8.1 INTRODUCTION AND PROBLEM DEFINITION

One of the main goals of this thesis is to enhance the operating model (OM), due to its inherent deficiencies, which were illuminated in Chapter 6. In the previous chapter (Chapter 7), seven requirement categories were identified for augmenting the OM concept, addressing the OM deficiencies pertaining to the identification of *process reuse* opportunities. This chapter [4]proceeds with the second *development* sub-cycle (Figure 68, *Sub-cycle 2*) to develop a part of PRIF (Figure 68, *The interaction model* component), in addressing the second research question, namely:

What constructs are required for a process reuse identification framework to enhance the operating model concept, using the business-IT contextualisation model?

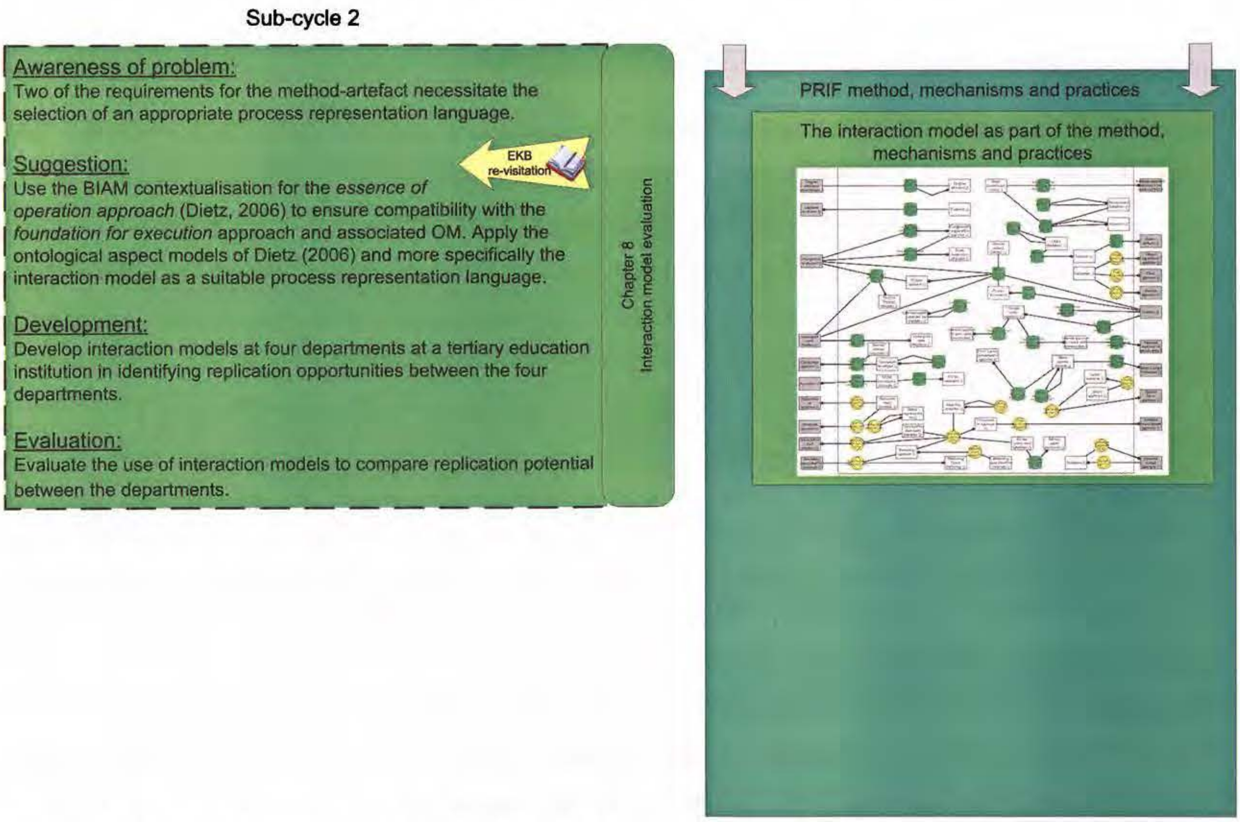

Figure 68: Design cycle context for Chapter 8 (duplicating part of Figure 15)

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[4] The content of Chapter 8 is based on: De Vries, M., Van der Merwe, A., Gerber, A., & Kotzé, P. (2011). Using the interaction model to identify replication potential between business units. In C. S. L. Schutte & L. Pretorius (Eds.), *Proc. 1st International Conference on Industrial Engineering, Systems Engineering and Engineering Management for Sustainable Global Development (ISEM)* (pp. 134_131 - 134_114). Stellenbosch: ISEM.

The first development sub-cycle of the PRIF (covered in the previous chapter), i.e. developing requirements for the PRIF *method, mechanism and practices*, led to circumscription and the awareness of another problem. The problem is that two of the requirement categories (Table 15 in section 7.4, R5 and R6), namely *process representation* and *replication identification*, necessitate the selection of a suitable *process representation language*. The requirement detail of the *process representation* requirement category indicates that consistent process representation should ensure re-use, in addition to allowing process measurement, end-to-end views of processes, modular process design, and ease of use/understanding for business users. The requirement detail of the *replication identification* requirement category pertains to the ease of identifying operational similar organising entities.

Since current *process representation languages* already address some of the last-mentioned requirements, the selection of a *suitable process representation language* that complied with both requirement categories was necessary. Re-visitation of literature revealed that the ontological aspect models, used within the *essence of operation* approach, looked promising in addressing the two requirement categories. The *essence of operation* approach (as discussed in section 3.3.6) has the objective to define the "essence of construction and operation" of an enterprise (Dietz, 2006, p. 8).

To ensure compatibility with the *foundation for execution* approach and its associated OM, a *suggestion* was made to contextualise the *essence of operation* approach and more specifically one of its ontological aspect models (the interaction model) within a business-IT alignment context. Using a common model for business-IT contextualisation, BIAM (as developed in 4.3.2), would enable one to compare the two alignment approaches (*foundation for execution* approach and *essence of operation* approach) and their supporting models.

In summary, the *problem* (Figure 68, *Awareness of problem*) is that two of the requirement categories (Table 15 in section 7.4, R5 and R6) necessitate the selection of a suitable *process representation* language. Based on a literature review, the ontological aspect models of the *essence of operation approach* could be suitable, but required additional contextualisation and evaluation. Thus, a *suggestion* (Figure 68, *Suggestion*) was made to apply a BIAM-contextualisation to the *essence of operation* approach to ensure compatibility with the *foundation for execution* approach and associated OM. A further *suggestion* was to use/evaluate the ontological aspect models of Dietz (2006) and more specifically the interaction model to confirm adherence to the two requirement categories.

This chapter addresses the *suggestion* (Figure 68, *Suggestion*) by providing a business-IT alignment contextualisation of the *essence of operation* approach, using the BIAM, in section 8.2. In addition, two BIAM-contextualised approaches and associated artefacts are compared in section 8.3 to highlight similarities and differences: the *foundation for execution* approach and operating model (OM), versus the *essence of operation* approach and the interaction model (IAM). The approach comparison is followed by a motivation to select the ontological aspect models and more specifically the interaction model as a *suitable process representation* *language*. Section 8.4 provides an *evaluation* method to evaluate the use of the interaction model as an appropriate *process representation language* for the required PRIF *method, mechanisms and practices*. The *developed* interaction models and *evaluation* results (Figure 68, *Development* and *Evaluation*) follow in section 8.5. The chapter concludes in section 8.6.

8.2 A BIAM CONTEXTUALISATION OF THE ESSENCE OF OPERATION APPROACH

Section 3.3.6 introduced the *essence of operation* approach and its association with five ontological aspect models (section 3.3.6.3). The purpose of the ontological aspect models was to define the essence of enterprise operation. One of the five ontological aspect models, the interaction model (IAM), could possibly be incorporated as part of the PRIF *method, mechanisms and practices*. However, prior to suggesting the use of the IAM as part of the PRIF *method, mechanisms and practices*, this section applies the BIAM components delineated in section 4.3 to provide a business-IT alignment contextualisation of the *essence of operation* approach introduced in section 3.3.6. The BIAM-contextualisation not only provides a business-IT alignment understanding of the *essence of operation* approach, but also allows comparison with the *foundation for execution* approach, that was already BIAM-contextualised in section 7.2. The following sub-sections correlate with the four main contextualisation components of the BIAM, namely (1) the paradigm of creating value; (2) the dimensions for alignment; (3) alignment mechanisms and practices; and (4) alignment approach classifiers.

8.2.1 Paradigm of creating value

The paradigm of value creation is that alignment of ICT systems with the enterprise system requires a *design process*, which requires constructional knowledge of the using system (i.e. the enterprise system) to derive functions for the object system (i.e. the ICT system). The approach reduces complexity of the constructional knowledge of the enterprise, by providing an implementation-independent view of enterprise construction, called enterprise ontology, and represented by ontological aspect models (OAMs) (Dietz, 2006).

Similar to Zachman, Dietz (2006) also emphasizes the value of *enterprise ontology*. Zachman includes both ontological and realisation models as part of his ontological framework, whilst Dietz explicitly distinguishes between ontological and realisation models. In addition, Dietz applies the language/action perspective (LAP) to represent enterprise ontology, where social beings achieve changes in the object world by means of communication. LAP offers a solution for the mismatch between social perspectives and technical perspectives (Dumay et al., 2005).

BIAM does not require a complete paradigmatic analysis, but the interested reader is referred to the paradigmatic analysis of the *essence of operation* approach performed by Dumay et al.(2005, pp. 86-89).

8.2.2 The dimensions for alignment

According to Figure 69, the *essence of operation* approach does *not* provide a methodology for designing and constructing the entire enterprise as the object system, but rather provides ontological models of the enterprise as the using system to design the ICT system as the object system. Dietz (2006, p. 77) explicitly mentions that his way of producing the ontology of an enterprise *does not* cover the ontological representation of the enterprise as the *object system*. Figure 69 (*Focus of the essence of operation approach)* clearly indicates the alignment focus of the *essence of operation* approach.

Hoogervorst (2009) incorporates the work of Dietz into a methodology to design the enterprise as the *object system*. In support of the primary function of the enterprise (i.e. delivering products/services to customers/markets) a number of constructional aspects are required in support of the primary function. In addition to the constructional aspects presented by Dietz (2006), enterprise construction also incorporates aspects such as norms, values, performance measurement, decision-structures, employee competencies, conflict resolution means and production means (material, equipment and methods). Many of the constructional elements are produced by default due to a dominant culture in the enterprise, and are *not produced by design* (Gharajedaghi, 2006). Figure 69 (*Focus of the Hoogervorst approach)* clearly indicates the alignment focus of the Hoogervorst approach.

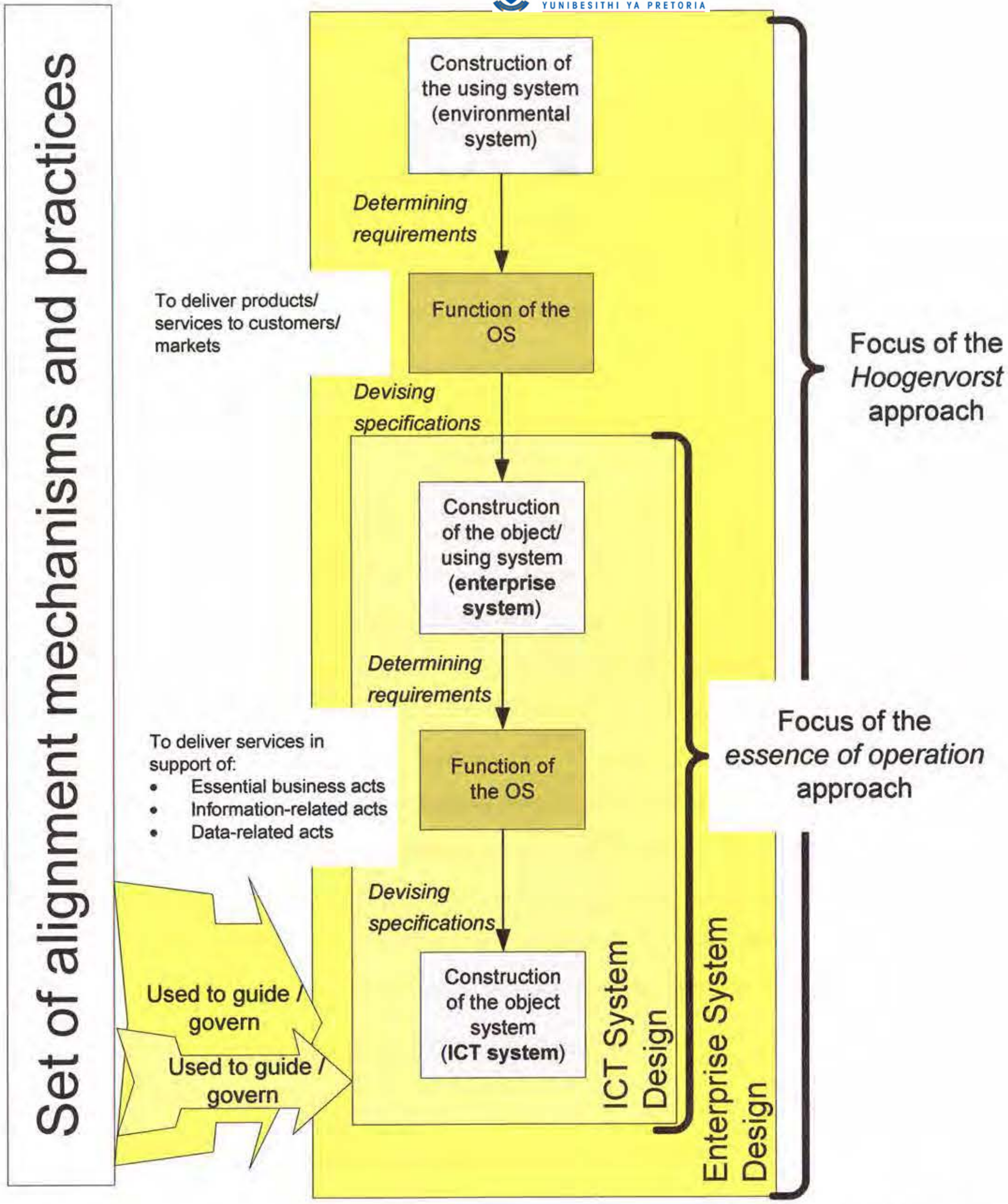

Figure 69: The essence of operations approach focusing on ICT system design

In terms of the first BIAM dimension, the *design domain* dimension, Hoogervorst (2009, p. 134) maintains that the demarcation of *design domains* should reveal "functional or constructional *system facets* for which *design activities* are required". Dietz (2006) takes a *layered systems* approach (as used by Bunge (1979)) to define *design domains*. According to Figure 70, the heterogeneous enterprise system consists of at least two sub-systems, the organisation system and an ICT system. The *organisation system* consists of the layered integration of *three aspect systems*, (1) the ontological aspect system (the **B**usiness-organisation), (2) the infological aspect system (the **I**ntellect-organisation), and (3) the datalogical aspect system (the **D**ocument-organisation). The three aspect systems are all of the same kind (social systems), but differ in their *kind of production*, such that the combination of the three homogenous aspect systems is a heterogeneous organisation system. In relating to the *kind of production*, the ontological aspect system produces ontological acts, such as decisions and judgements; the infological as aspect system produces infological acts, such as reproducing, deducing, reasoning and computing;

and the datalogical aspect system produces datalogical acts, such as storing, transmitting, copying and destroying.

In terms of the second BIAM dimension, the *concerns* dimension, Dietz does not emphasise the *specific* functional and non-functional *concerns* that should be considered while designing the various aspect systems. However, he uses the aspect systems to distinguish between business concerns (for the ontological aspect system), intellect concerns (for the infological aspect system) and document concerns (for the datalogical aspect system).

In terms of the third BIAM dimension, the *enterprise scope* dimension, the ontological aspect models are primarily used to design and align across the internal enterprise scope (Dietz, 2006, p. 215)

Dietz (2006) focuses on the ontological aspect system, which provides a view on the *essence of enterprise operation and construction.* Integration of the ontological aspect system with the two other aspect systems, is called the *realisation of the organisation* (see Figure 70, realisation arrow). Organisation realisation takes place due to the abilities of the *human being.* The human being could take on different roles (B-actor, I-actor or D-actor) to *realise* an ontological act, such as making a decision (e.g. *admitting* a student for enrolment at a college). The *implementation* of the organisation system (see Figure 70, implementation arrows) makes the organisation's realisation *operational* by means of technology (using software applications/services used in service-oriented architecture, and hardware). Although the *essence of operation* approach does not provide a complete methodology for aligning business with IT, the intent is to align business with IT, as indicated by the yellow-shaded part of Figure 70.

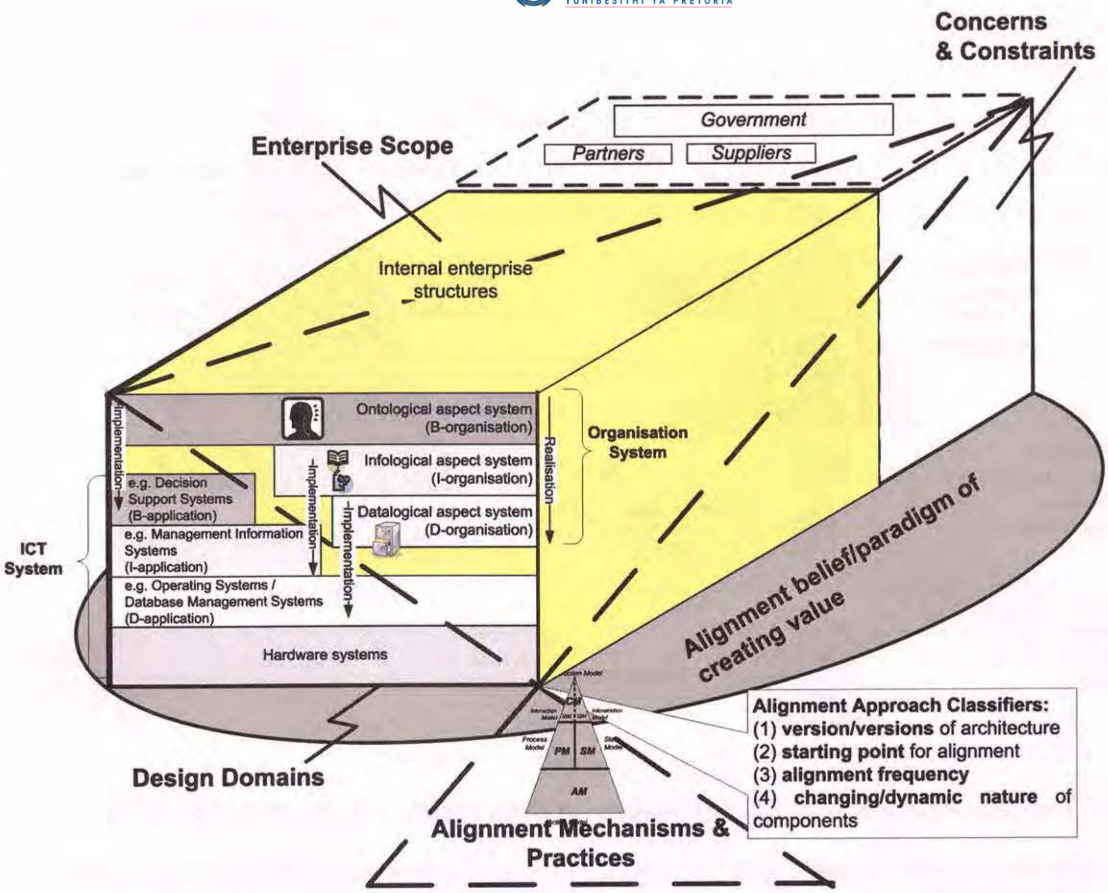

Figure 70: The BIAM contextualisation of the *essence of operation* approach

8.2.3 Alignment mechanisms and practices

This section highlights the categories of *alignment mechanisms and practices* that apply to the *essence of operation* approach.

1. Architecture description and reference models

Dietz (2006) provides a set of ontological aspect models to convey the ontological knowledge of enterprise construction. Figure 71 illustrates the three aspect systems and the set of OAMs to represent the ontological knowledge of an enterprise.

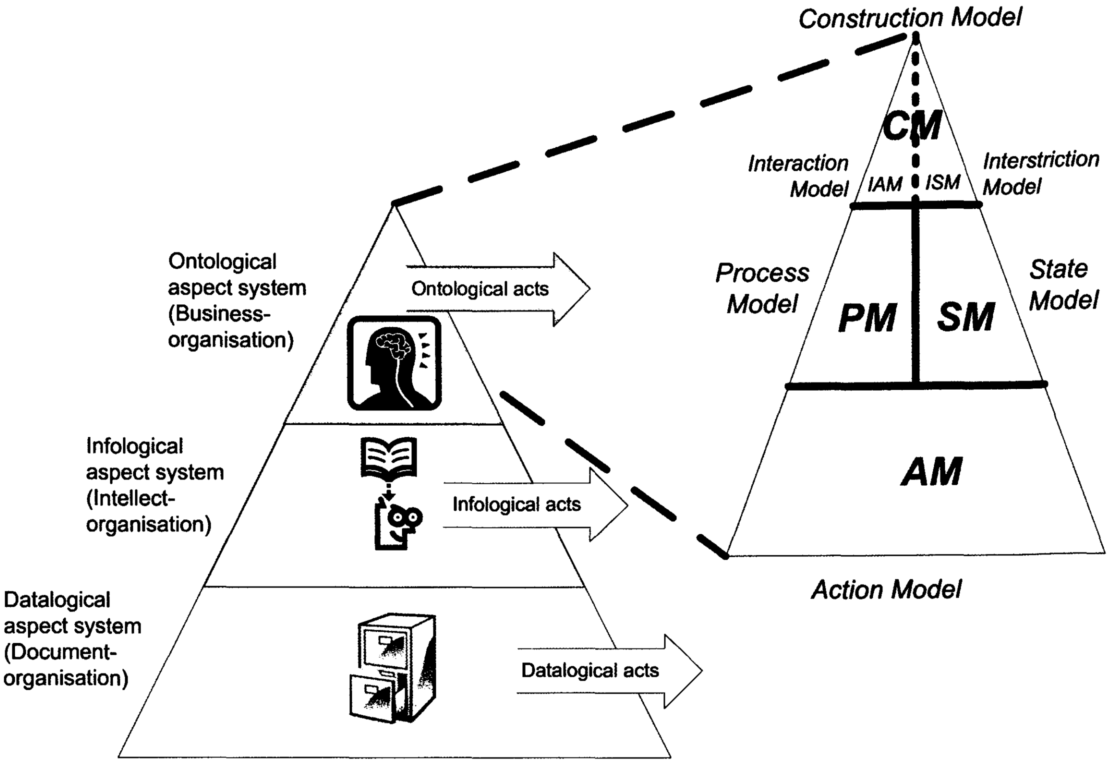

Figure 71: The ontological aspect models, based on Dietz (2006, p. 140) (duplicate of Figure 37)

Each of the four aspect models are represented by a number of graphical representations or diagrams (see Figure 72) based on a unique notation language. In addition, a number of cross-model tables ensure model-completeness.

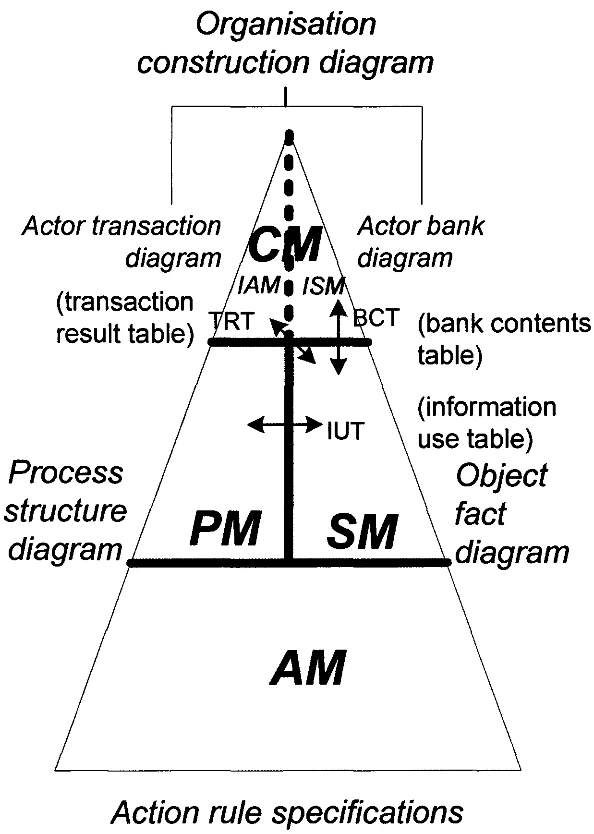

Figure 72: The OAM diagrams and tables, based on Dietz (2006, p. 141)

The first OAM, *interaction model* (see Figure 73, IAM), is the most compact ontological model of an enterprise that incorporates units of logic (transaction types) that are consistent in the detail embodied in the underlying transaction patterns. The interaction model is expressed in an *actor transaction diagram* and a *transaction result table*. The actor transaction diagram demonstrates interactions between actors during the execution of transactions. Figure 73 provides an example of an actor transaction diagram (modelled with the ABACUS toolset) of a hypothetical college that performs eight ontological transactions.

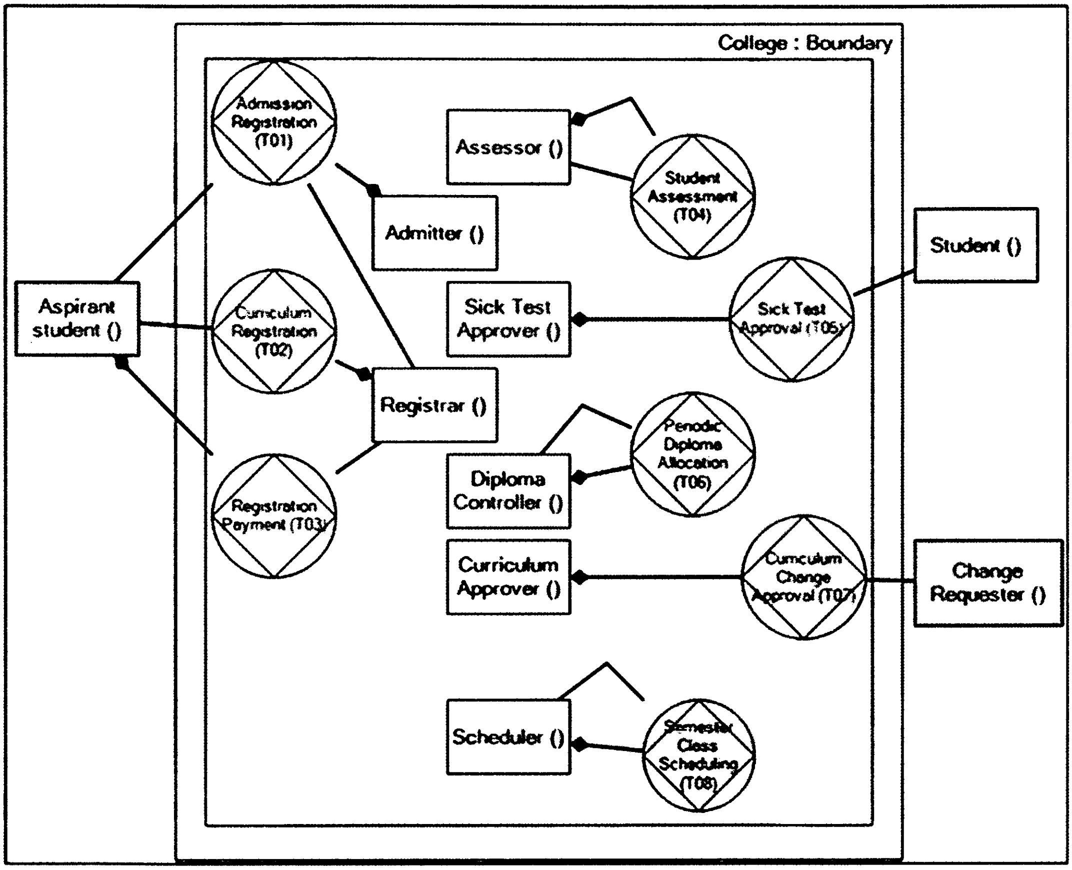

Figure 73: Actor transaction diagram for a hypothetical college (constructed using the ABACUS toolset)

The actor transaction diagram of Figure 73 consists of actors, transaction types, initiator links and executor links. The *actors* are indicated by rectangles (white rectangles represent elementary actors, whereas shaded rectangles represent composite actors). The *transaction types* are indicated by the disc-diamond combination. Each transaction type may be initiated by one or more actors - the *initiator link* is indicated by a solid line. Each transaction type is executed by only one actor - the *executor link* is indicated by a solid line with a diamond end that links to the executing actor. The transaction result table is merely an extension of the actor transaction diagram where the expected result of each transaction type is described. As an example, the result of the transaction type T01 (*Admission Registration*) in Figure 73 could be described as: *Admission A has been done*.

Each transaction type is a concise representation of a transaction pattern that consists of a number of coordination acts and facts that come into existence when actors start coordinating around the production of a production act and fact. When actors are consenting to each other's acts, a basic transaction pattern is followed (see Figure 74). Actors may also dissent to each other's acts and/or they may try to roll back part of the transaction acts/facts. When these deviations from the basic transaction pattern are incorporated, a complete/universal pattern exists that allows for the complete description of any transaction type (Dietz, 2006).

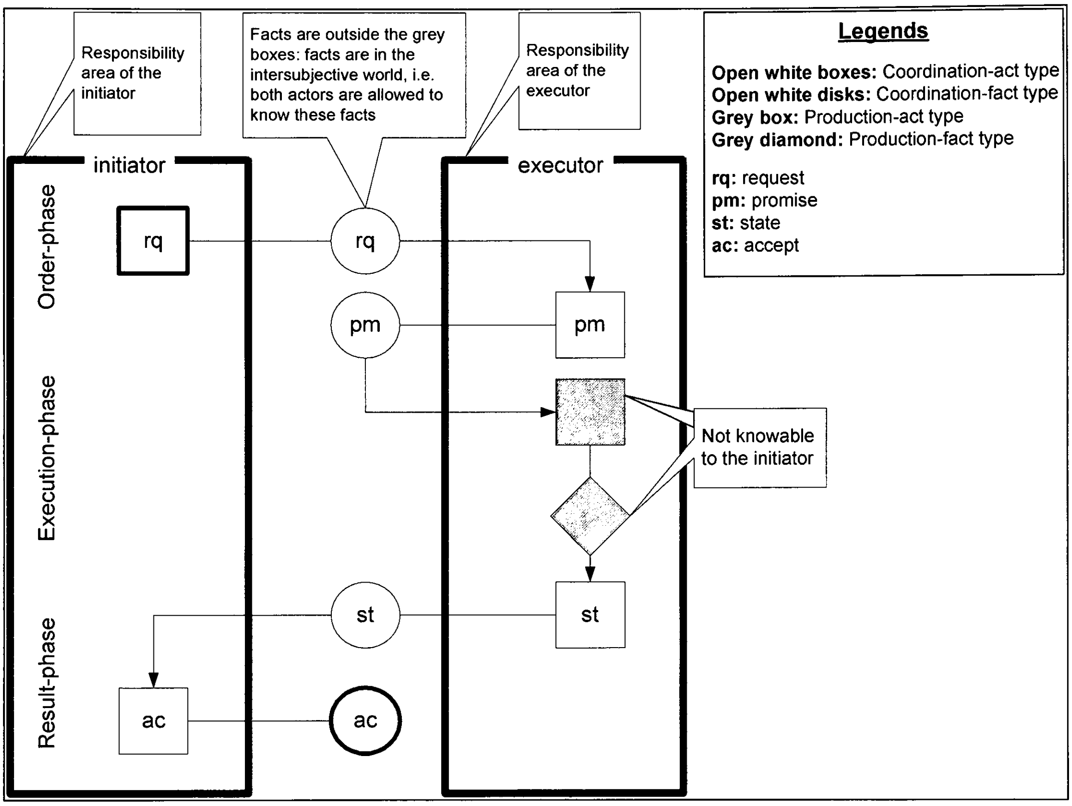

Figure 74: The basic transaction pattern, based on Dietz (2006)

The remaining three ontological aspect models (process model, action model and state model) and their respective diagrams extend the ontological knowledge of the interaction model. The *process model* details the *sequence* of coordination acts and production acts. The *action model* provides action rules to guide the behaviour of the actor in executing coordination acts and production acts. The state model specifies the object classes, fact types, result types and existential laws that hold.

According to Zachman terminology, ontological models need to be primitive models, i.e. a primitive model addresses the intersection of one column with one row on the Zachman Framework (see Figure 24). The ontological models of Dietz are however composite models. As an example, the interaction model contains actors (*who* / responsibility assignment column on the Zachman Framework), as well as transactions (*how* / process flows column on the Zachman Framework). As mentioned in section 5.2.3, composites are required for sense making. Figure 75 provides an indication of the columns and rows addressed by the interaction model. All ontological aspect models, including the interaction model, omits the motivations/mission of the enterprise (i.e. *why* / motivation intentions column on the Zachman Framework), as the ontological aspect models are only concerned about the means for realising the mission (Dumay et al., 2005).

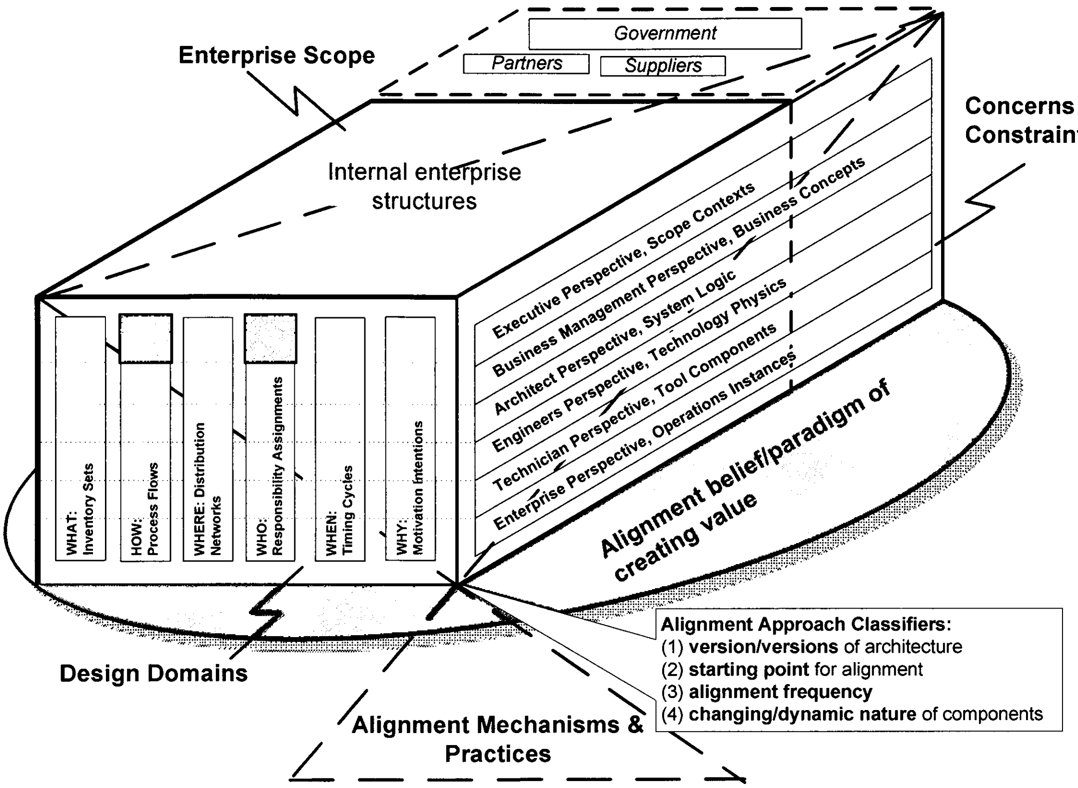

Figure 75: Alignment intent of the interaction model in terms of the Zachman Framework

2. Methodologies

Dietz provides a *method* (see section 3.3.5) for creating the OAMs of Figure 71, called DEMO (Design and Engineering Methodology for Organisations).

8.2.4 Alignment approach classifiers

The *essence of operation* approach primarily applies to the *future state* of the enterprise, i.e. conceiving the essence of the organisation system that is going to realise a new business (Dietz, 2006, p. 215).

A *top-down* approach is followed in terms of architecture development, i.e. starting at the enterprise as the using system and deriving requirements for the ICT system as the object system.

The *essence of operation* approach does not favour of a big bang approach, but rather *continuous*, systematic design according to the basic *system design process*.

The *essence of operation* approach aims at reducing architectural complexity by extracting the ontological construction of the enterprise (independent of realisation or implementation), "hence reducing the difficulty in understanding enterprises" (Hoogervorst, 2009). However, the mechanisms and practices do not explicitly address the problems associated with the *changing/dynamic nature* of architecture components.

To conclude, a BIAM-contextualisation of the *essence of operation* approach contextualised the *essence of operation* approach in terms of the four main components of the BIAM (Figure 45 in section 4.3.2, Components 1 to 4). The next section uses the BIAM-contextualisation to compare two alignment approaches, the *essence of operation* approach with the *foundation for execution* approach and propose the use of the interaction model (as part of the *essence of operation* approach) to address some of the deficiencies inherent in the operating model (as part of the *foundation for execution* approach).

8.3 COMPATIBILITY OF TWO ALIGNMENT APPROACHES

The purpose of this section is to compare two alignment approaches, based on their BIAM-contextualisation to motivate compatibility. According to Mingers & Brocklesby (1997) a variety of possibilities exist in combining approaches. According to their classification schema, this study applies approach enhancement, i.e. enhancing an approach (the *foundation for execution* approach) with elements from another (the *essence of operation* approach). Although Mingers & Brocklesby (1997) warn against various problems in combining approaches with different philosophical paradigms, this study does not suggest the parallel/combined implementation of two approaches, but rather an enhancement of a current approach, staying within the single paradigm of the *foundation for execution* approach.

This section further confirms the compatibility of the two approaches by providing a comparison between the approaches in section 8.3.1 provides a comparison of the two alignment approaches. Based on approach compatibility, section 8.3.2 motivates the selection of ontological aspect models as an appropriate process representation language in addressing two of seven requirement categories defined earlier in Chapter 7.

8.3.1 Comparison of two alignment approaches

As illustrated earlier in Figure 62 and Figure 69 both the *foundation for execution approach* and *essence of operation approach* focus on the design of ICT systems within the context of the enterprise as the using system. Similar alignment intent thus provides a starting point for comparison. Table 16 compares the two approaches in terms of the four main BIAM components to highlight differences/similarities.

Table 16: Comparison between two alignment approaches

***Foundation for execution* approach**	***Essence of operation* approach**	**Similarities / Differences**
Paradigm of creating value		
Value is created when enterprises *digitise their operational processes.* Before digitising their processes, managers need to have a vision (future view) of how the company	The paradigm of value creation is that alignment of ICT systems with the enterprise system requires a *design process*, which requires constructional	**SIMILAR** Both approaches states the requirement to decide on / understand the *operation* of the enterprise.

***Foundation for execution* approach**	***Essence of operation* approach**	**Similarities / Differences**
should operate, as articulated in an OM. The OM is used as a guide in the systematic development of the *foundation for execution.*	knowledge of the using system (i.e. the enterprise system) to derive functions for the object system (i.e. the ICT system). The approach reduces complexity of the constructional knowledge of the enterprise, by providing an implementation-independent view of *enterprise operation and construction*, called enterprise ontology, and represented by ontological aspect models (OAMs).	**<u>DIFFERENT</u>** The *foundation for execution* approach requires a *decision* about enterprise operation to guide the development of ICT systems, as articulated in the OM, whereas the *essence of operation* approach provides the *means to understand* the essence of operation and construction.
The dimensions for alignment		
Ross et al. (2006) do not stipulate different *design domains*, *concerns & constraints* or the *enterprise scope* to demarcate the three BIAM dimensions, but they suggest the use of the Zachman Framework. The Zachman framework focuses on two BIAM dimensions, *design domains* and *concerns & constraints*. The *design domains* consist of six interrogatives (what, how, where, who, when, why), whereas *concerns* of six audiences/stakeholders are defined (executives, business management, architects, engineers, technicians, enterprise). The Zachman Framework is used to do architecture work across the third BIAM dimension, *enterprise scope*, across different enterprises.	Dietz (2006) takes a *layered systems* approach to define *design domains.* The heterogeneous enterprise system consists of at least two sub-systems, the *organisation system* and an *ICT system*. The *organisation system* consists of the layered integration of *three aspect systems* In terms of *concerns* the aspect systems distinguish between three different concerns: business, intellect and document. In terms of the BIAM *enterprise scope* dimension, the ontological aspect models are primarily used to design and align across the internal enterprise scope.	**<u>DIFFERENT</u>** Although referring to the Zachman framework, the *foundation for execution* approach is not concerned with the detail of *architecture description*. In contrast, the main contribution of the *essence of operation* approach centres on an *architecture description*, which is based on systems theory. Although both the Zachman approach and *essence of operation* approach intends to create an enterprise ontology, they differ substantially in how they define *design domains*.
Alignment mechanisms and practices		
A key alignment mechanism is the operating model (OM) used to create *guidance* in developing a foundation for execution. The OM purposefully omits strategy as the	The most compact ontological model of an enterprise, is the interaction model (IAM), used to *understand* the essence of operation and construction of an	**<u>DIFFERENT</u>** The OM is primarily *normative* (provides guidance) for creating a foundation for execution, but also *descriptive* (see

***Foundation for execution* approach**	***Essence of operation* approach**	**Similarities / Differences**
driving force for business-IT alignment; however, the OM *becomes the strategy in itself*. Using Zachman's demarcation terminology, the OM emphasises two main *design domains* (data (WHAT: inventory sets) and process (HOW: process flows)), *concerns* of executives, and the objective to share data and replicate processes across different business units within the enterprise boundaries, i.e. *enterprise scope*. Figure 63 (grey-shaded bars) represents the alignment intent of the OM.	enterprise. The IAM does not concern itself with the enterprise mission, but only the means of realising it (Dumay et al., 2005, p. 86). Using Zachman's demarcation terminology for comparison purposes, the IAM contains actors (WHO: responsibility assignments) and transactions (HOW: process flows). Figure 75 (grey-shaded squares) represents the constructional knowledge of the IAM.	descriptive characteristics of the OMs in Figure 64). The IAM is *descriptive* in representing the constructional knowledge of the enterprise. **SIMILAR** The OM and IAM addresses a common descriptive facet: *processes* from a *contextual perspective*.
Alignment approach classifiers		
(1) Version of architecture		
Focus on *future state* architecture, which is also used to define architecture principles.	Focus on *future* state, i.e. conceiving the essence of the organisation system that will realise a new business.	**SIMILAR** Both focus on the *future state* architecture.
(2) Starting point for alignment		
Top-down approach (starting at the executive perspective and emphasizing the executive perspective)	A *top-down* approach is followed in terms of architecture development, i.e. starting at the enterprise as the using system and deriving requirements for the ICT system as the object system.	**SIMILAR** Both follow a *top-down* alignment approach.
(3) Alignment frequency		
Continuous, incremental alignment, building the foundation one project at a time.	Favours a *continuous*, systematic design according to the basic *system design process*.	**SIMILAR** Both favour a *continuous* alignment approach.
(4) Changing/dynamic nature of components		
Aims at reducing architectural complexity by rationalising data and	Aims at reducing architectural complexity by extracting the	

***Foundation for execution* approach**	***Essence of operation* approach**	**Similarities / Differences**
processes according to the OM requirements, thus limiting duplicated efforts in managing the *changing/dynamic nature* of architecture components.	ontological construction of the enterprise (independent of realisation or implementation), "hence reducing the difficulty in understanding enterprises" (Hoogervorst, 2009).	**DIFFERENT** Although both aims at reducing complexity, the *foundation for execution* approach focuses on data and process rationalisation, whereas the *essence of operation* approach reduces the difficulty in understanding enterprises.

Although Table 16 indicates differences between the *foundation for execution* approach and *essence of operation* approach, they could complement one another. The *foundation for execution* approach is primarily normative, focusing on guiding the development of ICT systems, whereas the *essence of operation* approach is primarily descriptive, representing the constructional knowledge of the enterprise. Furthermore, both the OM and IAM addresses a common facet: *processes* from a contextual perspective. The IAM (one of the ontological aspect models represented in Figure 71) may thus also have the potential to address the requirements relating to process representation and replication identification of Table 15 (R5 and R6), which is the topic of the next section.

8.3.2 A proposed process representation language

This section motivates the use of the ontological aspect models, and more specifically the interaction model (IAM), as an appropriate process representation language to address requirements R5 and R6 of Table 15.

In searching for alternative process representation languages, several languages comply with the requirements stated in Table 15 (R5 and R6). Examples include BPMN (Business Process Modelling Notation) (Object Management Group, 2009) and EPCs (Event-driven Process Chains) (Kindler, 2006; Van der Aalst, 1999). However, the OAMs (ontological aspect models) and associated notation standards are favoured. Contrary to other process representation languages, the OAMs represent enterprise operation independent of its realisation and implementation. By abstracting enterprise operation from the material aspects (i.e. excluding forms and files used for communication between participants), the identification of operational similar organising entities (Table 15, R6) is enhanced. In addition, the interaction model incorporates units of logic (transaction types) that are consistent in the detail embodied in the underlying transaction patterns – this characteristic contrasts with other process modelling techniques that are inconsistent in the aggregation of process logic for different levels of detail. The interaction model also encourages the identification of ontological units of competence, authorisation and responsibility, which will also assists the practitioner to compare different business units. Once ontological operational similarities have been established, 'flat' techniques (e.g. flow charts, EPCs, Petri Nets and BPMN diagrams) may be mapped to the ontological models and extended to accommodate variations in implementation at the different organising entities (Dietz, 2006). Configurable process models based on BPMN could for instance be used to accommodate implementation variations between different organising entities (Engelbrecht, 2010; La Rosa & Dumas, 2008).

In verifying the use of ontological aspect models (especially the interaction model) to identify *operational similar organising entities* (Table 15, R6), an experimental evaluation method was suggested and is discussed in the next section. Although the ontological aspect models satisfied the *process representation requirements* (Table 15, R5.1 to 5.3), they had to ensure *ease of understanding* (Table 15, R5.4), especially regarding the use of the interaction model. Table 17 repeats requirement categories R5 and R6 of Table 15 to highlight the need for additional experimentation.

Table 17: Adherence to requirement categories R5 and R6 of Table 15

No	Category	Requirement Detail	Means to address and additional verification required
R5	Process representation	The practices and mechanisms should encourage consistent process representation to ensure re-use. The extent of re-use includes the following: 1. It should be possible to add process measures if required for the purpose of performance measurement and/or process improvement.	Assuming that suitable measures have already been derived, Aveiro, Silva & Tribolet (2011) extend the ontological aspect models to specify measures and associated control limits. The process model (one of the five OAMs) collapses transaction types into process steps. Unfortunately, the ontological nature of the process model hampers performance measurement, i.e. informational and documental levels are aspects that are normally considered during performance measurement (Van Reijswoud & Dietz, 1999). Recent research however extends BPMN models from the ontological aspect models, which would allow for simulation and performance measurement based on the BPMN models (Van Nuffel, Mulder, & Van Kervel, 2009). Process models may also be converted to Petri Net models, which are suitable for process simulation (Dumay et al., 2005, p. 91).
		2. The process representations should support end-to-end views of processes.	The interaction model enhances the end-to-end view of processes via the wholeness of the transaction pattern. Contrary to almost all implementations of enterprises that separate sales from delivery, the interaction model emphasises the indivisible responsibility of taking customer orders, satisfying them and delivering the result (Dietz, 2006, p. 170).
		3. Process representations should not hamper the transition from the third to fourth levels of architecture maturity, i.e. it should allow for modular process design.	Services-oriented architecture (SOA) serves as a vehicle to implement modular process design. The service definition should make enterprise-wide reuse possible. Enterprise process design, based on the identification of transactions (as modelled in the interaction model) must precede the discussion about services. The interaction model is essential for defining the type of services and their

No	Category	Requirement Detail	Means to address and additional verification required
			granularity, their utilisation, performance and support requirements (Hoogervorst, 2009, p. 336).
		4. The representations that are used to communicate process replication opportunities should be understandable to business users (from the contextual and conceptual viewpoints).	**EXPERIMINTATION REQUIRED:** If an interaction model (IAM) is used to communicate process replication opportunities to *business users*, does the IAM enhance *ease of understanding*?
R6	Replication identification	The mechanisms and practices should enable the identification of operational similar organising entities.	**EXPERIMENTATION REQUIRED:** Does the interaction model (IAM) *enable the identification of operational similar organising entities* from a *practitioner's* perspective?

8.4 EVALUATION METHOD

The development and evaluation strategy followed a participative approach. Four research participants (industrial engineers) received extensive training in the use of the interaction model (IAM) and the underlying theory. Each participant was responsible for developing an IAM for a different engineering department at a tertiary education institution. The purpose was to develop an initial IAM for a department (say Department 1) and to verify (establishing the correctness) the contents of the interaction model consecutively at the different departments to identify replication potential.

An initial interaction model was developed by two of the engineers, working in Department 1. The initial interaction model content was based on their own knowledge about the department and analyses of the content available on the shared departmental repository. About twenty seeding transactions were identified during the first verification session. The verification sessions were structured as follows:

1. An introductory presentation was given to the head of department (HOD) on using the interaction model (IAM).
2. One of the participants presented the IAM of Department 1 to the HOD.
3. The HOD suggested changes to the IAM to reflect ontological transactions for his/her own department.
4. Changes (additions/deletions) could also be valid for other departments and were consequently verified separately.
5. The HOD was also requested to provide comments on the usability of the IAM to identify ontological similarity between departments and the *ease of understanding*.
6. Each participant modelled the IAM for their assigned department, using ABACUS (an enterprise architecture software tool).

7. The results (transaction similarity) were analysed using ABACUS.

8.5 INTERACTION MODELS AND EVALUATION RESULTS

The study produced four IAMs for the respective departments; represented by an *actor transaction diagram* and a *transaction result table* (see Figure 72). Each HOD received a copy of their departmental IAM. Figure 76 presents the *actor transaction diagram* of one of the departmental interaction models.

The resulting IAMs demonstrated that the departments provided process replication potential due to their ontological similarity. All departments perform the same forty-five (45) ontological transactions out of a total number of forty-six (46), i.e. only one department does not perform the transaction: "License approval for special materials". Using ABACUS, a visual comparison (a matrix of transactions versus department) was extracted. Manual inspection of the *actor transaction diagrams* exposed differences regarding the initiators of the transactions (unfortunately ABACUS could not be used to highlight initiation differences, which is a limitation of the tool and not the interaction model).

The results concerning the practical use of the interaction models is now discussed from (1) a practitioner's viewpoint (section 8.5.1); and (2) from a business user's viewpoint (section 8.5.2), in addressing the requirement pertaining to *ease of understanding* (Table 15, R5.4).

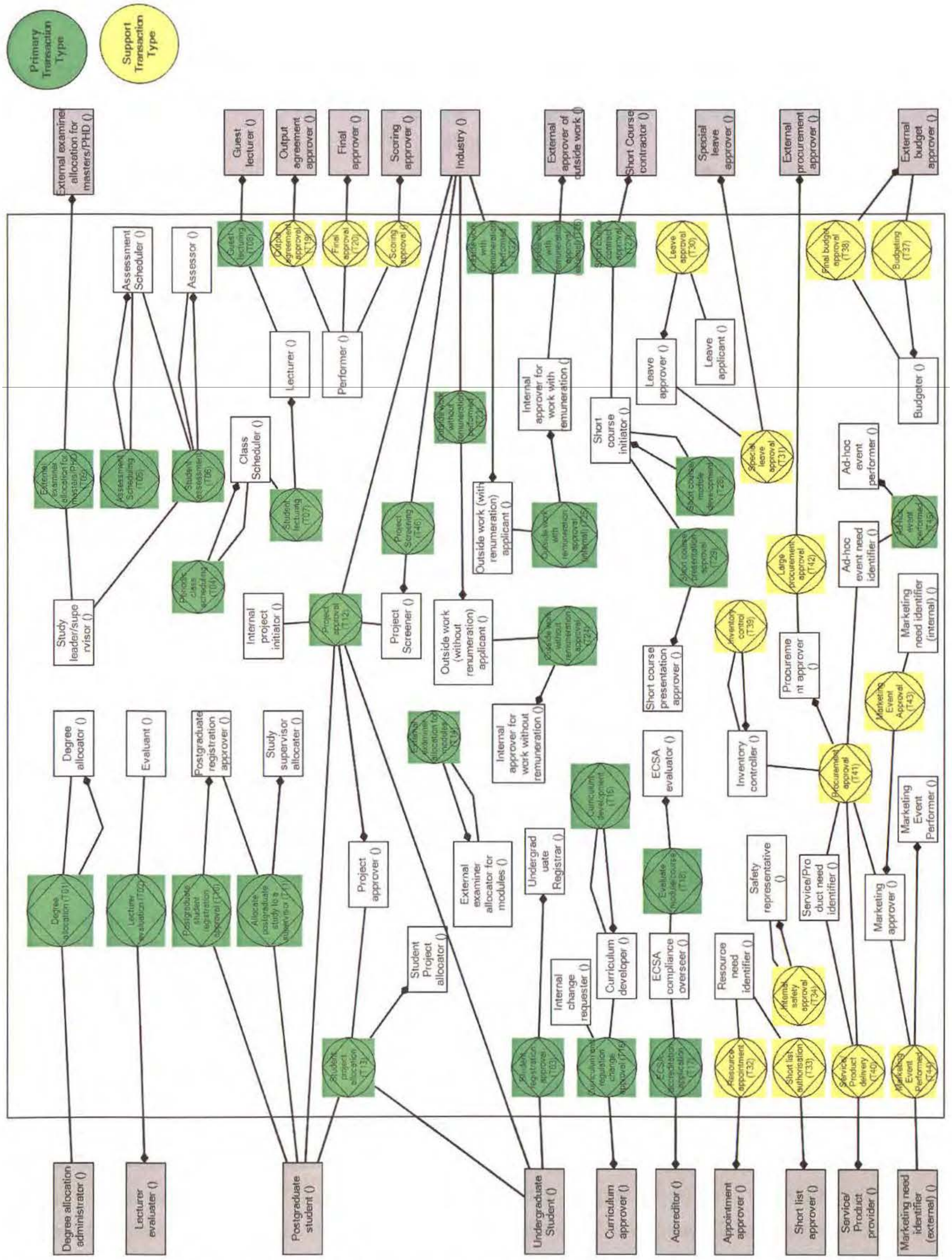

Figure 76: Example of a departmental actor transaction diagram (using the ABACUS software tool)

8.5.1 The practitioner's viewpoint

The feedback provided in this section incorporates the reflections of the four participants as well as the observations of the main researcher during the validation sessions and the discussion sessions that followed. A few deficiencies and/or limitations pertaining to the interaction model have been identified:

1. The participants did not follow a specific order in verifying the content of the actor transaction diagram. This partially contributed to some of the comments made by the HODs that a transaction sequence is required to enhance the use of the actor transaction diagram.
2. Each transaction may only have one executor according to the actor transaction diagram rules specified by Dietz (2006). This posed a problem in the scenario because a transaction (e.g. performance approval) could either be approved by an internal actor (an HOD) or an external actor (the dean of the faculty). The transaction pattern is exactly the same, but the executor differs. One solution is to duplicate the transaction and to assign different executors to the separate transactions. However, the problem is essentially a result of the definition of a boundary; if no boundary existed, one would simply have one executor.
3. All participants (including the HODs) expressed the need to express knowledge about the status of one transaction type as a prerequisite for executing another transaction type. Dietz (2006) accommodates this need by expressing the required access to transaction information per actor via information links. The interaction model is then converted to an interstriction model (one of five ontological aspect models represented in Figure 71).
4. Participants (including the HODs) expressed the need to show optional and conditional initiation and execution links on the actor transaction diagram. In its current format, all initiation and execution links seem to be mandatory. Dietz (2006) accommodates conditional logic only on the next level of detail embodied in the process model (one of five ontological aspect models represented in Figure 71).

8.5.2 The business user's viewpoint

The comments received from the HODs were positive. The training material used during the verification sessions was sufficient to provide the HODs with an understanding of the purpose, use and constructional elements of the interaction model. Questions from HODs regarding sequence and conditional execution of transaction types however emphasised the need to explain the entire set of ontological aspect models in addressing concerns about the interaction model limitations. Three of the four HODs provided additional comments pertaining to the use of the interaction model:

1. HOD 1 expressed the need to extend the analysis effort by analysing the implementation logic for some of the problematic transaction types as to suggest improvements that could be replicated to all departments.

2. HOD 2 highlighted the importance of distinguishing between core transaction types and supporting transaction types (via colour-coding) and emphasised the need to focus on the core transaction types during improvement analyses. This requirement was accommodated with ease (see Figure 76, using green for primary transaction types and yellow for supporting transaction types).
3. HOD 3 expressed the value of an interaction model (and other ontological aspect models) to her own department and their potential to capture knowledge about the operation of the department. Valuable operational knowledge is lost when HODs are replaced every four years. Explication of operational knowledge will contribute towards continuity and customer service.

Although the positive results pertaining to the experimental evaluation substantiates inclusion of the interaction model as part of the *new method, mechanisms and practices* of the PRIF, further development of the PRIF *method, mechanisms and practices*, led to another circumscription process. During circumscription, the awareness was that a *creative process* was required in developing the PRIF *method, mechanisms and practices*, whilst including the interaction model as part of the PRIF *method, mechanisms and practices.* Chapter 9 proceeds with a discussion of the problem pertaining to the development of the PRIF *method, mechanisms and practices*.

8.6 CONCLUSION

This chapter provided a business-IT alignment contextualisation of the *essence of operation* approach, using the BIAM, to compare the *essence of operation* approach with the *foundation for execution* approach. Subsequently, similarities and differences between the two alignment approaches were highlighted, followed by a motivation on selecting the ontological aspect models, and more specifically the interaction model (IAM), as a suitable process representation language. In verifying the use of ontological aspect models (especially the interaction model) within the context of two requirement categories (*replication identification* and *process representation*), an experimental evaluation method was suggested.

The positive results pertaining to the experimental evaluation, substantiates inclusion of the interaction model as part of the new *method, mechanisms and practices* of the PRIF to augment the OM concept in addressing the *replication identification* requirement (Table 15, R6). In addition, the interaction model promoted *ease of understanding* (Table 15, R5.4) from both practitioner and business user viewpoints. Some of the interaction model limitations identified by the participants were due to a limited understanding of the combined use of the ontological aspect models and the purpose or use of each ontological aspect model. The feedback is useful for future research to refine the method for constructing an interaction model and refining the constructs of the interaction model.

Based on the positive evaluation results of the interaction model, the next chapter proceeds with the third development sub-cycle of the PRIF, developing a PRIF *method, mechanisms and practices*, in accordance with the seven requirement categories that were identified in

Chapter 7. However, the development of the PRIF *method, mechanisms and practices*, led to another circumscription process and the awareness of another *problem*. The added *problem* is that a *creative process* was required in developing the PRIF *method, mechanisms and practices*, also including the interaction model as part of the PRIF *method, mechanisms and practices*. Chapter 9 addresses the *problem* pertaining to the development of the PRIF *method, mechanisms and practices*.