# *A PROCESS REUSE IDENTIFICATION FRAMEWORK USING AN ALIGNMENT MODEL*

by

**MARNÉ DE VRIES**

A thesis submitted in partial fulfilment of the requirements for the degree

PHILOSOPHIAE DOCTOR (INDUSTRIAL ENGINEERING)

at the

FACULTY OF ENGINEERING, BUILT ENVIRONMENT, AND INFORMATION TECHNOLOGY

UNIVERSITY OF PRETORIA

SUPERVISOR: Professor VSS Yadavalli

JOINT SUPERVISOR: Professor AJ Van der Merwe

June 2012

*Dedicated to my husband Jaco,*

*whose generous love and support*

*left fond memories*

*about this study*

# ACKNOWLDGEMENT

Sincere appreciation for all my supervisors. Thank you for your guidance, experience and wisdom. You are true mentors.

**Prof. Sarma Yadavalli:** Thank you for your supervision, invaluable support and motivation during this study. Thank you for investing in this thesis and providing me with the opportunity to dedicate my time to this study.

**Prof. Alta Van der Merwe:** Thank you for your excellent guidance and supervision. Thank you for your collaborative spirit, involving me with initiatives within the growing disciplines of enterprise engineering, enterprise architecture and enterprise ontology. You have inspired me to pursue my passion for enterprise design.

**Dr. Aurona Gerber:** Your supervision, ideas, critical reading and perspectives on content presentation were very helpful. Thank you for your time and effort.

**Prof. Paula Kotzé:** Thank you for your supervision, ideas, critical reading and technical care of the document. Thank you for your time and effort in spite of difficult personal circumstances.

**Dr. Jakkie Pretorius** and the **Enterprise Architecture Review Board:** Thank you for allowing me to observe the practical application of enterprise architecture at the University of Pretoria. You have also availed your time and experience to a number of industrial engineering students, which is much appreciated.

For the **University of Pretoria** who motivates and supports the staff to excel in teaching and research.

**Personnel** at the **Department of Industrial and Systems Engineering:** Thank you for your support and encouragement.

**National Research Foundation (NRF):** Thank you for the Thutuka grant that I received from the NRF. The funding made it possible to attend a conference and network with enterprise architecture practitioners.

Special thanks to all the research **participants**.

**Tim O'Neill** and **Avolution:** Thank you for your assistance with the ABACUS software and your willingness to develop templates for the DEMO models. Your professional assistance and rapid response were very helpful.

**Paul Van der Merwe:** Thank you for your initial involvement and the TOGAF participation and learning opportunities that you created.

Thank you to the **Enterprise Architecture Research Forum (EARF) members**. The discussions and ideas still inspire me as a research scholar.

To my father and deceased mother, **Nico** and **Marita**, thank you for the opportunities that you have created for me. Your love and support through the years were priceless.

To my parents-in-law, **Thys** and **Helene**, thank you for your love and support.

To **friends and family**, thank you for your love and interest.

**Marisa** and **Andrio:** thank you for your love and understanding; you deserve my dedicated attention during a fun-filled holiday.

My husband **Jaco**, thank you for reading the entire document. Moreover, thank you for your generous love and support. The discussions we had and late-night coffees while working on this thesis made it a memorable journey. You are an eternal friend.

# ABSTRACT

This thesis explores the potential to unify three *emerging disciplines*: enterprise engineering, enterprise architecture and enterprise ontology. The current fragmentation that exists in literature on enterprise alignment and design constrains the development and growth of the *emerging disciplines*. Enterprises need to use a multi-disciplinary approach when they continuously align, design and re-design the enterprise.

Although enterprises need to be aligned internally (across various enterprise facets), as well as externally (with the environment), most alignment approaches still focus on business-IT alignment, i.e. aligning the business operations with the information and communication technologies and systems of the enterprise. This study focuses on a popular business-IT alignment approach, called the *foundation for execution* approach, and its associated artefact, called the *operating model*. The study acknowledges the theoretical contribution of the *operating model* to establish the required level of business process integration and standardisation at an enterprise in delivering goods and services to customers. Highlighting the practical problems in selecting an *operating model* for an enterprise, and more specifically the practical problems of identifying process reuse potential at an enterprise, a thesis statement is formulated: *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.*

The study is divided into two research questions. The first research question addresses the current fragmentation that exists in the literature, which impairs reuse of the existing business-IT alignment knowledge base. An inductive literature review develops the Business-IT Alignment Model to provide a common contextualisation for current business-IT alignment approaches. The second research question addresses the practical problems of the *operating model* regarding the identification of process reuse potential at an enterprise. Applying the newly developed Business-IT Alignment Model as a contextualisation instrument, the study demonstrates the use of design research in developing the Process Reuse Identification Framework.

The conclusion after the investigation of the two research questions is that the thesis statement was confirmed, i.e. 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 contextualisation is used.

**Key words:** Enterprise engineering, enterprise architecture, enterprise ontology, enterprise design, enterprise alignment, business-IT alignment, operating model, process standardisation, process modelling, reusable process models.

# TABLE OF CONTENTS

# LIST OF FIGURES

# LIST OF TABLES

# ABBREVIATIONS

| | |
|---|---|
| AAEM | Alignment Approach Enhancing Method |
| ABACUS | Architecture Based Analysis of Complex Systems |
| ACMM | Architecture Capability Maturity Model |
| ADL | Architecture description language |
| ADM | Architecture Development Method |
| ARIS | Architecture of Integrated Information Systems |
| BIAF | Business-IT Alignment Framework |
| BIAM | Business-IT Alignment Model |
| BPMN | Business Process Modelling Notation |
| BPM | Business Process Management |
| BPR | Business Process Reengineering |
| CIMOSA | Computer Integrated Manufacturing Open System Architecture |
| CIO | Chief information officer |
| CobiT | Control Objectives for Information and related Technology |
| CORBA | Common Object Request Broker Architecture |
| CRUD | Create, read, update, delete |
| CSIR | Council for Scientific and Industrial Research |
| DCOM | Distributed Component Object Model |
| DEMO | Design and Engineering Methodology for Organisations |
| DODAF | Department of Defence Architecture Framework |
| DSDM | Dynamic Systems Development Methodology |
| DYA | Dynamic Architecture |
| E | Enterprise integrating (as used by Lapalme (2011)) |
| E2AF | Extended Enterprise Architecture Framework |
| EA | Enterprise architecture |

| | |
|---|---|
| EAP | Enterprise Architecture Planning |
| EARF | Enterprise Architecture Research Forum |
| EBA | Enterprise business architecture |
| EDM | Enterprise Design Methodology |
| EE | Enterprise engineering |
| EEMs | Methodologies for enterprise engineering |
| EETs | Enterprise engineering tools |
| EIA | Enterprise information architecture |
| EiE | Enterprise ecological adaptation (as used by Lapalme (2011)) |
| EIT | Enterprise IT architecting (as used by Lapalme (2011)) |
| EMLs | Enterprise modelling languages |
| EMs | Enterprise models |
| EMOs | Enterprise modules |
| EO | Enterprise ontology |
| EOS | Operational system of the enterprise |
| ESA | Enterprise solutions architecture |
| ETA | Enterprise technical architecture |
| e-TOM | Enhanced Telecom Operations Model (see www.tmforum.org) |
| EPCs | Event-driven Process Chains |
| ERP | Enterprise Resource Planning |
| FEA | Federal Enterprise Architecture |
| FEAF | Federal Enterprise Architecture Framework |
| FEAPMO | FEA Program Management Office |
| GAO | General Accountability Office |
| GEAF | Gartner Enterprise Architecture Framework |
| GERA | Generalised Enterprise Reference Architecture |

| | |
|---|---|
| GERAM | Generalised Enterprise Reference Architecture And Methodology |
| GIM | GRAI Integrated Methodology, developed by the GRAI laboratory of the University of Bordeaux (France) |
| HOD | Head of department |
| IAF | Integrated Architecture Framework |
| IAM | Interaction model |
| ICT | Information and communication technologies |
| IDEF | Integrated Definition Language |
| IE | Information Engineering |
| IFAC | International Federation Of Accountants |
| IFIP | International Federation For Information Processing |
| III-RM | Reference Model for Integrated Information Infrastructure |
| IS | Information systems |
| IT | Information technology |
| ITIL | IT Infrastructure Library |
| JAD | Joint Application Development |
| JTA | Joint Technical Architecture |
| OAM | Ontological aspect model |
| OM | Operating model |
| OMB | Office of Management and Budget |
| OMG | Object Management Group |
| PA | Process architecture |
| PERA | Purdue Enterprise Reference Architecture |
| PRIF | Process Reuse Identification Framework |
| QSR | Qualitative systematic review |
| RACI | Responsible, accountable, concerned, informed |

| | |
|---|---|
| RAD | Rapid Application Development |
| RUP | Rational Unified Process |
| SAD | Structured Analysis and Design |
| SAM | Strategic Alignment Maturity |
| SIB | Standards Information Base |
| SOA | Service Oriented Architecture |
| SCOR | Supply Chain Operations Reference |
| TOGAF | The Open Group Architecture Framework |
| TRM | Technical Reference Model |
| UML | Unified Modelling Language |
| VCOR | Value Chain Operations Reference |
| XML | Extensible Markup Language |

# PREFACE

Firstly, this thesis applies active voice, rather than passive voice, as advised by Hofstee (2006) in his book, titled: *Constructing a good dissertation*. In addition, abbreviations are only declared using capital letters, if the original authors used the abbreviation as a name. As an example, the *operating model* has not been named as OM by the original authors (Ross, Weill, & Robertson) of the *operating model.* Yet, OM is used as an abbreviation in this thesis due to its frequency of occurrence.

Secondly, it should be noted that this study already produced a number of articles in journals and conference proceedings prior to the final compilation of this thesis. The articles, published in accredited journals include:

- De Vries, M., & Van Rensburg, A. C. (2009). Evaluating and refining the 'Enterprise Architecture as Strategy' approach and artefacts. *South African Journal of Industrial Engineering, 20*(1), 31-43.
- De Vries, M. (2010). A framework for understanding and comparing enterprise architecture models. *Management Dynamics, 19*(2), 17-29.

Articles, published in conference proceedings include:

- De Vries, M., Van der Merwe, A., Gerber, A., & Kotzé, P. (2010). Refining the operating model concept to enable systematic growth in operating maturity. In C. Schutte (Ed.), *Proc. 24th SAIIE Conference* (pp. 32-46). Glenburn Lodge, Gauteng: SAIIE.
- 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.
- De Vries, M., Van der Merwe, A., Kotzé, P., & Gerber, A. (2011). A method for identifying process reuse opportunities to enhance the operating model. In *IEEE International Conference on Industrial Engineering and Engineering Management (IEEM) 2011* (pp. 1005-1009). Singapore: IEEE.

A compact disk (CD) is included with the thesis that contains the Appendices and the abovementioned articles published during the study.