responses<br>% value | # of responses<br>% value | # of responses<br>% value |
| EA Scope | # of responses<br>% value | # of responses<br>% value | # of responses<br>% value |
| | EA Purpose | | |

**Table B-4: EA factors and architect attributes aligned question classification – Step 2**

| | | | | | |
|---|---|---|---|---|---|
| Question 1<br>Position | Question 2<br>Experience | Question 3<br>Education discipline | Question 4<br>Education level | Question 5<br>EA certification | Question 6<br>EA scope |
| Question 7<br>EA purpose | Question 8<br>EA definition | Question 9<br>Role | Question 10<br>Position level | Question 11<br>EA segment | Question 12<br>EA domain |
| Question 13<br>Organisation segment | Question 14<br>EA level of detail | SoT Name | Question 15<br>Stakeholder perspective (Zachman) | Question 16<br>Abstraction (Zachman) | Question 17<br>EA model type |

| | | | | | |
|---|---|---|---|---|---|
| Question 18 EA maturity stage | Question 19 Critical success factors | Question 20 EA frameworks | Question 21 Stakeholder interaction | Question 22 EA governance structure | Question 23 EA modelling notation |
| Question 24 EA skills category | Question 25 EA competency | Question 26 Business value add | Question 27 Outcome achievement | Question 28 EA concerns | Question 29 EA challenges |
| Question 30 EA goals | Question 31 EA techniques | Question 32 Organisation culture | Question 33 EA reporting line | Question 34 EA benefits | Question 35 Business objectives |

**Table B-5: Question aligned EA factors and architect attributes classification – Step 3**

| | | | |
|---|---|---|---|
| EA Scope | High relevance question answer | High relevance question answer | High relevance question answer |
| | High relevance question answer | High relevance question answer | High relevance question answer |
| | High relevance question answer | | |
| | EA Purpose | | |

## *B.4 EA factors and architect attributes viewpoints*

### B.4.1 Question 1 – Architecture position

**Table B-6: Question 1 viewpoint**

| | | |
|---|---|---|
| EA | SA | EA |
| EA | EA | EA |
| EA | | |

### B.4.2 Question 2 – Architect experience

**Table B-7: Question 2 viewpoint**

| | | |
|---|---|---|
| 5-10 | 1-5 | 5-10 |
| 1-5 | 10-15 | 10-15 |
| 5-10 | | |

### B.4.3 Question 3 – Educational discipline

**Table B-8: Question 3 viewpoint**

| | | |
|---|---|---|
| PAS | N/A | FS |
| PAS | PAS | FS |
| FS | | |

### B.4.4 Question 4 – Educational level

**Table B-9: Question 4 viewpoint**

| | | |
|---|---|---|
| M | N/A | N/A |
| B | M | M |
| M | | |

### B.4.5 Question 5 – Architecture certification

**Table B-10: Question 5 viewpoint**

| | | |
|---|---|---|
| TOGAF + OTHER | TOGAF | TOGAF + NONE |
| TOGAF | TOGAF | TOGAF |
| ZACHMAN + TOGAF | | |

### B.4.6 Question 6 – EA scope

**Table B-11: Question 6 viewpoint (EA scope as EA SoT perspective)**

| |
|---|
| |
| |

### B.4.7 Question 7 – EA purpose

**Table B-12: Question 7 viewpoint (EA purpose as EA SoT perspective)**

| |
|---|
| |
| |
| |

### B.4.8 Question 8 – EA definition

**Table B-13: Question 8 viewpoint**

| | | |
|---|---|---|
| GARTNER | OPEN GROUP | ARCHI |
| GARTNER | GARTNER | GARTNER |
| MIT | | |

### B.4.9 Question 9 – Architect role

**Table B-14: Question 9 viewpoint**

| | | |
|---|---|---|
| CHANGE AGENT | N/A | LEADER |
| LEADER | CHANGE AGENT | CHANGE AGENT |
| LEADER | | |

### B.4.10 Question 10 – Architect position

**Table B-15: Question 10 viewpoint**

| | | |
|---|---|---|
| N/A | SENIOR LEVEL | SENIOR LEVEL |
| SENIOR LEVEL | SENIOR LEVEL | SENIOR LEVEL |
| SENIOR LEVEL | | |

### B.4.11 Question 11 – EA segment

**Table B-16: Question 11 viewpoint**

| | | |
|---|---|---|
| ENTERPRIS | SEGMENT | N/A |
| ENTERPRIS | ENTERPRIS | ENTERPRIS |
| SYSTEM + SEGMENT | | |

### B.4.12 Question 12 – EA domain

**Table B-17: Question 12 viewpoint**

| | | |
|---|---|---|
| N/A | N/A | N/A |
| APP | BUSINESS | BUSINESS |
| N/A | | |

### B.4.13 Question 13 – Organisational segment

**Table B-18: Question 13 viewpoint**

| | | |
|---|---|---|
| N/A | BUSINESS | BUSINESS |
| STRATEGIC + BUSINESS | BUSINESS | BUSINESS |
| BUSINESS | | |

### B.4.14 Question 14 – EA effort

**Table B-19: Question 14 viewpoint**

| | | |
|---|---|---|
| N/A | N/A | MEDIUM LEVEL |
| HIGH LEVEL | N/A | N/A |

### B.4.15 Question 15 – Stakeholder perspective

**Table B-20: Question 15 viewpoint**

| | | |
|---|---|---|
| N/A | LOGICAL | N/A |
| LOGICAL | LOGICAL + CONCEPT | CONCEPT |
| LOGICAL | | |

### B.4.16 Question 16 – EA abstractions

**Table B-21: Question 16 viewpoint**

| | | |
|---|---|---|
| PROCESS | DISTRIB | PROCESS |
| PROCESS | PROCESS | PROCESS |
| INVENTRY | | |

### B.4.17 Question 17 – EA models

**Table B-22: Question 17 viewpoint**

| | | |
|---|---|---|
| COMPSTE | COMPSTE | COMPSTE |
| COMPSTE | COMPSTE | COMPSTE |
| COMPSTE | | |

### B.4.18 Question 18 – EA maturity stage

**Table B-23: Question 18 viewpoint**

| | | |
|---|---|---|
| N/A | N/A | AWARE |
| CREATE | DEVELOP | N/A |
| CREATE | | |

### B.4.19 Question 19 – EA critical success factors

**Table B-24: Question 19 viewpoint**

| | | |
|---|---|---|
| N/A | PROVIDE | PROVIDE |
| PROVIDE | PROVIDE | PROVIDE |
| DEMO | | |

### B.4.20 Question 20 – EA frameworks

**Table B-25: Question 20 viewpoint**

| | | |
|---|---|---|
| N/A | TOGAF | ZACHMAN |
| TOGAF | TOGAF | TOGAF |

### B.4.21 Question 21 – Stakeholder interaction

**Table B-26: Question 21 viewpoint**

| | | |
|---|---|---|
| N/A | PM + ARCHITECT | ARCHITECT |
| PM | EXECUT + ARCHITECT | EXECUT + LINE |
| PM + ANALYST | | |

## B.4.22 Question 22 – EA governance structure

Table B-27: Question 22 viewpoint

| | | |
|---|---|---|
| N/A | N/A | COMMITE |
| COMMITE | BOARD | COMMITE |
| N/A | | |

## B.4.23 Question 23 – Modelling notation

Table B-28: Question 23 viewpoint

| | | |
|---|---|---|
| BPMN | N/A | CUSTOM |
| UML | UML + BPMN | BPMN |
| UML | | |

## B.4.24 Question 24 – Architect skills category

Table B-29: Question 24 viewpoint

| | | |
|---|---|---|
| EA | N/A | EA |
| N/A | EA | EA + BUSINESS |
| IT GENERIC | | |

## B.4.25 Question 25 – Architect competency

Table B-30: Question 25 viewpoint

| | | |
|---|---|---|
| CONSULT | CONSULT | CONSULT + STRATEGI |
| CONSULT | STRATEGST | CONSULT |
| CONSULT | | |

## B.4.26 Question 26 – EA value add

Table B-31: Question 26 viewpoint

| | | |
|---|---|---|
| FUTURE STATE | FUTURE STATE | FUTURE STATE |
| FUTURE STATE | FUTURE STATE + ROADMAP | FUTURE STATE |
| FUTURE STATE + ROADMAP | | |

## B.4.27 Question 27 – EA outcomes

Table B-32: Question 27 viewpoint

| | | |
|---|---|---|
| EFFECTIVE | N/A | EFFECTIVE |
| EFFECTIVE | EFFECTIVE | EFFECTIVE |
| EFFECTIVE + QUALITY | | |

## B.4.28 Question 28 – EA concerns

Table B-33: Question 28 viewpoint

| | | |
|---|---|---|
| ICT DIRECT + BUS DIRECT | BUSINESS VALUE | BUSINESS VALUE |
| BUSINESS VALUE | N/A | BUSINESS VALUE |
| QUALITY + ICT DIRECTION | | |

## B.4.29 Question 29 – EA challenges

Table B-34: Question 29 viewpoint

| | | |
|---|---|---|
| COLLAB | STRENGH WEAK + ALTERN | COLLAB |
| COLLAB | COLLAB | COLLAB |
| COLLAB | | |

## B.4.30 Question 30 – EA goals

Table B-35: Question 30 viewpoint

| | | |
|---|---|---|
| IT ALIGN | N/A | N/A |
| IT ALIGN | N/A | IT ALIGN |
| IT ALIGN | | |

## B.4.31 Question 31 – EA techniques

Table B-36: Question 31 viewpoint

| | | |
|---|---|---|
| N/A | KNOWLED EXCHA | N/A |
| APPROVE EA | APPROVE EA | BUS GOALS |
| PROJECT STARTUP | | |

## B.4.32 Question 32 – Organisational culture

Table B-37: Question 32 viewpoint

| | | |
|---|---|---|
| GROUP | N/A | RATIONAL |
| HIERARCH | RATIONAL | HIERARCH |
| RATIONAL + HIERARCH | | |

## B.4.33 Question 33 – EA reporting line

Table B-38: Question 33 viewpoint

| | | |
|---|---|---|
| CEO + CIO | N/A | CIO |
| CIO | CIO | CIO |
| CIO | | |

## B.4.34 Question 34 – EA benefits

Table B-39: Question 34 viewpoint

| | | |
|---|---|---|
| INTEGRATE + COMPLEX | INTEGRATE + FUTURE STATE | INTEGRATE + FUTURE STATE |

| | | |
|---|---|---|
| INTEGRATE | INTEGRATE + COMPLEX | INTEGRATE |
| N/A | | |

### B.4.35 Question 35 – Business objectives

**Table B-40: Question 35 viewpoint**

| | | |
|---|---|---|
| BUSINESS STRAT | N/A | ENABLE STRAT |
| ENABLE BUSINESS | IMPLEM STRAT | ENABLE BUSINESS |
| COSTS | | |

## *B.5 Enterprise architect attribute short list*

**Table B-41: Enterprise architect attribute classifications**

| Classification | Factor / Attribute |
|---|---|
| Enterprise architect | Stakeholders (Bredemeyer & Malan, 2004); Position (Bredemeyer & Malan, 2004; Ellinger, 2009); Position level; Educational discipline; Education level; Experience; Role (Strano & Rehmani, 2007); Skills category (The Open Group, 2009); Competency (Bredemeyer & Malan, 2004). |

**Table B-42: Enterprise architect attribute options**

| Architect attribute | Available Options |
|---|---|
| Competency | Credible Expert; Strategist; Organisational Politician; Leader; Consultant; Other. |
| Education discipline | None; Humanities; Social Sciences; Natural Sciences; Formal Sciences; Professional and Applied Sciences; Other. |
| Education level | Secondary education; Post-secondary non-tertiary education; Short cycle tertiary education; Bachelor or equivalent; Masters or equivalent; Doctoral or equivalent; Other. |
| Experience | < 1 Year experience; 1-5 years' experience; 5-10 years' experience; 10-15 years' experience; >15 years' experience. |
| Position | Analyst; System engineer / architect; Systems / solutions architect; Enterprise architect / Chief EA; Other. |
| Position level | Junior level; Mid-level; Senior level; Chief level; Executive level; Other. |
| Purpose (EA SoT) | IT business alignment; Strategy execution; Strategy Formulation. |
| Role | Change agent; Communicator; Leader; Manager; Modeller; Other |
| Scope (EA SoT) | IT; Entire enterprise; Enterprise in environment. |
| Skills category | Generic skills; Business skills and methods; EA skills; PM skills; IT general knowledge skills; Technical IT skills; Legal environment; Other. |
| Stakeholders | Analysts; Architects; Project managers; Executives; Line managers; Competency leads; Other. |

# Appendix C. Enterprise architect styles questionnaire and data

## C.1 Preparing questionnaire attributes and compliance

**Table C-1: Preparing questionnaire attribute and compliance (Saunders *et al.*, 2009, p. 358)**

| Questionnaire attribute | Internet mediated questionnaire | Compliance |
|---|---|---|
| Population characteristics suitability | Computer-literate individuals | Enterprise architects |
| Confidence that right person responded | High if using email | Notification via email and EA forums |
| Likelihood of contamination or distortion of respondents answers | Low | Electronically captured |
| Size of sample | Large | Practising enterprise architects within South African organisations |
| Likely response rate | Variable, 11% using internet | 10% estimated |
| Feasible length of questionnaire | Fewer screens advisable | 5 pages total. 3 pages core |
| Suitable types of questionnaires | Simple closed questions. Questions must be in interest of participants | Simple open ended questions. Mix of interesting questions |
| Time taken to complete collection | 2 – 6 weeks from distribution | Survey was open for 3 months |
| Main financial resource implications | Web page design | Used on free and dedicated online research methods site |
| Role of the interviewer | None | None |
| Data input | Automated | Automated |

## C.2 Data requirements table of questionnaire (Question 1 – 14)

**Table C-2: Data requirements table, (based on Saunders *et al.*, 2009, p. 364)**

| Research type | Exploratory | | | |
|---|---|---|---|---|
| Research question | How can an enterprise architect style indicator be developed for the consistent classification of enterprise architect styles? | | | |
| Research objective | To develop an enterprise architect style indicator for the consistent classification of the enterprise architect styles. | | | |
| # | Investigative Questions | Variable(s) required | Detail in which data measured | Data variables (opinion, behaviour, attribute) |
| 1 | What is your interest in enterprise architecture? | Participant attribute as architecture interest | As an EA practitioner<br>As an academic<br>As an EA author<br>As an EA consultant<br>As an EA stakeholder<br>Other (Please specify) | Opinion |
| 2 | What architecture position do you align with? | Participant attribute as architecture position | Analyst<br>System engineer<br>Solution architect<br>Enterprise architect<br>Other (Please specify) | Attribute |
| 3 | What do you believe the scope of EA is? Where scope refers to the scope under consideration to be changed as part of the EA initiative. | Participant attribute as architecture scope | Enterprise-wide IT platform<br>Enterprise as a sociocultural, techno-economic system<br>Enterprise in its environment<br>Other (Please Specify) | Opinion |
| 4 | What do you believe the purpose for planning an EA initiative is, rather than executing the EA initiative? | Participant attribute as architecture purpose | ICT and business alignment<br>Business strategy execution<br>Business strategy formulation<br>Other (Please specify) | Opinion |

| | | | | |
|---|---|---|---|---|
| Research type | Exploratory | | | |
| 5 | What would you believe the motto for enterprise architecture is? | Participant attribute as architecture motto | EA as the glue between business and IT<br>EA as the link between strategy and execution<br>EA as a means for organisation innovation and sustainability<br>EA as a tool for power and negotiation<br>EA as a decision transformation methodology<br>EA as an analysis approach to strategy execution<br>EA as a change agent considering external IT environment<br>Other (Please specify) | Opinion |
| 6 | What analogy would you use to best describe the enterprise architect? | Participant attribute as architecture analogy | As an urban planner<br>As an inquiring facilitator<br>As a nurturer and sense maker<br>As a politician<br>As a futurist<br>As a consultant<br>As a scholar or learner<br>Other (Please specify) | Opinion |
| 7 | What belief concepts do you align with, with respect to EA? | Participant attribute as architect belief concepts | System perspective (group)<br>Reductionism or<br>Holism<br>System dynamics (group)<br>Closed System or<br>Open System<br>Events doctrine (group)<br>Determinism or<br>Indeterminism<br>Applicability doctrine (group)<br>Universalism<br>Contextualism<br>System doctrine (group)<br>Realism or<br>Instrumentalism<br>authority<br>mechanism<br>I don't know<br>Other (Please Specify) | Opinion |
| 8 | What EA role do you associate with? | Participant attribute as architect role | Change agent<br>Communicator<br>Leader<br>Manager<br>Modeller<br>Other (Specify) | Attribute |
| 9 | Which stakeholders do you interact with? | Participant attribute as architecture stakeholders | Analysts<br>Architects<br>Programme / project managers<br>Executives<br>Line managers / functional groups<br>Competency leads<br>Business strategist<br>Capital investment planner<br>External stakeholder<br>Oversight officials<br>Other (Specify) | Attribute |
| 10 | What enterprise architecture competency do you most associate with? | Participant attribute as architect competency | Technology<br>Strategy<br>Organisational politics<br>Leadership<br>Consulting | Opinion |

| Research type | Exploratory | | | |
|---|---|---|---|---|
| 11 | What enterprise architect characteristics do you most associate with? | Participant attribute as architect characteristics | Abstraction capacity<br>Accuracy<br>Analytical skills<br>Authenticity<br>Consulting<br>Creativity<br>Decisiveness<br>Dedication<br>Didactical skills<br>Diplomacy<br>Facilitation skills<br>Flexibility<br>Independence<br>Initiative<br>Integrity<br>Leadership<br>Listening<br>Loyalty<br>Negotiation<br>Openness<br>Opinion forming<br>Organisational awareness<br>Persistence<br>Persuasiveness<br>Plan and organise<br>Result driven<br>Self-confident<br>Self-development<br>Sensitivity and empathy<br>Stability<br>Teamwork<br>Verbal communication skills<br>Visualisation skills<br>Working systematically<br>Written communication skills<br>Other (Specify) | Opinion |
| 12 | What styles of thinking about change do you associate with? | Participant attribute as change thinking styles | Blueprint-thinking<br>Focuses on the formulation of unambiguous objectives, development of a plan of action, monitoring and adjusting the change process accordingly.<br>Yellowprint-thinking<br>Focuses on bringing interests together, stimulating stakeholders to formulate opinions, creating win-win situations and forming coalitions.<br>Redprint-thinking<br>Focuses on stimulation of people, and implementing sophisticated HRM-instruments.<br>Greenprint-thinking<br>Focuses on ensuring that people are aware of new perspectives and personal shortcomings, while motivating them to see, learn, do new things, and create suitable shared learning experiences.<br>Whiteprint-thinking<br>Focuses on the natural flow of people's processes, interests and energies, and is concerned with the removal of blockades. | Opinion |

| Research type | Exploratory | | | |
|---|---|---|---|---|
| | | | Other (Specify) | |
| 13 | What team role, do you believe you associate with? | Participant attribute as team role | Implementer<br>Well-organised and predictable. Takes basic ideas and makes them work in practice.<br>Shaper<br>Lots of energy and action, challenging others to move forwards.<br>Completer/Finisher<br>Reliably sees things through to the end, ironing out the wrinkles and ensuring everything works well<br>Plant<br>Solves difficult problems with original and creative ideas.<br>Monitor/Evaluator<br>Sees the big picture. Thinks carefully and accurately about things.<br>Specialist<br>Has expert knowledge/skills in key areas and will solve many problems here.<br>Coordinator<br>Respected leader who helps everyone focus on their task.<br>Team worker<br>Cares for individuals and the team. Good listener and works to resolve social problems.<br>Resource/Investigator<br>Explores new ideas and possibilities with energy and with others. Good networker.<br>Other (Specify) | Opinion |
| 14 | What enterprise architecture segment do you associate with? | Participant attribute as architecture segment | Component level<br>Solutions level<br>Segment / Domain Level<br>Enterprise Level | Opinion |

## C.3 Personal competency table of questionnaire (Questions 15 – 83)

**Table C-3: Personal competency classes and attributes**

| # | Question | Competency **class** | Aspect | Source |
|---|---|---|---|---|
| 1 | You have an in-depth understanding of the domain and pertinent technologies | Technology | Know | Bredemeyer & Malan (2004) |
| 2 | You understand what technical issues are key to success | Technology | Know | Bredemeyer & Malan (2004) |
| 3 | You develop methods and modelling techniques | Technology | Know | Bredemeyer & Malan (2004) |
| 4 | You identify and address architectural challenges | Technology | Do | Bredemeyer & Malan (2004) |
| 5 | You create models and assess alternative approaches | Technology | Do | Bredemeyer & Malan (2004) |
| 6 | You build prototype / experiment / simulate | Technology | Do | Bredemeyer & Malan (2004) |
| 7 | You prepare architectural documents and presentations | Technology | Do | Bredemeyer & Malan (2004) |
| 8 | You perform technology trend analysis | Technology | Do | Bredemeyer & Malan (2004) |

| # | Question | Competency **class** | Aspect | Source |
|---|---|---|---|---|
| 9 | You take a system viewpoint | Technology | Do | Bredemeyer & Malan (2004) |
| 10 | You see yourself as creative | Technology | Are | Bredemeyer & Malan (2004) |
| 11 | You investigate problems / situations / concerns | Technology | Are | Bredemeyer & Malan (2004) |
| 12 | You are practical / pragmatic | Technology | Are | Bredemeyer & Malan (2004) |
| 13 | You are insightful | Technology | Are | Bredemeyer & Malan (2004) |
| 14 | You are tolerant of ambiguity, willing to backtrack, seek multiple solutions | Technology | Are | Bredemeyer & Malan (2004) |
| 15 | You are good at working at an abstract level | Technology | Are | Bredemeyer & Malan (2004) |
| 16 | You are competent in using elicitation techniques | Consulting | Know | Bredemeyer & Malan (2004) |
| 17 | You are competent in using consulting frameworks | Consulting | Know | Bredemeyer & Malan (2004) |
| 18 | You develop consulting frameworks | Consulting | Do | Bredemeyer & Malan (2004) |
| 19 | You understand what the developers / system implementers want and need from the architecture | Consulting | Do | Bredemeyer & Malan (2004) |
| 20 | You help developers / system implementers see the value of the architecture and understand how to use it successfully | Consulting | Do | Bredemeyer & Malan (2004) |
| 21 | You mentor junior architects | Consulting | Do | Bredemeyer & Malan (2004) |
| 22 | You are committed to others' success | Consulting | Are | Bredemeyer & Malan (2004) |
| 23 | You are empathetic, approachable | Consulting | Are | Bredemeyer Malan (2004) |
| 24 | You are an effective change agent, process savvy | Consulting | Are | Bredemeyer & Malan (2004) |
| 25 | You are a good mentor, teacher | Consulting | Are | Bredemeyer & Malan (2004) |
| 26 | You know your organisation's business strategy and rationale | Strategy | Know | Bredemeyer & Malan (2004) |
| 27 | You know your organisation's competition (products, strategies and processes) | Strategy | Know | Bredemeyer &Malan (2004) |
| 28 | You know your company's business practices | Strategy | Know | Bredemeyer & Malan (2004) |
| 29 | You influence business strategy | Strategy | Do | Bredemeyer & Malan (2004) |
| 30 | You translate business strategy into technical vision and strategy | Strategy | Do | Bredemeyer & Malan (2004) |
| 31 | You understand customer and market trends | Strategy | Do | Bredemeyer & Malan (2004) |
| 32 | You capture customer, organisational and business requirements on the architecture | Strategy | Do | Bredemeyer & Malan (2004) |
| 33 | You are visionary | Strategy | Are | Bredemeyer & Malan (2004) |
| 34 | You are entrepreneurial | Strategy | Are | Bredemeyer & Malan (2004) |
| 35 | You know who the key players are in the organization | Politics | Know | Bredemeyer & Malan (2004) |
| 36 | You know what key players want, both business and personal | Politics | Know | Bredemeyer & Malan (2004) |
| 37 | You communicate with key players | Politics | Do | Bredemeyer & Malan (2004) |
| 38 | You listen, network, influence | Politics | Do | Bredemeyer & Malan (2004) |
| 39 | You sell the vision, keep the vision alive | Politics | Do | Bredemeyer & Malan (2004) |

| # | Question | Competency class | Aspect | Source |
|---|---|---|---|---|
| 40 | You take and retake the pulse of all critical influencers of the architecture project | Politics | Do | Bredemeyer & Malan (2004) |
| 41 | You are able to see from and sell to multiple viewpoints | Politics | Are | Bredemeyer & Malan (2004) |
| 42 | You are confident and articulate | Politics | Are | Bredemeyer & Malan (2004) |
| 43 | You are ambitious and driven | Politics | Are | Bredemeyer & Malan (2004) |
| 44 | You are patient | Politics | Are | Bredemeyer & Malan (2004) |
| 45 | You are resilient | Politics | Are | Bredemeyer & Malan (2004) |
| 46 | You are sensitive to where the power is and how it flows in your organisation | Politics | Are | Bredemeyer & Malan (2004) |
| 47 | You know yourself | Leadership | Know | Bredemeyer & Malan (2004) |
| 48 | You set team context (vision) | Leadership | Do | Bredemeyer & Malan (2004) |
| 49 | You make decisions (stick) | Leadership | Do | Bredemeyer & Malan (2004) |
| 50 | You build teams | Leadership | Do | Bredemeyer & Malan (2004) |
| 51 | You motivate others | Leadership | Do | Bredemeyer & Malan (2004) |
| 52 | You and others see you as a leader | Leadership | Are | Bredemeyer & Malan (2004) |
| 53 | You are charismatic and credible | Leadership | Are | Bredemeyer & Malan (2004) |
| 54 | You believe it can and should be done, and that you can lead the effort | Leadership | Are | Bredemeyer & Malan (2004) |
| 55 | You are committed, dedicated, passionate | Leadership | Are | Bredemeyer & Malan (2004) |
| 56 | You see the entire effort in a broader business and personal context | Leadership | Are | Bredemeyer & Malan (2004) |
| 57 | You are responsible for components or elements of a system (Analyst) | Responsibility | Position | Bredemeyer & Malan (2004) |
| 58 | You are responsible for the architecture of an application or system (System engineer) | Responsibility | Position | Bredemeyer & Malan (2004) |
| 59 | You are responsible for more broadly scoped architectures (System architect) | Responsibility | Position | Bredemeyer &Malan (2004) |
| 60 | You are responsible for the enterprise's architecture (Enterprise architect or chief architect) | Responsibility | Position | Bredemeyer & Malan (2004) |
| 61 | You are responsible for requirements identification and management process under the leadership / mentoring of a system engineer senior grade (Analyst) | Responsibility | Position | Ellinger (2009) |
| 62 | You are responsible to the project manager for technical leadership on small and medium projects and are responsible to the system architect on large projects and programs (System engineer) | Responsibility | Position | Ellinger (2009) |
| 63 | You are responsible for developing functional designs and allocating the designs to actual components (System architect) | Responsibility | Position | Ellinger (2009) |
| 64 | You are responsible to support the investment decision-making process to support the organisation's mission and strategies (Enterprise architect or chief architect) | Responsibility | Position | Ellinger (2009) |
| 65 | As a change agent, the enterprise architect supports enterprise leaders in establishing and promoting the best strategy to accomplish business goals and objectives. | Responsibility | Role | Strano & Rehmani (2007) |
| 66 | As a communicator, he assists managers, analysts, systems architects, and engineers in understanding the details of the strategy sufficiently well to make decisions and execute the plan that leads to realisation | Responsibility | Role | Strano & Rehmani (2007) |

| # | Question | Competency **class** | Aspect | Source |
|---|---|---|---|---|
| | of the shared vision. | | | |
| 67 | As a leader, the enterprise architect participates in creating a shared vision, motivating members of the enterprise to aspire to achieving the vision, and providing clear direction regarding what is required to execute a strategy to accomplish goals and objectives that result in performance improvements. | Responsibility | Role | Strano & Rehmani (2007) |
| 68 | As a manager, he organises the architecture team and ensures that adequate resources are secured to perform the architecture process. | Responsibility | Role | Strano & Rehmani (2007) |
| 69 | As a modeller, the enterprise architect provides a representation of the relationships of enterprise components with sufficient detail and in the format needed to enable making necessary decisions to execute the strategic plan. | Responsibility | Role | Strano 7 Rehmani (2007) |

## C.4 Personal competency taxonomy

**Table C-4: Enterprise architect competency taxonomy**

| Personal competency characteristics (Natural ability) / Competency class – Be (Why – Rationale | Leadership | | | | | Organisational politics | | | | | | Technical | | | | | | Strategy | | Consulting | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Contextual perspective | Charismatic and credible | Optimistic belief | Seen as a leader | Commitment & dedication | Sell different viewpoints | Confident and articulate | Ambitious and driven | Patience | Resilient | Power sensitivity | Creative | Investigative | Pragmatic | Insightful | Tolerance | Level of abstraction | Visionary | Entrepreneurial | Committed to team success | Empathetic and approachable | Effective change | Mentor and teacher |
| Abstraction capacity | X | | | | | | | | | | | | | | | | X | | | | | | |
| Accuracy | | | | | | | | | | | | | X | | | | X | | | | | | |
| Analytical skills | | | | | | | | | | | | | | | | | X | | | | | | |
| Authenticity | | X | | X | | | | | | | | X | | | | | | | | | X | | |
| Consulting | X | | | | | X | X | | X | | X | | X | X | | | | | | X | X | X | X |
| Creativity | | | | | | | | | | | | X | | | | | | | X | | | | |
| Decisiveness | | X | | X | | | X | X | | X | X | | | | | | | | | | | | |
| Dedication | | | | | X | | | X | | | | | | | | | | | | X | | | |
| Didactical skills | | | | | | | | | | | | | | | | | | | | | | | X |
| Diplomacy | | X | | X | | | X | X | X | | X | | | | | X | | | | | | | |
| Facilitation skills | X | | | X | | X | X | | | | | | | X | | | | X | | | | | X |
| Flexibility | | | | X | | | | | X | X | | X | | | | | | X | X | | | X | |
| Independence | | X | | | | | | | | | | | | | | | | | | | | | |
| Initiative | | | X | | | X | | X | | | | | X | | X | | | X | X | X | | X | |
| Integrity | | | | X | X | X | | X | | | X | | | X | | X | | | X | | X | | X |
| Leadership | | X | X | X | X | | X | X | X | | | | | X | | X | | X | | | X | | X |
| Listening | | X | | X | | | | | X | X | | | | | X | X | | X | | | X | | |
| Loyalty | | | | | X | | | | | | X | | | | | | | | | X | | | |
| Negotiation | X | | | | | X | X | X | X | X | X | | | X | | X | | | X | | | X | |
| Openness | | | X | X | | | | | | | | X | X | | | X | | | X | X | | X | |
| Opinion forming | | X | X | X | | X | X | X | | | | X | | X | | | | X | | | | | |
| Organisational awareness | X | | | | | | | | | | X | | | X | X | | | X | X | | | X | |
| Persistence | | | | | X | X | | X | | X | X | | | | | X | | | X | X | | | |
| Persuasiveness | | X | | X | X | X | X | | | | X | | | X | | | | X | X | | | X | X |

| Personal competency characteristics (Natural ability) / Competency class – Be (Why – Rationale | Leadership | | | | | Organisational politics | | | | | | Technical | | | | | | Strategy | | Consulting | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Contextual perspective | Charismatic and credible | Optimistic belief | Seen as a leader | Commitment & dedication | Sell different viewpoints | Confident and articulate | Ambitious and driven | Patience | Resilient | Power sensitivity | Creative | Investigative | Pragmatic | Insightful | Tolerance | Level of abstraction | Visionary | Entrepreneurial | Committed to team success | Empathetic and approachable | Effective change | Mentor and teacher |
| Plan and organise | | X | | X | X | X | X | X | | | | | | X | X | | X | X | X | | | X | |
| Result driven | | | | X | X | X | | X | | | | | | X | | | | | X | X | | X | |
| Self-development | | | | | X | X | | | | | X | | X | X | X | | X | | X | X | | X | X |
| Self-confidence | | X | X | | | X | X | X | | X | X | | | X | | | | | X | | | X | X |
| Sensitivity and empathy | | X | X | | | | | | | | X | | | | X | X | | | | | X | | X |
| Stability | | | | X | | | | | X | | | | | X | | X | | | X | X | | | |
| Teamwork | | | | | X | | | | X | X | X | | | X | | X | | | | X | X | | |
| Verbal communication | X | X | | | | X | X | | | X | X | | | X | X | X | | X | X | | | | X |
| Visualisation skills | X | | | | | X | | | | | | X | | X | | | X | X | X | | | | X |
| Working systematically | X | | | | | X | | | | | | | | X | | | X | | X | | | X | |
| Written communication | X | | | | | X | X | | | | | | | X | X | | X | X | X | | | | X |

## C.5 Architect style traits and coding categories

**Table C-5: Alignment of EA beliefs to coding categories**

| Architect attribute | Disrupting technology style | Translating technology style | Innovating technology style | Control technology style | Directing strategy style | Deciding strategy style | Shifting advisory style | Conversing advisory style |
|---|---|---|---|---|---|---|---|---|
| Role | Change agent | Communicator | Leader | Manager | Change agent | Leader | Change agent | Communicator |
| Competency area | Technical | Technical | Technical | Technical | Strategy | Strategy | Consultant | Consultant |
| Position | N/A | N/A | Enterprise architect | Enterprise architect | Enterprise architect | Enterprise architect | Enterprise architect | Enterprise architect |
| Position level | N/A | Senior level | Executive | N/A | Senior level | Senior level | Senior level | Senior level |
| Experience | N/A | 10 years > 15 years | N/A | 1 year > 5 years | 10 years > 15 years | 10 years > 15 years | 5 years > 10 years | 5 years > 10 years |
| Educational discipline | Formal sciences | Professional and Applied Sciences | Professional and Applied Sciences | N/A | N/A | Formal sciences | Formal sciences | Formal sciences |
| Education level | Bachelor | Bachelor | Masters | Masters | Bachelor | Masters or Doctoral | Masters | Masters |
| Stakeholders | N/A | Architects, PM, Exec, | Analyst, PM, Exec, other architects | N/A | Other architects, exec, line managers | Other architects, exec | Analysts, other architects, exec, pm | Exec, Line managers |
| Skills category | EA | Business, EA skills | Business, EA skills, general IT | EA, general IT | EA, general IT, Technical IT | N/A | Business, EA skills, general IT, PM | General skills |
| Thinking style | Green | N/A | N/A | Blue | Yellow | N/A | N/A | White |
| Team role | Team worker | N/A | N/A | Planter | Shaper | N/A | Implementer | Monitor |
| Characteristics | Creativity, integrity, leadership, openness, opinion forming, team work | N/A | N/A | Organisational awareness, persuasiveness, result driven, self-confident, teamwork, written communication skills | Abstract, analytical skills, consulting, facilitation, in-dependency, organisational awareness, sensitivity & empathy, verbal communication skills, visualisation skills | N/A | Analytical, consulting, diplomacy, facilitation, independence, listening, organisational awareness, written communication | Analytical, persuasiveness, result driven, team work |
| | Creative, Investigative, Pragmatic, Insightful, Tolerance | N/A | N/A | Creative, Investigative, Pragmatic, Insightful, Tolerance, Level of abstraction | Visionary, Entrepreneurial | N/A | Committed to team success, Empathetic and approachable, Effective change, Mentor and teacher | Committed to team success, Empathetic and approachable, Effective change, Mentor and teacher |

## C.6 Architect styles

**Table C-6: Architect styles responses**

| Architect styles | Architect styles responses | Responses | Style | Name | Role | Competency | Position | Position level | Experience | Edu discipline | Edu level | Stakeholders | Skills category | Thinking | Team roles | Competency characteristics - Steghuis | Competency characteristics- Bredemeyer |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Architect style I | 9.46% | 7 | 1 | Disrupting technology style | Change agent | Technical | 0 | 0 | 0 | Formal sciences | Bachelor | 0 | EA | Green | Team worker | Creativity, integrity, leadership, openness, opinion forming, team work | All but abstract level |
| Architect style II | 6.76% | 5 | 2 | Translating technology style | Communicator | Technical | 0 | Senior level | 10 years > 15 years | Professional and Applied Sciences | Bachelor | Architects, PM, Exco, | Business, EA skills | 0 | 0 | | |
| Architect style III | 9.46% | 7 | 3 | Innovating technology style | Leader | Technical | Enterprise architect | Executive | 0 | Professional and Applied Sciences | Masters | Analyst, PM, Exco, other architects | Business, EA skills, general IT | 0 | 0 | | |
| Architect style IV | 6.76% | 5 | 4 | Control technology style | Manager | Technical | Enterprise architect | 0 | 1 year > 5 years | 0 | Masters | 0 | EA, general IT | Blue | Planter | Organisational awareness, persuasiveness, result driven, self-confident, teamwork, written communication skills | All |

| Architect styles | Architect styles responses | Responses | Style | Name | Role | Competency | Position | Position level | Experience | Edu discipline | Edu level | Stakeholders | Skills category | Thinking | Team roles | Competency characteristics - Steghuis | Competency characteristics- Bredemeyer |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Architect style V | 12.16 % | 9 | 6 | Directing strategy style | Change agent | Strategy | Enterprise architect | Senior level | 10 years > 15 years | 0 | Bachelor | Other architects, Exco, line managers | EA, general IT, Technical IT | Yellow | Shaper | Abstract, analytical skills, consulting, facilitation, independency, organisational awareness, sensitivity & empathy, verbal communication skills, visualisation skills | Entrepreneur, pragmatic |
| Architect style VI | 12.16 % | 9 | 8 | Deciding strategy style | Leader | Strategy | Enterprise architect | Senior level | 10 years > 15 years | Formal sciences | Masters or Doctoral | Other architects, Exco | | 0 | 0 | | |
| Architect style VII | 21.62 % | 16 | 21 | Shifting advisory style | Change agent | Consultant | Enterprise architect | Senior level | 5 years > 10 years | Formal sciences | Masters | Analysts, other architects, Exco, pm | Business, EA skills, general IT, PM | 0 | Implementer | Analytical, consulting, diplomacy, facilitation, independence, listening, organisational awareness, written communication | All |
| Architect style VIII | 14.86 % | 11 | 22 | Conversing advisory style | Communicator | Consultant | Enterprise architect | Senior level | 5 years > 10 years | Formal sciences | Masters | Exco, Line managers | General skills | White | Monitor | Analytical, persuasiveness, result driven, team work | All |

| Architect styles | Architect styles responses | Responses | Style | Name | Role | Competency | Position | Position level | Experience | Edu discipline | Edu level | Stakeholders | Skills category | Thinking | Team roles | Competency characteristics - Steghuis | Competency characteristics- Bredemeyer |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Architect style IX | 6.76% | 5 | 23 | Mastering advisory style | Leader | Consultant | System architect | Mid-level | 1 year > 5 years | Professional and Applied Sciences | Post-secondary non-tertiary education | Analyst, architects, PM, competency lead | Business, PM, general IT, technical IT | Yellow | Completer / finisher | Consulting | All |

# Appendix D. DIA artefact

## D.1 Enterprise architect profiles design

**Table D-1: Enterprise architect profile alignment**

| Research type | Descriptive | |
|---|---|---|
| Research question | How can enterprise architect profiles be developed for the understanding of the enterprise architect? | |
| Research objective | To develop enterprise architect profiles for the understanding of the enterprise architect. | |
| Theory | Constructs | • Concepts |
| Architect Profile | Comprehensive list of EA factors and architect attributes | • EA factors<br>• Architect attributes |
| | EA schools of thought | • EA scope<br>• EA purpose |
| | Architect styles | • Architect role<br>• Architect competency |

## D.2 Comprehensive list of architect attributes

**Table D-2: Comprehensive list of architect attributes**

| | | | | |
|---|---|---|---|---|
| Level of detail | Governance | Standards | Positions | Challenges and problems |
| Architecture Segment | Maturity stage | Views | Roles | Concerns |
| Certification | Methodologies | Organisational Segment (Business unit) | School of thought | Critical success factors |
| Configuration | Modelling Notation | Reporting Line | Skills Category | Goals |
| Definitions | Models | Competencies | Stakeholders | Organisational culture |
| Deliverables | Profile (Organisation, UML) | Discipline | Style (Type) | Outcomes |
| Domains | Purpose | Experience | Benefits | Politics (Power) |
| Framework | Scope | Position Levels | Business objectives | Techniques |

## D.3 Architect style indicator

**Table D-3: Architect style indicator (selection)**

| # | Investigative questions | Variable(s) required | Detail in which data measured | Data variables (opinion, behaviour, attribute) |
|---|---|---|---|---|
| 1 | What is your interest in enterprise architecture? | Participant attribute as architecture interest | • As an EA practitioner<br>• As an academic<br>• As an EA author<br>• As an EA consultant<br>• As an EA stakeholder<br>• Other (Please specify) | Opinion |
| 2 | What architecture position do you most associate with? | Participant attribute as architecture position | • Analyst<br>• System engineer / architect<br>• Systems / solutions architect<br>• Enterprise architect / Chief EA<br>• Other (Specify) | Attribute |
| 3 | What experience do you have in enterprise | To determine if there is a link between EA experience and a | • < 1 Year experience<br>• 1-5 years' experience<br>• 5-10 years' experience | Attribute |

| # | Investigative questions | Variable(s) required | Detail in which data measured | Data variables (opinion, behaviour, attribute) |
|---|---|---|---|---|
| | architecture? | specific EA school of thought | • 10-15 years' experience<br>• >15 years' experience | |
| 4 | What do you believe the scope of EA is? Where scope refers to the scope under consideration to be changed as part of the EA initiative. | To determine in which EA school of thought an architect would be | • Enterprise-wide IT platform<br>• Enterprise as a sociocultural, techno-economic system<br>• Enterprise in its environment<br>• Other (Please Specify) | Opinion |
| 5 | What do you believe the purpose for planning an EA initiative is, rather than executing the EA initiative? | To determine in which EA school of thought an architect would be | • ICT and business alignment<br>• Business strategy execution<br>• Business strategy formulation<br>• Other (Please specify) | Opinion |
| 6 | What EA role do you most associate with? | To determine if there is a link between a specific EA role and a specific EA school of thought | • Change agent<br>• Communicator<br>• Leader<br>• Manager<br>• Modeller<br>• Other (Specify) | Behaviour |
| 7 | What enterprise architecture competency class do you most associate with? | To determine if there is a link between a EAM competency and a specific EA school of thought | • Technology<br>• Strategy<br>• Organisational politics<br>• Leadership<br>• Consulting<br>• Other (Specify) | Opinion |
| 8 | What enterprise architect characteristics do you most associate with? | Participant attribute as architect characteristics | • Abstraction capacity<br>• Accuracy<br>• Analytical skills<br>• Authenticity<br>• Consulting<br>• Creativity<br>• Decisiveness<br>• Dedication<br>• Didactical skills<br>• Diplomacy<br>• Facilitation skills<br>• Flexibility<br>• Independence<br>• Initiative<br>• Integrity<br>• Leadership<br>• Listening<br>• Loyalty<br>• Negotiation<br>• Openness<br>• Opinion forming<br>• Organisational awareness<br>• Persistence<br>• Persuasiveness<br>• Plan and organise<br>• Result driven<br>• Self-confident<br>• Self-development<br>• Sensitivity and empathy<br>• Stability<br>• Teamwork | Opinion |

| # | Investigative questions | Variable(s) required | Detail in which data measured | Data variables (opinion, behaviour, attribute) |
|---|---|---|---|---|
| | | | • Verbal communication skills<br>• Visualisation skills<br>• Working systematically<br>• Written communication skills<br>• Other (Specify) | |
| 9 | In what educational discipline are you formally trained? | To determine if there is a link between educational discipline a specific EA school of thought | • None<br>• Humanities<br>• Social Sciences<br>• Natural Sciences<br>• Formal Sciences<br>• Professional and Applied Sciences<br>• Other (Specify) | Attribute |
| 10 | What is your highest level of education obtained? | To determine if there is a link between education level and a specific EA school of thought | • Secondary education<br>• Post-secondary non-tertiary education<br>• Short cycle tertiary education<br>• Bachelor or equivalent<br>• Masters or equivalent<br>• Doctoral or equivalent<br>• Other (Specify) | Attribute |
| 11 | What enterprise architect position level do you currently hold? | To determine if there is a link between position level and a specific EA school of thought | • Junior level<br>• Mid-level<br>• Senior level<br>• Chief level<br>• Executive level<br>• Other (Specify) | Attribute |
| 12 | What enterprise architecture segment do you work on? | To determine if there is a link between enterprise architecture segment and a specific EA school of thought | • Component level<br>• Solutions level<br>• Segment / Domain Level<br>• Enterprise Level<br>• Other (Specify) | Opinion |
| 13 | What enterprise architecture domain do you associate with? | To determine if there is a link between enterprise architecture domain and a specific EA school of thought | • Business<br>• Information<br>• Data<br>• Application<br>• Technology<br>• Security<br>• Solutions<br>• Integration<br>• Other (Specify) | Opinion |
| 14 | What organisational segment is most affected by the architecture effort you work on? | To determine if there is a link between the affected organisational segment and a specific EA school of thought | • Corporate<br>• Business<br>• Functional<br>• Operational<br>• Technical<br>• Other (Specify) | Behaviour |
| 15 | What level of detail do you perform in the architecture effort? | To determine if there is a link between the enterprise architecture work level of detail and a specific EA school of thought | • Low level of detail<br>• Medium level of detail<br>• High level of detail<br>• Various levels of detail | Opinion |
| 16 | What EA configurations or transformation stages do you make use of in | To determine if there is a link between EA configurations or transformations and a | • No configurations or transformations are made to the EA once it is planned<br>• Transform EA based on changes in | Opinion |

| # | Investigative questions | Variable(s) required | Detail in which data measured | Data variables (opinion, behaviour, attribute) |
|---|---|---|---|---|
| | your current role? | specific EA school of thought | scope<br>• Transform EA based on changes in purpose<br>• Transform EA based on decision changes<br>• Transform EA based on new requirements<br>• Other (Please specify) | |
| 17 | What role does politics play in the execution of an EA initiative? | To determine if there is a link between the role politics play and a specific EA school of thought | • There is no place for politics in the planning or execution of an EA initiative<br>• EA is used as a political tool to advance self interest<br>• EA is used as a political tool to negotiate the future state of the enterprise<br>• EA is used to control and govern business units within the organisation<br>• EA is used for justification for necessary organisational change<br>• Other (Please specify) | Opinion |
| 18 | What behavioural style do you most often align to when executing your specific role? | To determine if there is a link between behavioural styles and a specific EA school of thought | • Focus on using new or disrupting technologies in the EA initiative<br>• Focus on communicating technological advantages to other stakeholders participating in the EA initiative<br>• Focus on using technology in an EA initiative to innovate<br>• Focusing on controlling or managing the EA initiative or the EA team<br>• Focus on directing the EA initiative to support organisational strategy<br>• Focus on creating an organisational strategy while participating in an EA initiative<br>• Focus on advising EA stakeholders to best accomplish the organisational strategy<br>• Focus on communicating technology strategy to other stakeholders to support the organisation strategy<br>• Focusing on creating a shared vision and providing direction on executing the organisational strategy | Opinion |
| 19 | What role do standards play when executing your specific role? | To determine if there is a link between standards and a specific EA school of thought | • To standardise processes and systems within the organisation<br>• To reduce complexity and simplify<br>• To achieve better alignment and integration<br>• To reduce duplication and optimise | Opinion |
| 20 | What would you believe the motto for enterprise architecture is? | Participant attribute as architecture motto | • EA as the glue between business and IT<br>• EA as the link between strategy and execution<br>• EA as a means for organisation innovation and sustainability<br>• EA as a tool for power and | Opinion |

| # | Investigative questions | Variable(s) required | Detail in which data measured | Data variables (opinion, behaviour, attribute) |
|---|---|---|---|---|
| | | | negotiation<br>• EA as a decision transformation methodology<br>• EA as an analysis approach to strategy execution<br>• EA as a change agent considering external IT environment<br>• Other (Please specify) | |
| 21 | What analogy would you use to best describe the enterprise architect? | Participant attribute as architecture analogy | • As an urban planner<br>• As an inquiring facilitator<br>• As a nurturer and sense maker<br>• As a politician<br>• As a futurist<br>• As a consultant<br>• As a scholar or learner<br>• Other (Please specify) | Opinion |
| 22 | What belief concepts do you align with, with respect to EA? | Participant attribute as architect belief concepts | • System perspective (group)<br>• Reductionism or<br>• Holism<br>• System dynamics (group)<br>• Closed System or<br>• Open System<br>• Events doctrine (group)<br>• Determinism or<br>• Indeterminism<br>• Applicability doctrine (group)<br>• Universalism<br>• Contextualism<br>• System doctrine (group)<br>• Realism or<br>• Instrumentalism<br>• Authority<br>• Mechanism<br>• I don't know<br>• Other (Please Specify) | Opinion |
| 23 | What stakeholder perspectives do you focus on for the architecture function? | To determine if there is a link between the Zachman architectural representations and a specific EA school of thought | • Contextual perspective (Executive)<br>• Conceptual perspective (Business management)<br>• Logical perspective (Architect)<br>• Physical perspective (Engineer)<br>• Assembly perspective (Technician)<br>• Instantiable (Enterprise) | Behaviour |
| 24 | What architecture abstractions do you focus on? | To determine if there is a link between the Zachman architectural representations and a specific EA school of thought | • Inventory / data<br>• Process / function<br>• Distributions / network / location<br>• Responsibilities / people<br>• Timing<br>• Motivation | Opinion |
| 25 | Which stakeholders do you interact with? | To determine if there is a link specific EA stakeholders and a specific EA school of thought | • Analysts<br>• Architects<br>• Programme / project managers<br>• Executives<br>• Line managers / functional groups<br>• Competency leads<br>• Business strategist<br>• Capital investment planner<br>• External stakeholder | Opinion |

| # | Investigative questions | Variable(s) required | Detail in which data measured | Data variables (opinion, behaviour, attribute) |
|---|---|---|---|---|
| | | | • Oversight officials<br>• Other (Specify) | |
| 26 | To whom does the enterprise architecture function report to? | To determine if there is a link between EAM reporting line and a specific EA school of thought | • CEO<br>• CIO<br>• CFO<br>• CTO<br>• ICT manager<br>• Business manager<br>• Board of directors<br>• Other (Please specify) | Attribute |
| 27 | What architecture models do you create? | To determine if there is a link between enterprise architecture models architects use and specific EA school of thought | • Primitive models<br>• Composite models (viewpoints)<br>• Don't know | Opinion |
| 28 | What EAM frameworks do you align most with? | To determine if there is a link between the use of an EA framework and a specific EA school of thought | • IAF<br>• ARIS<br>• EABOK<br>• GEA<br>• GWEA<br>• GERAM<br>• Zachman<br>• TOGAF<br>• PEAF<br>• FEAF<br>• TEAF<br>• DoDAF<br>• MoDAF<br>• Vendor Specific<br>• Using an adapted EA framework<br>• Internal or own developed EA framework<br>• Other (Specify) | Opinion |
| 29 | What governance structure do you interact with? | To determine if there is a link between specific EA governance structures and a specific EA school of thought | • Committees<br>• Boards<br>• Authorities<br>• Other (Specify) | Opinion |
| 30 | What skills category do you most often use as an architect? | To determine if there is a link between enterprise architect skill category and a specific EA school of thought | • Generic skills<br>• Business skills and methods<br>• EA skills<br>• PM skills<br>• IT general knowledge skills<br>• Technical IT skills<br>• Legal environment<br>• Other (Specify) | Opinion |
| 31 | What enterprise architecture techniques do you use within your current role? | To determine if there is a link between EAM techniques and a specific EA school of thought | • EA being formally approved<br>• Choices in EA are explicitly linked to business goals<br>• Projects are being explicitly assessed on their degree of compliance with EA<br>• Knowledge is being exchanged in an organised manner between different types of architects | Opinion |

| # | Investigative questions | Variable(s) required | Detail in which data measured | Data variables (opinion, behaviour, attribute) |
|---|---|---|---|---|
| | | | • Knowledge is being exchanged in an organised manner between architects and other employees participating in projects that have to conform to EA<br>• Assistance is being offered in order to stimulate conformance to EA<br>• Projects make use of a project start architecture<br>• Document templates are being used to stimulate conformance to EA<br>• Financial rewards and disincentives are being used in order to stimulate conformance to EA<br>• Imposing penalties in case of deviations from the EA<br>• Other (Please specify) | |
| 32 | What organisational culture best describes the enterprise architecture function within your organisation? | To determine if there is a link between organisational culture and a specific EA school of thought | • Group culture<br>• Development culture<br>• Hierarchical culture<br>• Rational culture<br>• Other (Please specify) | Opinion |
| 33 | What enterprise architecture certification have you obtained to date? | To determine if there is a link between enterprise architecture certification and a specific EA school of thought | • None<br>• Open Group - TOGAF<br>• Zachman International - Zachman Framework<br>• Open Group - Certified Architect<br>• FEAC Institute - Certified Enterprise Architect<br>• EA COE Certified<br>• USA CIO Certificate Program<br>• Commercial Vendor Specific<br>• IASA - Certified IT Architect<br>• Other (Specify) | Attribute |
| 34 | What architecture definition would you most associate with? | To determine in which EA school of thought an architect would be | • MIT CISR<br>• EARF<br>• FEAF<br>• The Open Group<br>• Archimate Foundation<br>• IEAD<br>• ISO/IEC/IEEE 42010<br>• Gartner<br>• Other (Specify) | Opinion |
| 35 | What stage of maturity do you believe the architecture effort has obtained? | To determine if there is a link between the enterprise architecture maturity level and a specific EA school of thought | • Creating EA Awareness<br>• Building the EA Management Foundation<br>• Developing the EA<br>• Completing the EA<br>• Leveraging the EA to Manage Change | Opinion |
| 36 | What CSF or success attributes has the architecture effort realised? | To determine if there is a link between the enterprise architecture maturity level and a specific EA school of thought | • Demonstrates Commitment<br>• Provides Capability to Meet Commitment<br>• Demonstrates Satisfaction of Commitment<br>• Verifies Satisfaction of Commitment | Opinion |
| 37 | What value do you add to the enterprise architecture effort? | To determine if there is a link between a EAM value and a | • An articulation of the strategic requirements of the enterprise<br>• Models of the future state, which | Opinion |

| # | Investigative questions | Variable(s) required | Detail in which data measured | Data variables (opinion, behaviour, attribute) |
|---|---|---|---|---|
| | | specific EA school of thought | illustrate what the enterprise should look like across all EA viewpoints in support of the business strategy<br>• A roadmap of the change initiatives required to reach that future state<br>• The requirements, principles, standards, and guidelines that will steer the implementation of change initiatives<br>• Other (Specify) | |
| 38 | What outcomes do you try to achieve by delivering on the EAM effort? | To determine if there is a link between a EAM outcomes and a specific EA school of thought | • Improvements to the effectiveness, efficiency, and agility of the enterprise<br>• Innovations in the structure of an organisation<br>• Improvements in the capability of continuous organisational innovation and change competency<br>• The rational centralisation or federation of business processes<br>• Improvements to the quality and timeliness of business information<br>• Clarification and articulation of business rules<br>• Alignment of spending so that money spent on business initiatives and systems actually delivers on the strategic intent<br>• Other (Specify) | Behaviour |
| 39 | What enterprise architecture concerns do you have in your current role? | To determine if there is a link between EAM concerns and a specific EA school of thought | • Meeting quality requirements<br>• Meeting budgets<br>• Meeting delivery deadlines<br>• Meeting business objectives<br>• Solving business problems<br>• Delivering on ICT solutions<br>• Realising business value<br>• Ensuring good governance practises<br>• Communicating the value of enterprise architecture<br>• Providing future ICT direction<br>• Providing future business strategic direction<br>• Managing the architecture effort<br>• Leading the architecture team<br>• Driving change through the organisation<br>• Ensuring regulatory or statutory compliance<br>• Other (Please specify) | Opinion |
| 40 | What enterprise architecture challenges do you have in your current role? | To determine if there is a link between EAM challenges and a specific EA school of thought | • Factors hindering effective collaboration<br>• Methods used in practice to support collaborative tasks<br>• Strengths and weaknesses of methods currently used<br>• Evaluation of enterprise architecture design alternatives<br>• Acceptance<br>• Success factors for enterprise | Opinion |

| # | Investigative questions | Variable(s) required | Detail in which data measured | Data variables (opinion, behaviour, attribute) |
|---|---|---|---|---|
| | | | architecture creation<br>• Other (Please specify) | |
| 41 | What enterprise architecture goals do you try to achieve in your current role? | To determine if there is a link between EAM goals and a specific EA school of thought | • Business-IT alignment<br>• Cost reduction<br>• Standardisation / consolidation<br>• Governance or transformation / IT management<br>• Agility<br>• Business support (e.g. risk management and business continuity management)<br>• Transparency<br>• Complexity management<br>• Innovation<br>• Regulatory compliance<br>• Other (Please specify) | Opinion |
| 42 | What enterprise architecture benefits do you believe you bring in your current role? | To determine if there is a link between EAM benefits and a specific EA school of thought | • Accomplish enterprise-wide goals instead of (possibly contradictory) local optimisations<br>• Provide insight into the complexity of the organisation<br>• Integrate, standardise or de-duplicate related processes and systems<br>• Depict a clear image of the desired future situation<br>• Enable different stakeholders to communicate with each other effectively<br>• Make enterprise architecture, in general, to be a good instrument<br>• Other (Please specify) | Opinion |
| 43 | What business objectives do you try to achieve in your current role? | To determine if there is a link between business objectives and a specific EA school of thought | • Effectively enable the enterprise strategy<br>• Support IT planning and reduce costs<br>• Enable business<br>• Effectively implement the enterprise strategy<br>• Support organisational coherence<br>• Innovate and adapt<br>• Support organisational coherence<br>• Encourage system-in-environment coevolution<br>• Other (Please specify) | Opinion |
| 44 | What modelling notations do you most often use in your current role? | To determine if there is a link between EA modelling notation and a specific EA school of thought | • UML<br>• BPMN<br>• Archimate<br>• SOMF<br>• DEMO<br>• ABACUS<br>• ACME<br>• EPC<br>• Custom<br>• Other (Specify) | Opinion |
| 45 | What styles of thinking about change do you associate with? | Participant attribute as change thinking styles | • Blueprint-thinking<br>• Focuses on the formulation of unambiguous objectives, | Opinion |

| # | Investigative questions | Variable(s) required | Detail in which data measured | Data variables (opinion, behaviour, attribute) |
|---|---|---|---|---|
| | | | development of a plan of action, monitoring and adjusting the change process accordingly.<br>• Yellowprint-thinking<br>• Focuses on bringing interests together, stimulating stakeholders to formulate opinions, creating win-win situations and forming coalitions.<br>• Redprint-thinking<br>• Focuses on stimulation of people, and implementing sophisticated HRM-instruments.<br>• Greenprint-thinking<br>• Focuses on ensuring that people are aware of new perspectives and personal shortcomings, while motivating them to see, learn, do new things, and create suitable shared learning experiences.<br>• Whiteprint-thinking<br>• Focuses on the natural flow of people's processes, interests and energies, and is concerned with the removal of blockades.<br>• Other (Specify) | |
| 46 | What team role do you believe you associate with? | Participant attribute as team role | • Implementer<br>• Well-organised and predictable. Takes basic ideas and makes them work in practice.<br>• Shaper<br>• Lots of energy and action, challenging others to move forwards.<br>• Completer/Finisher<br>• Reliably sees things through to the end, ironing out the wrinkles and ensuring everything works well<br>• Plant<br>• Solves difficult problems with original and creative ideas.<br>• Monitor/Evaluator<br>• Sees the big picture. Thinks carefully and accurately about things.<br>• Specialist<br>• Has expert knowledge/skills in key areas and will solve many problems here.<br>• Coordinator<br>• Respected leader who helps everyone focus on their task.<br>• Team worker<br>• Cares for individuals and the team. Good listener and works to resolve social problems.<br>• Resource/Investigator<br>• Explores new ideas and possibilities with energy and with others. Good networker. | Opinion |

| # | Investigative questions | Variable(s) required | Detail in which data measured | Data variables (opinion, behaviour, attribute) |
|---|---|---|---|---|
| | | | • Other (Specify) | |

**Table D-4: Likert scale used for personal competency opinions**

| # | Likert scale |
|---|---|
| 1 | Strongly disagree |
| 2 | Disagree |
| 3 | Slightly disagree |
| 4 | Slightly agree |
| 5 | Agree |
| 6 | Strongly agree |

**Table D-5: Architect style indicator (Likert)**

| # | Question | Competency class | Likert | Aspect |
|---|---|---|---|---|
| 1 | You see yourself as creative | Technology competency | Likert | Opini-on |
| 2 | You investigate problems / situations / concerns | Technology competency | Likert | Opini-on |
| 3 | You are practical / pragmatic | Technology competency | Likert | Opini-on |
| 4 | You are insightful | Technology competency | Likert | Opini-on |
| 5 | You are tolerant of ambiguity, willing to backtrack, seek multiple solutions | Technology competency | Likert | Opini-on |
| 6 | You are good at working at an abstract level | Technology competency | Likert | Opini-on |
| 7 | You are committed to others' success | Consulting competency | Likert | Opini-on |
| 8 | You are empathetic, approachable | Consulting competency | Likert | Opini-on |
| 9 | You are an effective change agent, process savvy | Consulting competency | Likert | Opini-on |
| 10 | You are a good mentor, teacher | Consulting competency | Likert | Opini-on |
| 11 | You are visionary | Strategy competency | Likert | Opini-on |
| 12 | You are entrepreneurial | Strategy competency | Likert | Opini-on |
| 13 | You are able to see from and sell to multiple viewpoints | Politics competency | Likert | Opinion |
| 14 | You are confident and articulate | Politics competency | Likert | Opini-on |
| 15 | You are ambitious and driven | Politics competency | Likert | Opini-on |
| 16 | You are patient | Politics competency | Likert | Opini-on |
| 17 | You are resilient | Politics competency | Likert | Opini-on |
| 18 | You are sensitive to where the power is and how it flows in your organisation | Politics competency | Likert | Opini-on |
| 19 | You and others see you as a leader | Leadership competency | Likert | Opini-on |
| 20 | You are charismatic and credible | Leadership competency | Likert | Opini-on |
| 21 | You believe it can and should be done, and that you can lead the effort | Leadership competency | Likert | Opini-on |

| # | Question | Competency class | Likert | Aspect |
|---|---|---|---|---|
| 22 | You are committed, dedicated, passionate | Leadership competency | Likert | Opini-on |
| 23 | You see the entire effort in a broader business and personal context | Leadership competency | Likert | Opini-on |
| 24 | You are responsible for components or elements of a system (Analyst) | Position | Likert | Opini-on |
| 25 | You are responsible for the architecture of an application or system (System engineer) | Position | Likert | Opini-on |
| 26 | You are responsible for more broadly scoped architectures (System architect) | Position | Likert | Opini-on |
| 27 | You are responsible for the enterprise's architecture (Enterprise architect or chief architect) | Position | Likert | Opinion |
| 28 | You are responsible for requirements identification and management process under the leadership / mentoring of a system engineer senior grade (Analyst) | Position | Likert | Opini-on |
| 29 | You are responsible to the project manager for technical leadership on small and medium projects and is responsible to the system architect on large project and programs (System engineer) | Position | Likert | Opini-on |
| 30 | You are responsible for developing functional designs and allocating the designs to actual components (System architect) | Position | Likert | Opini-on |
| 31 | You are responsible to support the investment decision-making process to support the organisation's mission and strategies (Enterprise architect or chief architect) | Position | Likert | Opini-on |
| 32 | As a change agent, the enterprise architect supports enterprise leaders in establishing and promoting the best strategy to accomplish business goals and objectives. | Role | Likert | Opini-on |
| 33 | As a communicator, he assists managers, analysts, systems architects, and engineers in understanding the details of the strategy sufficiently well to make decisions and execute the plan that leads to realisation of the shared vision. | Role | Likert | Opini-on |
| 34 | As a leader, the enterprise architect participates in creating a shared vision, motivating members of the enterprise to aspire to achieving the vision, and providing clear direction regarding what is required to execute a strategy to accomplish goals and objectives that result in performance improvements. | Role | Likert | Opini-on |
| 35 | As a manager, he organises the architecture team and ensures that adequate resources are secured to perform the architecture process. | Role | Likert | Opini-on |
| 36 | As a modeller, the enterprise architect provides a representation of the relationships of enterprise components with sufficient detail and in the format needed to enable making necessary decisions to execute the strategic plan. | Role | Likert | Opini-on |

## *D.4 Daedalus Instrument for Architects (DIA) component lessons*

**Table D-6: Daedalus Instrument for Architects (DIA) component lessons**

| # | Component | Representation | Deliverable | Lesson |
|---|---|---|---|---|
| 1 | EA factors & architect attributes | List | Comprehensive list | Include additional EA factors and architect attributes identified from systematic literature review as opposed to the original traditional literature review |
| 2 | EA schools of thought | Indicator Classification | Questionnaire Taxonomy | Include participant demographic. Add additional question from attributes of EA schools |
| 3 | Enterprise architect styles | Indicator Classification | Questionnaire Taxonomy | Concentrate only on personal enterprise architect competencies rather than competency areas or competency categories |
| 4 | Enterprise architect profiles | Viewpoints | Model | Develop report template |
| 5 | Daedalus Instrument | Instrument | Model | Develop technology-based solution as website |

### D.5 Architect profile template

Daedalus Instrument

Understanding the Architect in Enterprise Architecture

# Architect Name

## Architect profile executive summary

This executive summary applies the results from the Daedalus Instrument for Architects® (DIA®) assessment to help organizations and architects identify their EA schools of thought and their EA behavioral styles, which are in line with their EA profiles. The DIA® was developed by researchers at the University of Pretoria as part of a PhD study. It is being used by organizations and architects alike to better understand architects profiles in order to create a better working environment.

# Appendix E. DIA evaluation results

## E.1 Daedalus Instrument evaluation

**Table E-1: Daedalus Instrument for Architects (DIA) evaluation form**

| # | Evaluation question |
|---|---|
| 1 | How well does the list of EA factors and architect attributes address different aspects of enterprise architects? |
| 2 | How well do the EA schools of thought address the EA belief system of enterprise architects? |
| 3 | How well do the architect styles address the EA behavioural styles of enterprise architects? |
| 4 | How well do the architect profiles address the understanding of enterprise architects? |
| 5 | How valuable is the use of the Daedalus Instrument in an EA practice? |
| 6 | How efficient is the technology-based solution in allowing organisations to determine the architect profiles of enterprise architects? |

## E.2 Daedalus Instrument evaluation answers

**Table E-2: Evaluand 1 - Daedalus Instrument for Architects (DIA) evaluation answers**

| # | Evaluation question | Evaluation answer |
|---|---|---|
| 1 | How well does the list of EA factors and architect attributes address different aspects of enterprise architects? | The list appears to be comprehensive, with no new EA factors or architect attributes being identified |
| 2 | How well do the EA schools of thought address the EA belief system of enterprise architects? | It is difficult to say as the EA schools of thought is an unknown concept with regards to EA |
| 3 | How well do the architect styles address the EA behavioural styles of enterprise architects? | It is difficult to say as architect styles are an unknown concept with regards to EA |
| 4 | How well do the architect profiles address the understanding of enterprise architects? | Fairly well as it represents, roles, competencies, EA scope and purpose |
| 5 | How valuable is the use of the Daedalus Instrument in an EA practice? | It would be valuable to better understand the practising enterprise architects |
| 6 | How efficient is the technology-based solution in allowing organisations to determine the architect profiles of enterprise architects? | Excellent tool, which can be used using a web browser or a mobile device. The current version states the answers of the questions first and then the question, which is difficult to follow |

**Table E-3: Evaluand 2 - Daedalus Instrument for Architects (DIA) evaluation answers**

| # | Evaluation question | Evaluation answer |
|---|---|---|
| 1 | How well does the list of EA factors and architect attributes address different aspects of enterprise architects? | The list is comprehensive indicating EA factors and architect attributes not widely known or considered by practising architects |
| 2 | How well do the EA schools of thought address the EA belief system of enterprise architects? | The EA schools of thought is based on the concepts of scope and purpose, which are frequently used in existing EA definitions and frameworks, such as TOGAF |
| 3 | How well do the architect styles address the EA behavioural styles of enterprise architects? | It is difficult to say as the idea of using role and competency as a style is a new concept (construct) |
| 4 | How well do the architect profiles address the understanding of enterprise architects? | Based on the underlying theory, fairly well |
| 5 | How valuable is the use of the Daedalus Instrument in an EA practice? | It can be of great use if it is understood correctly |
| 6 | How efficient is the technology-based solution in allowing organisations to determine the architect profiles of enterprise architects? | Fairly efficient, the number of questions are just excessive |

**Table E-4: Evaluand 3 - Daedalus Instrument for Architects (DIA) evaluation answers**

| # | Evaluation question | Evaluation answer |
|---|---|---|
| 1 | How well does the list of EA factors and architect attributes address different aspects of enterprise architects? | A systematic research study was followed, as such one can expect a great deal of identified architect attributes and EA factors |
| 2 | How well do the EA schools of thought address the EA belief system of enterprise architects? | It is based on existing literature, where the study went to test the idea and eventually extended its classification and understanding |

| # | Evaluation question | Evaluation answer |
|---|---|---|
| 3 | How well do the architect styles address the EA behavioural styles of enterprise architects? | The concept of behaviour styles would include environment, which is featured, but not a great deal of emphases is placed on it |
| 4 | How well do the architect profiles address the understanding of enterprise architects? | With the use of the social cognitive theory, the understanding of architect profiles should have a solid foundation for understanding |
| 5 | How valuable is the use of the Daedalus Instrument in an EA practice? | Unknown |
| 6 | How efficient is the technology-based solution in allowing organisations to determine the architect profiles of enterprise architects? | It is implemented as a web site, which makes it accessible and intuitive. Consider indicating how the results were determined |

**Table E-5: Evaluand 4 - Daedalus Instrument for Architects (DIA) evaluation answers**

| # | Evaluation question | Evaluation answer |
|---|---|---|
| 1 | How well does the list of EA factors and architect attributes address different aspects of enterprise architects? | Unsure |
| 2 | How well do the EA schools of thought address the EA belief system of enterprise architects? | Unsure |
| 3 | How well do the architect styles address the EA behavioural styles of enterprise architects? | Unsure |
| 4 | How well do the architect profiles address the understanding of enterprise architects? | No indication was given for the understanding or the testing of architect profiles. It should be indicated as a future research topic |
| 5 | How valuable is the use of the Daedalus Instrument in an EA practice? | Unsure |
| 6 | How efficient is the technology-based solution in allowing organisations to determine the architect profiles of enterprise architects? | The questionnaires should be broken down into smaller more manageable sections to be easier to follow and complete |

**Table E-6: Evaluand 5 - Daedalus Instrument for Architects (DIA) evaluation answers**

| # | Evaluation question | Evaluation answer |
|---|---|---|
| 1 | How well does the list of EA factors and architect attributes address different aspects of enterprise architects? | It seems to be complete |
| 2 | How well do the EA schools of thought address the EA belief system of enterprise architects? | The understanding of how EA scope and purpose influences the architect's belief system is not that clear |
| 3 | How well do the architect styles address the EA behavioural styles of enterprise architects? | Again, the understanding of how architect competency and role influence the architect's behavioural style is not that clear |
| 4 | How well do the architect profiles address the understanding of enterprise architects? | Solid application of underlying theory, the influence of the environmental aspect needs to be considered in more detail |
| 5 | How valuable is the use of the Daedalus Instrument in an EA practice? | N/A |
| 6 | How efficient is the technology-based solution in allowing organisations to determine the architect profiles of enterprise architects? | The list of questions on the site is excessive. It should be shortened or even spilt, having separate questionnaires for separate target audiences, such as managers and architects |

## E.3 Daedalus Instrument for Architects (DIA) evaluation lessons

**Table E-7: Daedalus Instrument for architects (DIA) component lessons**

| # | Sub-characteristic | Lesson |
|---|---|---|
| 1 | Presentation | Consider explaining how the Daedalus Instrument can be used in an organisation and describe where the EA function should fit within the organisation depending on the results and architect profiles of the architects within the organisation.<br>Shorten the presentation by focusing on the message being portrayed.<br>Customise the presentation for different EA population groups, such as executives, architects and EA stakeholders<br>Align the presentation slide deck to the objectives and goals of the presentation to the various EA population groups. E.g. exclude research design and methodology when the population group is not academic. |

| # | Sub-characteristic | Lesson |
|---|---|---|
| 2 | Design artefact | Consider having a separate questionnaire for senior management that asks only a few core questions to determine the architect profile for EA managers and executives.<br>Consider providing a viewpoint of which EA schools of thought work well with certain architect styles as to indicate and provide a better representation of architect profiles. |
| 3 | Technology-based artefact | 69 questions are too long, consider splitting the questionnaire into sections or pages.<br>Categorise the questions of the questionnaire into sections for better understanding, where each section represents a specific area being addressed, e.g. EA factors and architect attributes, EA schools of thought, architect styles and the architect profiles.<br>Reverse answers and questions on the site. Currently the answers are displayed prior to the questions.<br>Showcase the result of a test and how the architect profile is determined from the EA schools of thought and the architect styles. |

# Appendix F. Published papers

## F.1 Conference papers

Du Preez, J.A., Van Der Merwe, A.J., & Matthee, M.C., 2014. Enterprise Architecture Schools of Thought: An Exploratory Study, in: 2014 IEEE 18th International Enterprise Distributed Object Computing Conference Workshops and Demonstrations. Presented at the International Enterprise Distributed Object Computing Conference Workshops and Demonstrations, IEEE Computer Society, Ulm, Germany, pp. 3–12. doi:DOI 10.1109/EDOCW.2014.11