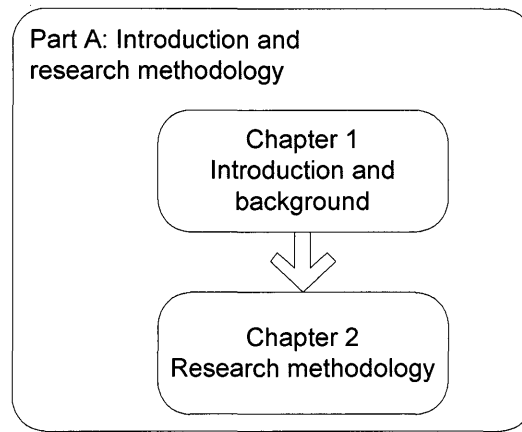


## PART A: INTRODUCTION AND RESEARCH METHODOLOGY

*Solving a problem simply means representing it so as to make the solution transparent. ~ Herbert Simon*

Part A of this thesis introduces the theoretical background, research rationale, research questions and research methodology for this study.

- Chapter 1 provides an introduction to the thesis, including a theoretical background, research rationale and research questions. The chapter also delineates the structure used for presenting the content of this study.
- Chapter 2 presents the research methodology used for completing this study.



# Chapter 1. Introduction

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## 1.1 INTRODUCTION

This thesis focuses on the enhancement of the operating model concept within the context of a business-IT alignment approach. The study resides within the *industrial and systems engineering* discipline, with the focus on *systems engineering*. Two systems are of concern, (1) the enterprise system and (2) the information, communication and technology (ICT) system.

Enterprise systems of the 21<sup>st</sup> century are exceedingly complex, and in addition, these systems need to be dynamic to stay ahead of competition. Information technology opened up new opportunities for enterprises to extend enterprise boundaries in offering complementary services, entering new business domains and creating networks of collaborating enterprises. The extended enterprise however still need to comply with corporate governance rules and legislation and need to be flexible and adaptable to seize new opportunities (Hoogervorst, 2009).

In the past, a reductionist approach was often used to study enterprise problems; researchers from various different disciplines studied a single sub-system or perspective of the enterprise. *Industrial engineers*, for example, traditionally considered only the production subsystem, whereas *organisational scientists* investigated the structure of an organisation. *Behavioural scientists* studied the productivity effects of interacting workers, management policies and work environment, whereas *information sciences* studied the design and management of information systems (Giachetti, 2010). However, both researchers and practitioners realise that there is a need for an overall view of the enterprise (Liles, Johnson, & Meade, 1995; Martin, 1995; Rouse, 2004; Towill, 1997). An overall cross-disciplinary enterprise-view would lead to a better understanding of enterprise problems within the context of the enterprise as a whole.

In support of an overall view of the enterprise, three disciplines emerged: enterprise engineering (EE), enterprise architecture (EA) and enterprise ontology (EO). Although limited literature is available on EO, a number of publications exist for EE and EA. In spite of the publications, there is still a lack of shared meaning in terms of the *theoretical foundations*, *definitions* and *business benefits*. This lack of agreed-upon meaning creates challenges in searching for relevant literature and assessing the maturity of EE and EA (Kappelman, McGinnis, Pettit, Salmans, & Sidorova, 2010; Lapalme, 2011). Even though EE and EA pose a number of *potential business benefits* in designing and aligning the enterprise, Kappelman et al. (2010) state that claims are not consistently theoretically grounded. Although alignment between business and IT is a strong theme in enterprise alignment, and numerous business-IT alignment approaches and frameworks exist (Schekkerman, 2004), it remains difficult to compare the alignment approaches or extend a current alignment approach with knowledge from the existing business-

IT alignment knowledge base. Comparing and enhancing alignment approaches is one of the fundamental problems addressed in this research.

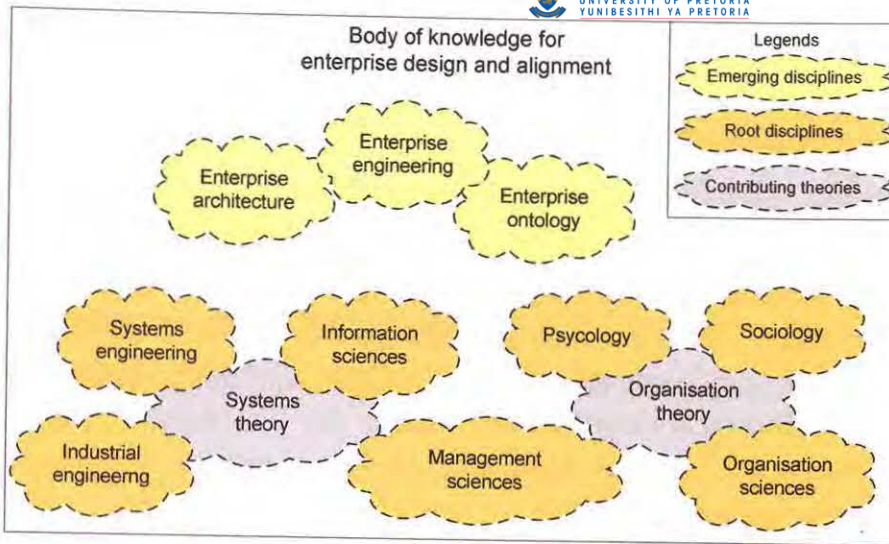
The next section (section 1.2) provides additional theoretical background to define business-IT alignment and related concepts. Section 1.3 provides the rationale for this study, as related to business-IT alignment, followed by the research questions and the main thesis outputs in section 1.4. The scope and limitations of the study are given in section 1.5, and the main contributions are provided in section 1.6. A research methodology is presented in section 1.7 to solve the research questions, concluding with section 1.8 to provide structural guidance to read this thesis.

## 1.2 THEORETICAL BACKGROUND

EE is not a new field, but neither is it a discipline yet (if compared to electrical engineering or civil engineering). Both enterprise engineering and organisation(al) engineering are practiced-based and aims at studying enterprises in a multidisciplinary and *engineering-driven* way, but often without much scientific foundation (Dietz, 2006).

EA and the word 'architecture' exemplify the inconsistency in definition. According to Kappelman et al. (2010) the most common understanding of the term 'architecture' for an enterprise, is *collection of artefacts* (models, descriptions etc.) to define the *as-is* model of the enterprise. Bernard (2005) on the other hand, equates EA with the *process* of defining standards and creating *as-is* models, whereas Kappelman (2007) avers that EA creates and use a *shared language* to discuss and document important aspects of the enterprise (also see section 4.3.2.1 for other EA benefits/means). According to Sidorova & Kappelman (2010) the presence of a *multiplicity of definitions* suggests that EA is a highly complex dynamic construct that encapsulates both technical and social dimensions, the present and future, as well as the logical and physical aspects of the enterprise.

Rather than focusing on the disparities that exist, this study acknowledges the current deficiencies in *theoretical foundations*, *definitions* and *business benefits* and search for common grounds in the pursuit for consistent enterprise design and alignment. To illustrate the domain, Figure 1 highlights contributing theories, root disciplines and *emerging disciplines* (EE, EA and EO) that create the body of knowledge for enterprise design and alignment. The common aspect in the three *emerging disciplines* is the *enterprise*, which will be defined next.



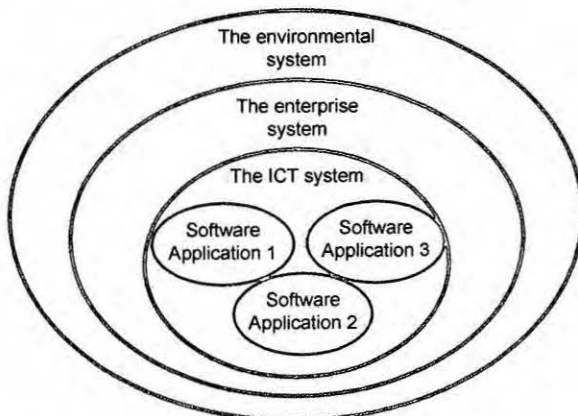
**Figure 1: Contributing theories, root disciplines and emerging disciplines in enterprise design and alignment, based on Bernard (2005) and Giachetti (2010)**

### 1.2.1 An enterprise

An *enterprise* is “a complex, *socio-technical system* that comprises interdependent resources of people, information, and technology that must interact with each other and their environment in support of a common mission” (Giachetti, 2010, p. 4). Defining the enterprise as a *system*, requires knowledge about *systems theory* and this theory will be covered in section 3.2.1. For understanding the scope of this study, definitions of a *system* and *sub-system* are provided.

A *system* is “a set of discernable, interacting parts or subsystems that form an integrated whole that acts with a single goal or purpose”. A boundary is used to encapsulate a system; everything outside of the boundary forms part of the external environment (Giachetti, 2010, p. 29).

*Sub-systems* are systems in their own right, but they are also part of a larger system. Although there may be several ways to define a sub-system for an enterprise system (e.g. using a functional viewpoint or a geographical viewpoint), enterprise design should aim to find optimal ways to structure the enterprise into sub-systems (Giachetti, 2010). Figure 2 demonstrates that any given system (e.g. an enterprise system) may be a sub-system to a larger system (e.g. the environmental system) and contain sub-systems (e.g. an ICT system).



**Figure 2: Enterprise as a sub-system and composed of sub-systems**

A concept that is related to the enterprise system is the *business*. The term *business* is often used to define certain aspects of the enterprise or beyond the boundaries of the enterprise. However, the boundary of *business* as a system is not clear. In addition, the term *business* is often used interchangeably with the term *organisation*. The following section provides different views on *business* versus *organisation*.

### 1.2.2 Business versus organisation

The term *business* is used in various ways. In understanding the term *business* and its scope, a list of popular *business architecture* definitions as found in literature, is given below:

- “Business architecture is a *general description of a system*. It identifies its purpose, vital functions, active elements, and critical processes and defines the nature of the interaction among them” (Gharajedaghi, 2006, p. 152).
- “It is a definition of what the *enterprise must produce* to satisfy its customers, compete in a market, deal with its suppliers, sustain operations, and care for its employees. It is composed of models of architectures, workflows, and events” (Whittle & Myrick, 2007, p. 31).
- “...business architecture is fitting the major elements of a business together...” “a set of *interrelated views of how a business works*” (McWhorter, 2008, p. 11). Supporting the latter, business architecture is “a *formal blueprint* of governance structures, business semantics, and value streams across the extended enterprise” (OMG’s BAWG in Ulrich, 2008: 38).

From the definitions provided, it can be deduced that the scope of the term *business* is unclear. Another term, which is often used interchangeably with the term *business* or *enterprise*, is *organisation*. Similar to the position taken by Giachetti (2010), this thesis refrains from using the word *organisation* as a substitute for *enterprise*, unless directly quoted from literature.

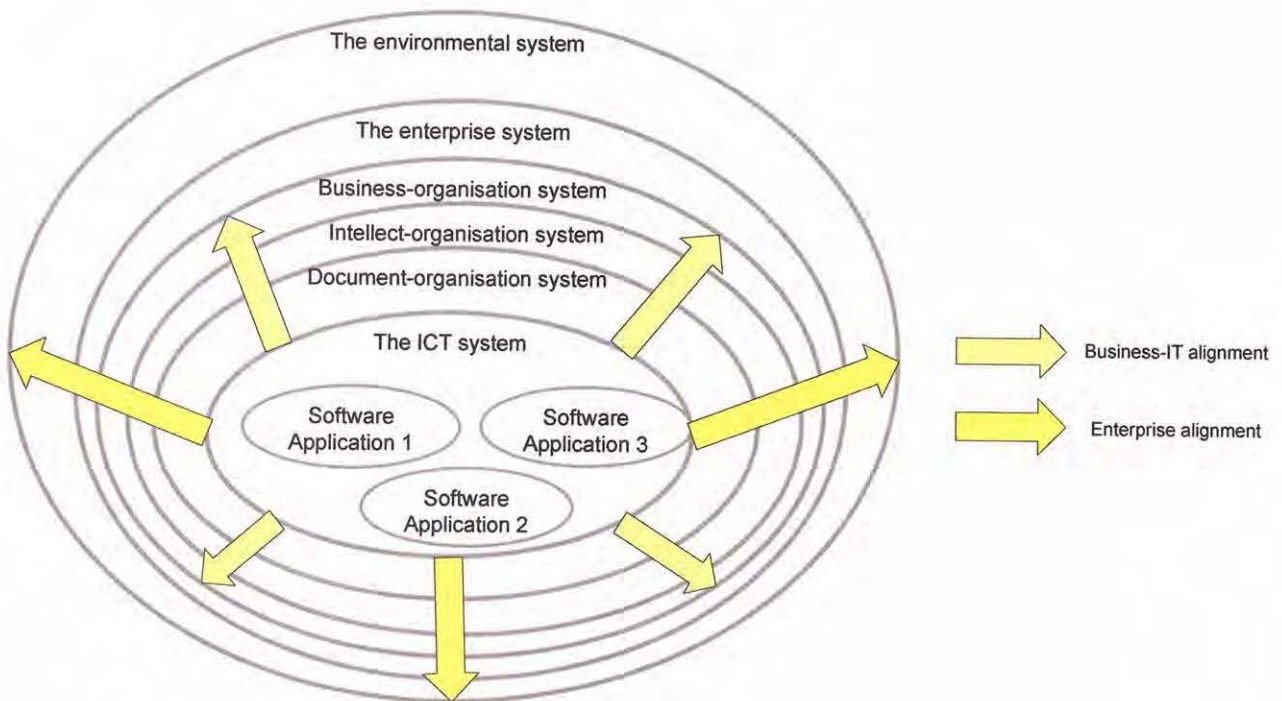
This thesis uses the term *organisation* in a similar way than Dietz (2006) does, where Dietz defines the enterprise system as a heterogeneous system that contains several sub-systems. The two enterprise sub-systems of concern are the *organisation* sub-system and the *ICT* sub-system. Within the *organisation* sub-system, Dietz (2006) encapsulates three aspect systems: the *business-organisation*, the *intellect-organisation* and the *document-organisation*. The *business-organisation* system encapsulates the *essential operation* of the enterprise within the *internal boundaries* of the enterprise, producing essential acts, such as decisions and judgements. The *intellect-organisation* system produces information-related acts, such as reproducing, deducing, reasoning and computing, whilst the *document-organisation* system produces data-related acts, such as storing, transmitting, copying and destroying. Section 3.3.6 provides additional theory about the three aspect systems.

Using the conceptualisation of Dietz (2006), the next section defines the concept of *business-IT alignment* as compared to *enterprise alignment*.

### 1.2.3 Business-IT alignment versus enterprise alignment

In terms of the various systems that are related to the enterprise, most of the current alignment approaches aligns four system layers: (1) the business-organisation, (2) intellect-organisation, (3) document-organisation, and (4) ICT (see Figure 3, arrows in light yellow) (Lapalme, 2011). The enterprise achieves a *business-IT alignment* state, when the *business-organisation* system is aligned via several system layers, with the *ICT system*, i.e. business and IT are “integrated, in harmony, converged, linked, fused, synthesized” (Luftman & Kempaia, 2008, p. 102).

Although *not* the focus of this thesis, Hoogervorst (2009) emphasises that enterprises need to expand the scope of alignment beyond the boundary of the *business-organisation* system. *Enterprise alignment*, not only aligns the essential operation (*business-organisation* system) with the *ICT system*, but also require alignment with other enterprise aspects, such as norms, convictions and culture. In addition, *enterprise alignment* also needs to align the enterprise with the environmental system (see Figure 3, arrows in bright yellow).



**Figure 3: Business-IT alignment vs. enterprise alignment scope**

The purpose of this study is to enhance an existing business-IT alignment approach with an element from another business-IT alignment approach. The problem is that existing fragmentation in the *emerging disciplines* (EE, EA and EO) creates difficulties when reusing knowledge from the existing knowledge base. Disciplines that contribute towards enterprise alignment do not use a common vocabulary (Lapalme, 2011). The fragmentation is partly due to different origins of EA and EE. EA originated within the *information systems domain* (Kappelman, 2010) and consequently the value-creating paradigm for using EA was IT-focused. The Open Group (2009, p. 6) for instance provide three main business benefits for using EA: (1) a more efficient IT operation, (2) better return on existing IT investment, coupled with reduced risk for future investment, and (3) faster, simpler and cheaper procurement of multi-vendor open

IT systems. EE on the other hand, developed as a sub-discipline of the *systems engineering* domain (Giachetti, 2010).

An extension of the fragmentation problem is that various alignment approaches exist, each with its own alignment intent, scope and means for alignment. Lapalme (2011) identified three schools of thought in the enterprise architecture community, but are also evident in current alignment approaches. The three schools of thought primarily differ in alignment scope. The first school (enterprise IT architecting) emphasises alignment of components related to the enterprise IT assets, whereas the second school (enterprise integrating) considers alignment of all facets of the enterprise (IT assets being one asset). The third school (enterprise ecological adaptation) expands the extent of alignment even further by adding the environment as an alignment component.

Although various theoretical alignment approaches or frameworks exist in literature, a study performed by OVUM (Blowers, 2012) indicates that 66% of enterprises had developed a customised framework, with one third of the participants making use of two or more frameworks. Although practitioners combine elements from various alignment approaches, a lack of theoretical backing about these combinations exist (Dumay, Dietz, & Mulder, 2005, p. 94). Mingers & Brocklesby (1997) state that the most effective contribution in dealing with the richness of the real world requires use of more than one approach/methodology, in whole or in part, and possibly from different paradigms. However, mixing approaches is not simple due to paradigm incommensurability, possible ineffectiveness in theoretical fitting and practicality in requiring a wide range of knowledge, skills and flexibility of practitioners. Prior to assessing the feasibility of mixing approaches, a *common frame of reference* is required to understand/compare different approaches. This thesis suggests the enhancement of one business-IT alignment approach (the *foundation for execution* approach) with another, using a common frame of reference.

The *foundation for execution* approach was developed by Ross, Weill, & Roberson (2006) and provided a unique element, called the operating model (OM). The OM articulates a vision of how the enterprise should operate, by defining the required levels of process standardisation and integration. The required OM drives the implementation of a whole set of strategic initiatives. A study about the practicality of defining an OM and its translation (the core diagram), however, indicated several OM deficiencies (De Vries & Van Rensburg, 2009). Although the construction of both artefacts (OM and core diagram) were problematic (De Vries & Van Rensburg, 2009), the core diagram is dependent on the OM and translates the process standardisation and integration requirements of the OM into the core diagram components. Since the core diagram is a derivative of the OM, the study directed its focus to the OM alone, providing a rationale for enhancing the OM concept.

A follow-up study (De Vries, Van der Merwe, Gerber, & Kotzé, 2010), highlighted that the OM deficiencies could be categorised as *process reuse* and *data sharing* deficiencies respectively. The *process reuse* deficiencies related to the inability of identifying reusable process

components in the enterprise, whereas the *data sharing* deficiencies associated with the inability to identify reusable data components in the enterprise. The next section elaborates on the need to address the OM deficiencies.

### 1.3 RATIONALE FOR THIS STUDY

There is a need to enhance the OM concept by addressing the OM deficiencies (specifically pertaining to *process reuse* and *data sharing*), by using knowledge from the existing business-IT alignment knowledge base.

From the factors discussed in the previous sections, the rationale is summarised as follows:

- Fragmentation exists in the *emerging disciplines* (EE, EA and EO), which creates difficulties in reusing knowledge from the existing knowledge base. In addition, numerous alignment approaches exist, each with its own alignment intent, scope and means for alignment.
- Enterprise alignment approaches differ in alignment scope. Most of the alignment approaches still focus on business-IT alignment. Therefore, the main focus of this study is also confined to business-IT alignment (see Figure 3, constructs in light yellow).
- There is a need to combine elements from various alignment approaches. Although practitioners already combine elements from different alignment approaches, there is a lack of theoretical backing about these combinations.
- One of the business-IT alignment approaches, called the *foundation for execution* approach, provides an operating model (OM). Due to its inherent deficiencies, there is a need to enhance the OM within the context of business-IT alignment.
- Given that many enterprises have already seized the opportunity of *sharing data* (Hoogervorst, 2009; O'Kane, Radcliffe, & White, 2012; Smith & Fingar, 2003), this study focused on deficiencies pertaining to the identification of *process reuse opportunities*.

The thesis statement is that *the operating model concept, as part of a business-IT alignment approach, can be enhanced with a process reuse identification framework, when a business-IT alignment contextualisation is used.*

### 1.4 THE RESEARCH QUESTIONS, OBJECTIVES AND OUTPUTS

Contrary to other business-IT alignment approaches where IT supports strategy (Lapkin, 2005; Rosser, 2004), Ross et al. (2006) maintain that strategy rarely offers clear direction for development of stable IT infrastructure and business process capabilities. Strategic priorities shift as enterprises attempt to respond to competitor initiatives or seize new opportunities. Ross et al. (2006) state that management needs to make a strategic decision on the required operating model (OM) of the enterprise, that would guide systematic development of the supporting ICT system. A decision about a required OM would assist in creating a *foundation for execution*, i.e. rationalising and digitising the routine, everyday processes and competitively distinctive capabilities of the enterprise. The stable *foundation*, created according to the



selected OM, enables an enterprise to become a “a proactive – rather than reactive – force in identifying future strategic initiatives” (Ross et al., 2006, p. 43).

The OM concept requires that senior management select an appropriate OM that will leverage reusable capabilities, driving profitable growth. A poor choice of OM, i.e. one that is not viable in a given market, will have dire consequences (Ross et al., 2006). Since, the OM is a key artefact used during strategic decision-making; this study focuses on the deficiencies of the OM, and more specifically the deficiencies pertaining to *process reuse*. A *design process* was needed to address the *process reuse* deficiencies in developing a *process reuse identification framework*.

In support of the *design process* and the aim to reuse fragmented knowledge from the *emerging disciplines* (EE, EA and EO), the study also provides a business-IT alignment contextualisation to contextualise current alignment approaches.

The research questions defined for the study are as follows:

**Primary Research Question:**

What constructs are required for a process reuse identification framework to enhance the operating model concept within the context of business-IT alignment?

**Secondary Research Questions:**

1. What model is required to contextualise different business-IT alignment approaches?
2. What constructs are required for a process reuse identification framework to enhance the operating model concept, using the business-IT contextualisation model?

The following *research objectives* are applicable in solving the research questions:

- The construction of a business-IT alignment model to contextualise different business-IT alignment approaches:
  - Identifying an appropriate research design to develop a business-IT alignment model.
  - Data-gathering to construct the Business-IT Alignment Model (BIAM).
  - Verifying the use of BIAM.
- The construction of a process reuse identification framework to enhance the operating model concept, using the business-IT contextualisation model.
  - Identifying an appropriate research design to develop a process reuse identification framework, enhancing the operating model concept.
  - Using the Business-IT Alignment Model (BIAM) as an instrument to contextualise current alignment approaches and evaluate their compatibility while constructing the Process Reuse Identification Framework (PRIF).
  - Data-gathering during the construction of the Process Reuse Identification Framework (PRIF) to verify inclusion of PRIF constructs.

The *main outputs* of this study are a framework, called the PRIF (process reuse identification framework), and a model, called the BIAM (Business-IT Alignment Model). In using the terminology *framework* and *model*, the Cambridge Dictionary provides the following definitions:

- A framework “is a system of rules, ideas or beliefs that is *used to plan or decide* something or a supporting structure around which something can be built” (Cambridge Dictionary, n.d.-a).
- A model “is a *representation* of something, either as a physical object which is usually smaller than the real object, or as a simple description of the object which might be used in calculations” (Cambridge Dictionary, n.d.-b).

The PRIF, in accordance with the definition of a *framework*, provides a set of requirements and derived *method, mechanisms and practices* that is *used to plan or decide* whether process reuse standardisation opportunities exist that may be exploited in an enterprise.

The BIAM is a *model* that provides a *representation* of a class of alignment approaches that aim towards the alignment of business and IT components in an enterprise. According to the classification provided by Giachetti (2010), the BIAM is a *non-analytical* model. The *non-analytical* model is a descriptive model that is used for qualitative analysis, such as comparing different designs.

## 1.5 THE SCOPE AND LIMITATIONS OF THE STUDY

This section defines the scope and limitations of the study, with reference to the main outputs of the thesis, i.e. the PRIF (Process Reuse Identification Framework), and the BIAM (Business-IT Alignment Model).

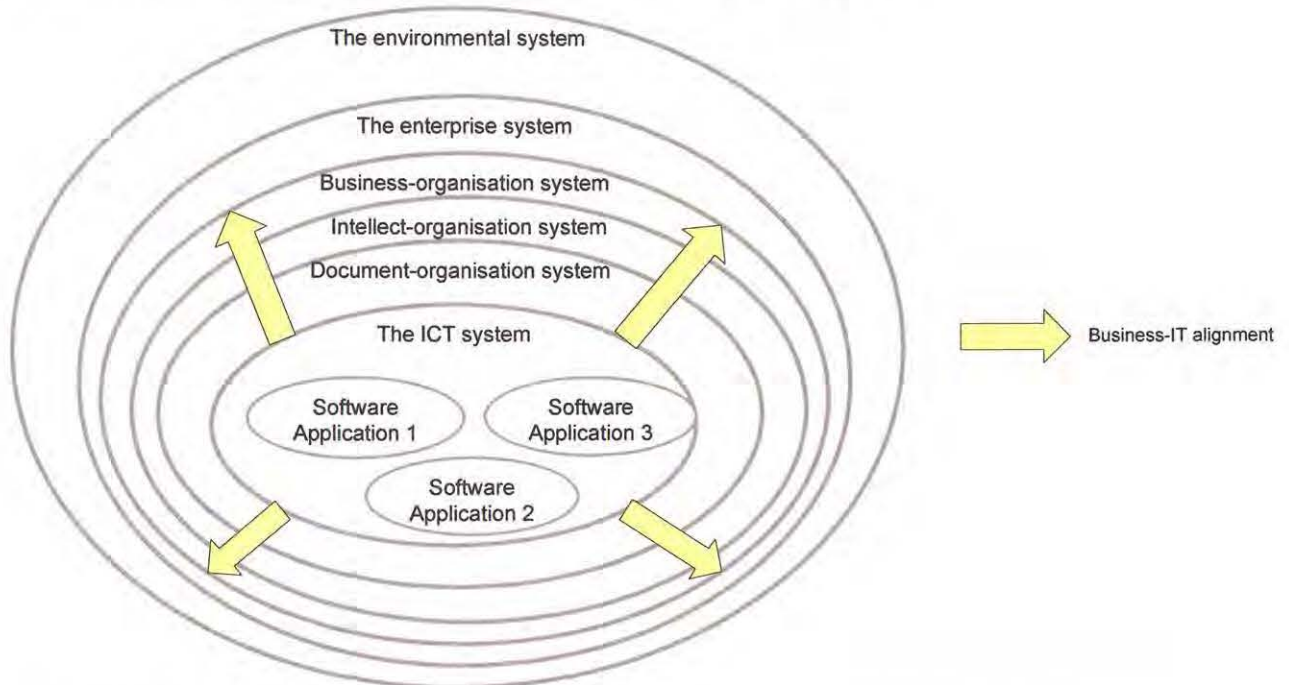
### 1.5.1 Scope of the PRIF

The PRIF is developed for the purpose of identifying *process reuse* opportunities, to enhance the operating model (OM). Even though the PRIF may be applicable to identify process reuse opportunities for different reasons than augmenting the OM, this study does not claim such general use. The rationale is that the *requirements* for the PRIF are primarily related to the deficiencies of the OM, as defined in section 7.4. Yet, the *requirements* for the PRIF may be extended as part of future research, to increase generality of identifying process reuse opportunities at an enterprise.

### 1.5.2 Scope of the BIAM

As stated in section 1.3, the main focus of this study is confined to business-IT alignment. In a previous section (section 1.2.3), the concept of business-IT alignment was discussed in terms of layered systems. Figure 4 repeats Figure 3 to illustrate six system layers: environmental system, enterprise system, business-organisation system, intellect-organisation system, document-organisation system and ICT system. Most of the current alignment approaches aligns four system layers: the business-organisation, intellect-organisation, document-

organisation, and ICT (see Figure 4, arrows in light yellow) (Lapalme, 2011). The enterprise achieves a *business-IT alignment* state, when the *business-organisation* system is aligned via several system layers, with the *ICT system*, i.e. business and IT are “integrated, in harmony, converged, linked, fused, synthesized” (Luftman & Kempaia, 2008, p. 102). This study is also concerned with business-IT alignment (Figure 4, arrows in light yellow).



**Figure 4: Business-IT alignment scope of this study**

Hoogervorst (2009, p. 262) emphasises that business and IT alignment can only be achieved within the overall enterprise governance context. The rationale is that incremental IT developments occur collaboratively, iteratively, and concurrently with other enterprise developments. Martin (1995, p. 380) also supports the notion that the whole enterprise, “all of its business, social, and technical systems must be dealt with in a holistic and integrated way”.

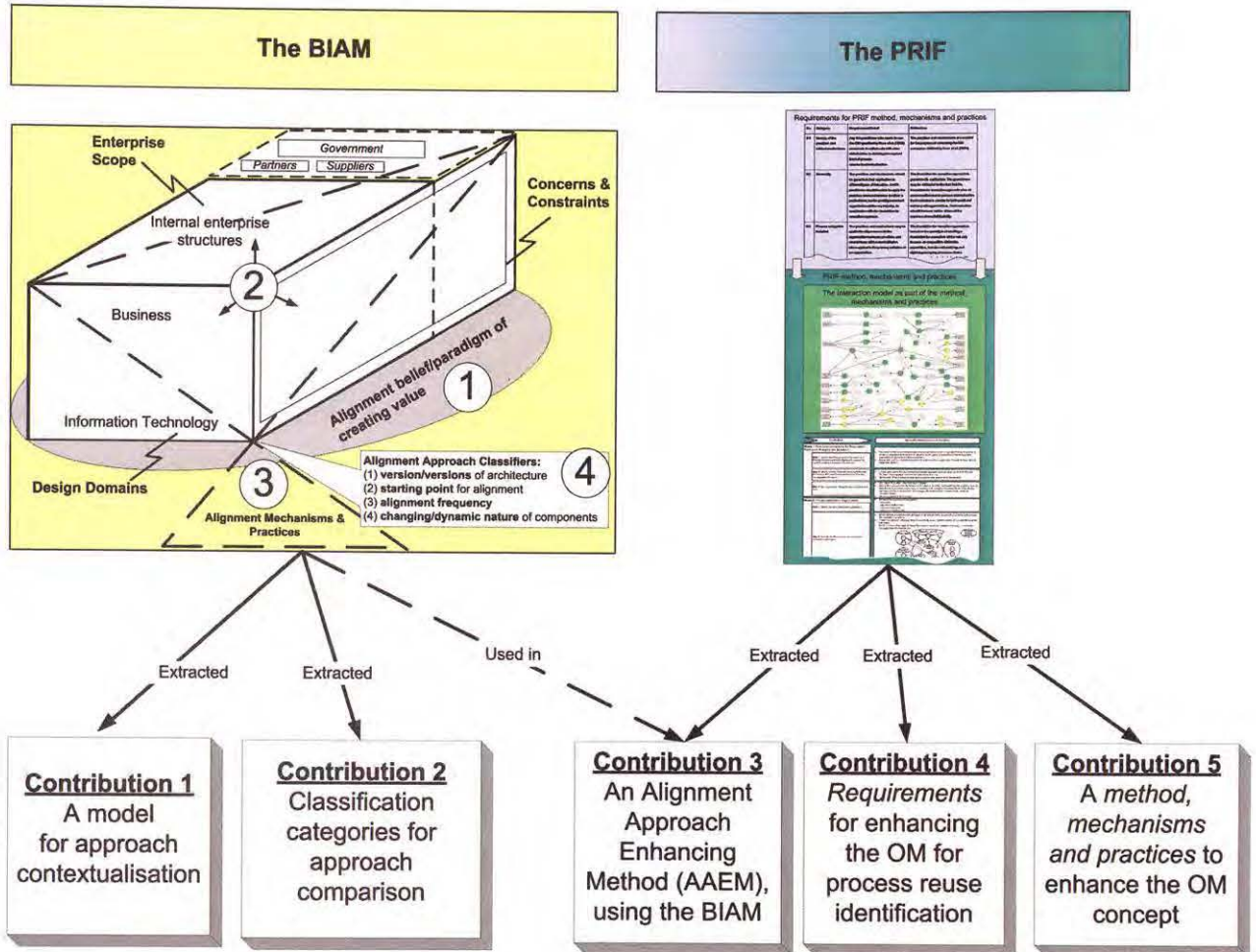
Although the BIAM is sensitive to the enterprise as a whole, and may even be representative of enterprise alignment beyond business-IT alignment, BIAM only claims representation for contextualising business-IT alignment approaches.

## 1.6 SUMMARY OF SCIENTIFIC CONTRIBUTIONS

As mentioned earlier, the main purpose of this study is to enhance the OM (within an existing business-IT alignment approach) with an element from another business-IT alignment approach. The study meets the primary purpose, by delivering two artefacts: the PRIF (process reused identification framework) and the BIAM (Business-IT Alignment Model). However, due to the research process itself, five scientific contributions are presented (see Figure 5):

- Contribution 1: A model for approach contextualisation
- Contribution 2: Classification categories for approach comparison
- Contribution 3: An Alignment Approach Enhancement Method (AAEM), using the BIAM

- Contribution 4: Requirements for enhancing the OM for process reuse identification
- Contribution 5: A *method, mechanisms and practices* to enhance the OM concept

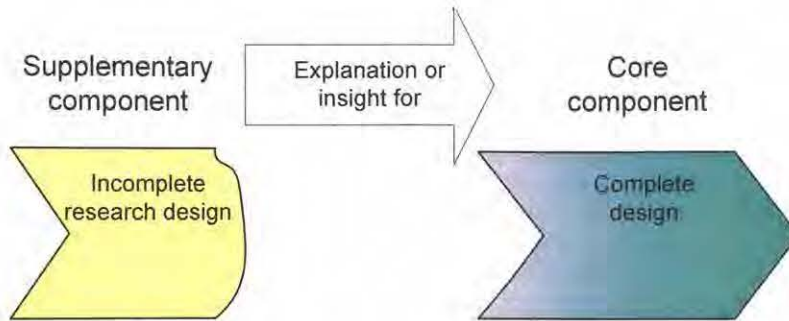


**Figure 5: Thesis contributions**

The contributions are discussed in more detail in Chapter 11.

## 1.7 RESEARCH METHODOLOGY

The study applies a mixed methods design, based on the definition provided by Morse (2010), which suggests that a mixed methods design consists of a complete design method (i.e. the *core component*), plus one (or more) incomplete design method(s) (i.e., the *supplementary component(s)*) (see Figure 6). The result of the supplementary component provides explanation or insight for the core design component.



**Figure 6: Supplementary and core component of mixed methods research, based on Morse (2010)**

In this study, the deficiencies of the current OM initiated the development of the main artefact, the PRIF. The development of the PRIF as the main artefact thus required a *core component* (complete design) as a research design. This thesis (see section 2.6.2) motivates the use of *design research* as the *core component*. Since this study primarily intended to enhance the OM within a business-IT alignment context, reusing knowledge within the business-IT alignment discipline, a supplementary component was required. The prime purpose of the supplementary component was to provide a business-IT alignment contextualisation instrument (BIAM), to provide explanation or insight for the development of the PRIF. Due to its supplementary role, an incomplete research design, i.e. *exploratory design*, was sufficient in developing the BIAM. Section 2.6.3 provides a motivation for using *exploratory design* as the *supplementary component*.

## 1.8 STRUCTURE OF THIS THESIS

Figure 7 illustrates the structure of this thesis in terms of four main parts:

- Part A: Introduction (this chapter) and research methodology
- Part B: The BIAM (Business-IT Alignment Model)
- Part C: The PRIF (Process Reuse Identification Framework)
- Part D: Scientific contribution and conclusion

The main parts (B and C) address the secondary research questions (Research Questions 1 and 2) respectively. Part B also provides the theoretical framework and develops the BIAM (Business-IT Alignment Model) to extend the knowledge base (Figure 7, vertical yellow bar, *Extended knowledge base*). The *extended knowledge base* (including the BIAM) is then applied in part C. Correspondingly, the development of the PRIF (part C) often refers back to Part B during re-visitation of the *extended knowledge base* (Figure 7, yellow arrow, *EKB re-visitation*).

The next chapter is the second chapter in Part A, presenting theory about research methodology and its application in this thesis.

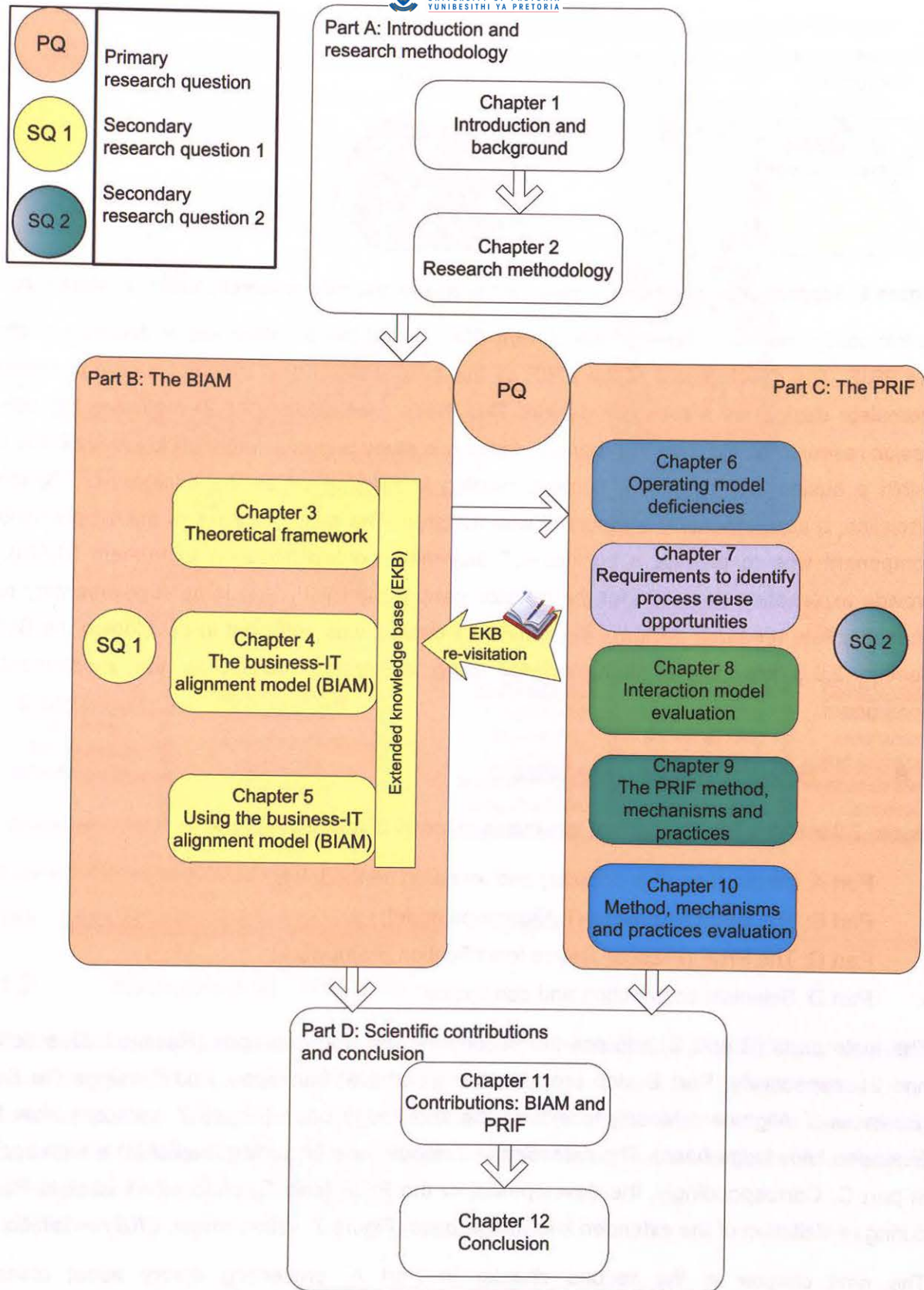


Figure 7: Structure of the thesis