

***A NEW STRATEGY-ALIGNMENT APPROACH TO EVOLVE  
ENTERPRISE ARCHITECTURES – CASE STUDY AT THE  
UNIVERSITY OF PRETORIA***

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## ***EXECUTIVE SUMMARY***

This document contains a brief explanation concerning the importance of Enterprise Architecture for an organisation. It will also underline the importance of integrating Enterprise Business Architecture with Enterprise Architecture. A lot of research and work has been done at UP regarding this subject. The current status of the Enterprise Architecture at UP will be discussed including a variety of tools, frameworks, modelling languages and artefacts that can contribute to the successful implementation of Enterprise Architecture.

A new approach for Enterprise Architecture (EA) has emerged: Enterprise Architecture as Strategy. This entails the integration of Enterprise Architecture into the strategy planning process of an enterprise by using a selection of three artefacts. This approach will be evaluated by looking at the ease of implementation and the effectiveness of this approach.

Enterprise Architecture has been integrated at the University of Pretoria over the past five years. Currently EA is employed out of an IT perspective rather than an enterprise wide strategy. Some deficiencies have been identified concerning the business strategy alignment approach to define EA objectives. The right selection of EA objectives will contribute to value creation in the organization.

There has also been difficulties identifying a suitable framework, tools, modelling language and artefacts that would help in future strategic decision-making, this will be discussed and recommendations will be made.

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## ABBREVIATIONS

<b>Terminology</b>	<b>Description</b>
<b>ADM</b>	Architectural Development Method
<b>BAWG</b>	Business Architecture Working Group
<b>BPM</b>	Business Process Managing
<b>BPML</b>	Business Process Modelling Language
<b>BPMN</b>	Business Process Modelling Notation
<b>EA</b>	Enterprise Architecture
<b>EBA</b>	Enterprise Business Architecture
<b>ERA</b>	Enterprise Reference Architecture
<b>IDEF</b>	Integrated Definition Models
<b>OCL</b>	Object Constraint Language
<b>ORM</b>	Object Relational Mapping
<b>ROI</b>	Return On Investment
<b>SOA</b>	Systems Orientated Architecture
<b>TOGAF</b>	The Open Group Architecture Framework
<b>UP</b>	University of Pretoria
<b>UML</b>	Unified Modelling Language
<b>UEML</b>	Unified Enterprise Modelling Language
<b>ZF</b>	Zachman Framework

# **1. INTRODUCTION AND BACKGROUND**

## **1.1 THEORETICAL CONTEXT**

### **1.1.1 Enterprise Architecture**

Enterprise Architecture (EA) is a powerful management tool that can be used to align a company's strategic objectives, future goals, strategies etc. with business and technology initiatives throughout the company.

There are several good definitions of Enterprise Architecture (EA).

- Enterprise Architecture is like blue prints, drawings or models. (Spewak and Hill,1999)
- Enterprise Architecture refers to an organized set of elements with clear relationships to one another, which together form a whole defined by its finality. (Vernadat,1996)
- Enterprise Architecture is a master plan which acts as an integrating force between aspects of business planning such as goals, visions, strategies and governance principles (Stevenson, 2007).

EA contains the following domains: Business Architecture, Data Architecture, Application Architecture and Technology Architecture. It is about bringing together all of these different forms of architectures and different parts of the organization to create a holistic view of the enterprise.

When introducing EA to a company, an EA framework needs to be selected. This will then provide the strategic context/guidelines for all operations. A framework is useful in identifying and categorising the parts of the architecture.

Different enterprises/companies will focus on different key elements of EA but in the end, the focus is to create better business performance.

Many triggers exist that would initiate the implementation of EA. According to Stuart McGregor (MD of Real IRM) the following are typical triggers:

- Regulatory compliance issues such as Sarbanes-Oxley, King II, Basel II, FICA and IAS 2005. Each of these drives an enormous amount of organisational and system change.
- Government-driven regulations, such as safety, health, environment and quality, which introduce deep and enduring systemic change, along with complex, non-negotiable checks and balances.
- Mergers and acquisition, which result in a need to bring two or more business models together.
- Major system implementation. This refers to initiatives such as ERP, business intelligence or business performance management, or major system conversion (main frame to open systems or downsizing).

### **1.1.2 New Approach towards Value-creation**

By implementing Enterprise Architecture in a company, many benefits can be achieved. Lately, there has been a shift in focus towards EA value-creation in terms of strategy (Ross, Weill & Robertson, 2006). By integrating EA in strategy planning, enterprise optimization can be accomplished through standardization and process integration. EA as strategy aligns the business strategy and vision ensuring ultimate improved business performance.

Some of the benefits of this approach include:

- Reduced IT cost - Because of more shared IT capability (shared data, technical infrastructure and enterprise systems) maintenance cost will decrease. It will be easier and faster to update the system and it will also be easier to expand the current system (Ross *et al*, 2006:93).
- Increased IT responsiveness - In a standardized environment less time is spent on making technological choices and more time is spent preparing and repairing technical problems. The responsiveness of the system to change is quicker because most of the processes are standardized and integrated (Ross *et al*, 2006:96).
- Improved risk management - By having a more manageable IT environment, a business will have reduced the risk of security



breaches. More reliable, up to date and consistent data will be available for users and this will enable better decision-making (Ross *et al*, 2006:96).

- Increased management satisfaction (Ross *et al*, 2006:98).
- Better operational excellence - More predictable and reliable operations at lower cost (Whittle & Myrick, 2004; Ross *et al*, 2006:100).
- Better customer service - Quick response time, better knowledge of the customer's needs and wants (Ross *et al*, 2006:100).
- More strategic agility – The ability to respond faster to market changes (Ross *et al*, 2006:100).
- It could identify possible problem areas in the business or operations – Identifying any operations that don't align with the business strategy and vision, these operations can then be eliminated or re-engineered.
- Increased return on investment - Lower IT and maintenance costs, increased productivity

Past EA efforts attempted to demonstrate EA value in terms of IT cost reductions only. They focused on efficiency rather than effectiveness, numerous frameworks, methodologies and tools emerged. These efforts could however not demonstrate sufficient ROI, only a sub-set of benefits could be realised when this approach was followed.

### **1.1.3 Research Problem and Rationale**

Previous research highlighted the requirement for defining EA objectives that support the strategy of the organisation. A new approach by Ross *et al* (2006) was defined to assist the management team in selecting EA objectives that would contribute to value-creation in the organisation.

The approach was validated and some deficiencies were discovered. The operating model, for instance, required knowledge about product/market diversity, international diversity, current organisation structures (level of centralisation/decentralisation), as well as the identification of core

operations – those that would require standardisation / integration. Most of these knowledge artefacts describe the current Enterprise Business Architecture (EBA) of the organisation and may not be available in an explicit format. The researcher re-visited the operating model identifiers (see Table 1) and realised that the required knowledge could be acquired by obtaining / analysing EBA artefacts. These artefacts mainly address the first logical level of the Zachman framework.

<b>Operating model characteristic</b>	<b>Business architecture artefact</b>
Customers, products, supplier's characteristics.	Markets, main customers, main suppliers per business unit.
Impact on other business unit transactions.	Process links (inputs/outputs) to external entities (customers, suppliers, vendors) and process links between business units (inputs/outputs).
Operationally unique business units or functions versus similar business units.	End-to-end processes. Organisation structure. Mapping of current organisation structure to end-to-end processes.
Autonomous business management of business units versus centralised management of business processes.	Mapping of process owners to value chains.
Shared data (customer / supplier / product) vs. locally owned data.	Entity / organisation structure matrix. <i>Technology architecture artefact:</i> databases.
IT services and IT decision-making.	IT processes. Organisation structure. Mapping of current organisation structure to IT processes.

**Table 1: Business architecture artefacts**

In addition to the deficiencies of the new approach, the researchers (De Vries & Van Rensburg, 2007) also realised that the proposed approach mainly addressed *large organisations* with conglomerate organisation structures. The aim was to find process standardisation and integration

opportunities across organisational units. Small organisations would gain little value from EA if EA objectives were only defined in terms of process standardisation and integration. Even though small organisations may not require consolidation and integration of current processes to add value, they still need to design their architectures to enable future growth of their business and information systems. Any organisation (irrespective of its size) could use EBA on a high level and mid level to:

- Understand the current enterprise model to assist in strategic decision-making (including EA strategic choices with regards to process standardisation and integration for larger organisations); and
- Enable evolution / reinvention towards a future-state EBA that supports the strategic decisions.

The EBA (high level and mid level designs) could also be used as a blueprint /point of departure in developing more detailed-level architectures for process redesign, process improvement, and business requirements definition (use cases and workflows) for software development or packaged software configuration.

Figure 1: Explains the old and the new approach towards EA. The old approach focused on EA out of an IT perspective while the new approach focuses in applying EA in the whole organization. In the new approach EA is used to guide strategic decisions and through this adds value to the organization.

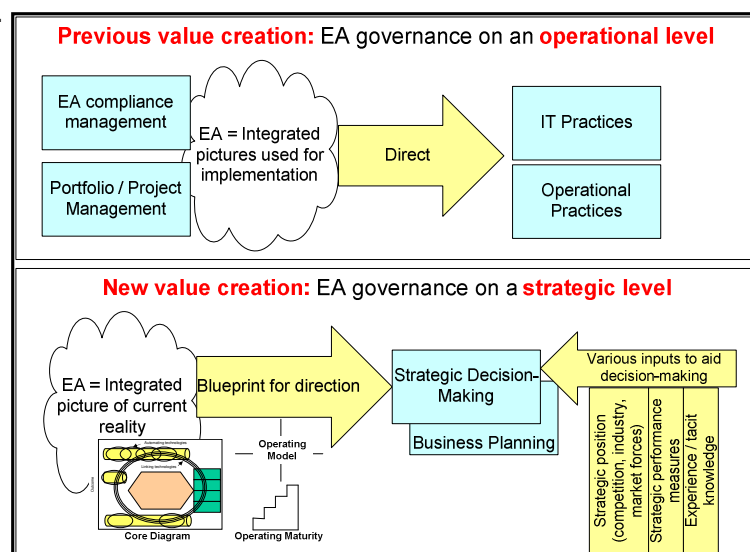


Figure 1: Previous value creation proposition vs. new value creation proposition

#### **1.1.4 Research Objectives – Theoretical Context**

This follow-up research will be used to address deficiencies in the “EA as Strategy” approach defined by Ross *et al.*

A case study will be performed at the University of Pretoria to demonstrate the adapted approach and to model the baseline enterprise business architectures that are linked to the core processes of the University. A suitable tool will be selected to demonstrate and model how Business Architecture building blocks can be used to help in future strategic decision-making, thus adding value to the organization.

### **1.2 ORGANISATION CONTEXT - UP**

The University Of Pretoria (UP) was established in 1908. Since then it has grown to be one of the best-known university's in South Africa. Four campuses, two satellite campuses and a sporting facility are located in Pretoria and the surrounding area. Today the UP offers 18 000 different study programmes.

UP is the largest residential university in South Africa and the leading research university.

The UP's strategic plan is aimed at positioning the University of Pretoria at the top of the academic pyramid in South Africa. The strategic plan is based on eight strategic thrusts, namely:

1. Academic excellence.
2. A people-centred University.
3. Excellence in the University's core functions.
4. Excellence in the University's support services.
5. Local impact.
6. Transformation.

7. Interfaces.

8. Sustainability.

The vision and mission statement of UP centres around being recognized nationally and internationally for academic excellence, quality education and groundbreaking research.

On a corporate level, the UP has three core business processes:

- Learning and Teaching.
- Research.
- Community Engagement.

For each of the named processes the service/product, key customer and key suppliers are summarized in Table 2.

Business Process	Product/Service	Key customers	Key Suppliers
Teaching	Graduates	Industry, students	Schools, industry
Research	Solution, research	Research community, government	Industry, research community
Community engagement	Skills, service	Community	Industry, students

**Table 2: Key business processes, customers and suppliers.**

The University Of Pretoria (UP) can be divided into a number of strategic business units, namely the nine different faculties and support services. Until recently, the UP has been using a functional organizational structure, thus faculties and support services were run in their own unique way.

The trigger for implementing EA at UP is major system implementation. EA is though not being implemented as part of the strategy but rather out of an IT perspective. Currently the UP is focussing on establishing a centralized database and standardization of processes through the implementation of COTS systems.

### **1.2.1 The operating environment at UP**

Like many other universities in South Africa and the rest of the world, UP has been faced with many rapid changes in the environment. This can be attributed to:

- International mobility – Students can study in any country and at any university of their choice.
- Rapid technological advancement lessens the restrictions caused by distance, this also causes a wider variety of influences and easier access to information.
- Academic institutes in the same region are becoming more dependent on each other by sharing high cost facilities, infrastructure and knowledge.
- The industry puts more pressure on academic institutes to deliver more and better trained professionals.
- Increased need internationally for new applied knowledge in all sectors.

In South Africa, academic institutes are placed under immense financial pressure, this results in institutes having to spend less and prioritizing their needs. In the last few years, more previously disadvantaged students have had the opportunity to study. Universities today are a playground for different cultures, languages and diversity. A bigger emphasis exists on community engagement with universities and other academic institutes taking part in initiatives to uplift the community.

### **1.2.2 The University of Pretoria's Management Model**

The University Of Pretoria (UP) has a single corporate office and two main business units namely:

- 1) The Academic Enterprise which consists of the different faculties and
- 2) The Support Services with departments like administration, finances...etc.

Development of a new Management Model for the UP was started in 2006. This arose due to concerns from various stakeholders and the need to redesign institutional structures to achieve and support UP objectives as well as the core business processes (Research, Learning & Teaching and Community Engagement).

The old Hybrid Management Model was terminated in mid 2007, making way for the new improved Matrix Management Model (please refer to Figure 2 for visual representation). This new model entails that three Vice-Principals will have cross-cutting responsibilities for the portfolios of, Research and Postgraduate studies, Undergraduate Learning and Teaching, and Community Engagement (UP Management Model, 2007) across all faculties and support services.

This means that Vice-Principals no longer have responsibilities for faculties as a whole but only for their cross-cutting responsibilities. One of the big changes in the new management model is the direct line function to matrix reporting. In the new model, the Deans will now deal with three Vice-Principals instead of one.

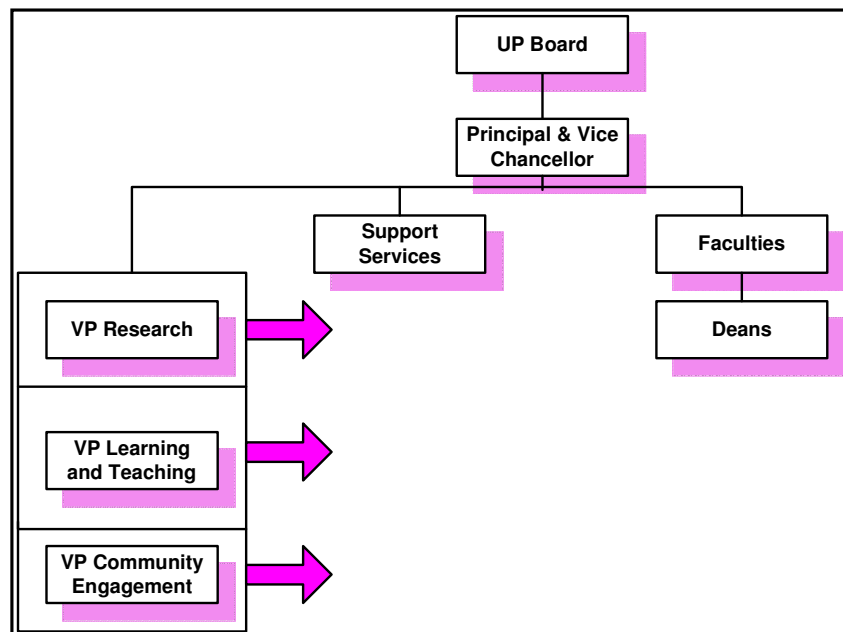


Figure 2: Organizational Structure of the University of Pretoria

Each faculty and support service have to supply management with a plan, this plan will entail how they implement the three core business processes within their department. These plans must include strategic objectives, missions and actions concerning the three core processes that must align and support the UP's strategic objectives and mission and vision.

For University (UP), that previously operated following the silo approach and hierarchical culture, a big change like this holds many risks. That is why many modifications will have to be made to support operations and current architecture to help with the successful implementation of the new management model.

### **1.2.3 System Renewals Project**

The University of Pretoria is currently focussed on an initiative called The Systems Renewals Project. This project was launched in 2005 and is scheduled for completion in 2010.

The Systems Renewals Project's aim is to replace the current applications used at UP with a completely new portfolio of applications and aspects of the underlying ICT architecture. By doing this, the following outcomes are expected:

- Long-term Risk Minimization.
- Increased Efficiency and Effectiveness.
- Improved Services.
- Increase System's Agility and Manageability.
- Less Legacy System maintenance.

With the implementation of the System Renewals project, a variety of applications has been purchased to update the current software. After much consideration an acquisition was made from Oracle, various suites of software were purchased to support business operations. These include:

- Oracle's PeopleSoft offering.



- Oracle's Business Intelligence offering.
- Oracle's Enterprise Content Management offering and
- Oracle's "Fusion" Middle ware offering.

Please refer to Appendix B for a full list of all applications and tools acquired.

According to UP Management, The Systems Renewal Project also supports the New Management Model in the following ways:

- Tools and functionality supportive of current Management Model vision and the Shared Services model.
- Workflow processes can entrench desired business processes.
- Approval routings, Signing Limits, etc.
- Self-Service functionality empowers end-users.
- Business Intelligence capabilities provide potential for greater business insight and management of business against performance metrics.
- Enterprise Content Management supports coherent approach to 'unstructured' data and provides powerful tools for managing documents, records & web content.
- Portals/WebCentre tools facilitate aggregation of data for easy access to configurable portlets and provide mechanisms for collaboration and Web 2.0 functionality.

The aim of the Systems Renewals Project is to help with alignment between the different departments within the university, data, and technology to support UP objectives and goals. Standardization and increased integration of processes and data are one of the intended outcomes of this project.

#### 1.2.4 Problem Context at UP

As previously mentioned, one of the initiatives UP is focussing on, is the Systems Renewal Project. EA is being used to direct IT practices during the execution of this project. This however does not create an understanding of creating a vision for transforming the University in terms of all four components (Business, Data, Application, and Technology).

Although many individuals are actively involved in this project, there is a low awareness of what exactly the project entails through the rest of the enterprise and the role of EA in the enterprise.

EA will create more value in the business if it was used throughout the organization. Putting more focus on using EA as a strategy rather than using it purely out of an IT point of view, will help with future strategic decision-making and thus add more value to the organization.

Modelling is not really done and few artefacts are accessible. Artefacts are created using different tools which makes artefact integration cumbersome and difficult.

A new management model was introduced at UP. Currently there are many different opinions about the new model and the main problem seems to be the assignment of responsibility in the new organizational structure.

A strategic framework doesn't exist at UP that can be used by management to make strategic decisions. The IT department has developed their own framework, but this cannot be used through out the whole organization. Management is also in need of BA artefacts that describe the basic building blocks and which would support strategic decision-making.

### 1.2.5 Project Objectives (UP context)

The main objectives of this project include:

- Identifying artefacts needed to obtain a clearer picture of the business and describe the high-level building blocks.
- Do research in what artefacts are currently available at UP and their importance to the organization.
- Define tools and techniques to be used to describe the BA building blocks in support of strategic decision-making.
- Define the process (combined with methods and tools) required in establishing BA building blocks and the expected outputs that would support strategic decision-making.
- Partially validate the process by demonstrating how some of the BA building blocks could be used at UP to support strategic decision-making.

## **2. LITERATURE STUDY**

### **Chapter Introduction**

A literature study was done to identify possible frameworks, tools and languages that could be used to implement EA at UP.

The Zachman framework (2.1.1) and TOGAF ADM (2.1.2) are discussed as well as the current framework being used at the UP (2.1.3). The strengths and weaknesses of the frameworks are identified and discussed in the following sections.

As mentioned previously a new approach towards EA has emerged, 'EA as strategy', (Ross *et al*, 2006). This new approach is discussed in section 2.2 and the deficiencies of this new approach are examined in detail in section 2.4.

As a result of the deficiencies that exist with the new approach, a number of artefacts (2.7) were identified that could solve this problem. These artefacts originate mainly out of the Business Architecture (section 2.5) of an enterprise. Strategy Management (2.3) is also discussed and the relationship between Business Architecture and Strategy Management is discussed in 2.5.1.

Many tools and languages exist that can be used in the different architectural domains. These are discussed en section 2.6 and 2.8.

### **2.1 ENTERPRISE ARCHITECTURE**

Enterprise Architecture was already defined in the previous section. As mentioned, many EA frameworks exist to help with the implementation and design of EA in an organization. An EA framework is a tool that helps with the development of different architectures. It should describe a method to design an information system or architectures in terms of which building blocks are needed and how they fit together. As there are so many different frameworks, no industry standard exists for developing EA.

## 2.1.1 Zachman Framework

The best-known EA framework is the Zachman framework (ZF). This framework was designed by J.A Zachman in 1987 and is also known as the first EA framework.

Zachman framework is the theory that certain models or artefacts exist that can help describe, design and build complex objects (Zachman, 2006). Please refer to Figure 3 for Zachman framework. The ZF consists of various models that are used to answer the six fundamental questions (what, how, where, who when and why) based on the stakeholders involved (planner, owner, designer, builder and sub-contractor).










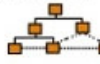


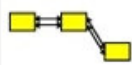
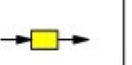
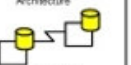
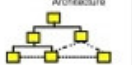





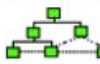








	DATA <i>What</i>	FUNCTION <i>How</i>	NETWORK <i>Where</i>	PEOPLE <i>Who</i>	TIME <i>When</i>	MOTIVATION <i>Why</i>	
SCOPE (CONTEXT)	List of Things Important to the Business 	List of Processes the Business Performs 	List of Locations in which the Business Operates 	List of Organizations Important to the Business 	List of Events/Cycles Significant to the Business 	List of Business Goals/Strategies 	SCOPE (CONTEXT)
<i>Planner</i>	ENTITY = Class of Business Thing	Process = Class of Business Process	Node = Major Business Location	People = Major Organization Unit	Time = Major Business Event/Cycle	Ends/Means = Major Business Goal/Strategy	Strategic
BUSINESS MODEL (CONCEPTS)	e.g. Semantic Model 	e.g. Business Process Model 	e.g. Business Logistics System 	e.g. Work Flow Model 	e.g. Master Schedule 	e.g. Business Plan 	BUSINESS MODEL (CONCEPTS)
<i>Owner</i>	Ent = Business Entity Rel = Business Relationship	Proc. = Business Process IO = Business Resources	Node = Business Location Link = Business Linkage	People = Organization Unit Work = Work Product	Time = Business Event Cycle = Business Cycle	End = Business Objective Means = Business Strategy	Executive Leadership
SYSTEM MODEL (LOGIC)	e.g. Logical Data Model 	e.g. Application Architecture 	e.g. Distributed System Architecture 	e.g. Human Interface Architecture 	e.g. Processing Structure 	e.g. Business Rule Model 	SYSTEM MODEL (LOGIC)
<i>Designer</i>	Ent = Data Entity Rel = Data Relationship	Proc. = Application Function IO = User Views	Node = IS Function (Processor, Storage, etc) Link = Line Characteristics	People = Role Work = Deliverable	Time = System Event Cycle = Processing Cycle	End = Structural Assertion Means = Action Assertion	Architects
TECHNOLOGY MODEL (PHYSICS)	e.g. Physical Data Model 	e.g. System Design 	e.g. Technology Architecture 	e.g. Presentation Architecture 	e.g. Control Structure 	e.g. Rule Design 	TECHNOLOGY MODEL (PHYSICS)
<i>Builder</i>	Ent = Segment/Table/etc. Rel = Pointer/Key/etc.	Proc. = Computer Function IO = Data Elements/Sets	Node = Hardware/Systems Software Link = Line Specifications	People = User Work = Screen Format	Time = Execute Cycle = Component Cycle	End = Condition Means = Action	Engineers
DETAILED REPRESENTATIONS (OUT-OF-CONTEXT)	e.g. Data Definition 	e.g. Program 	e.g. Network Architecture 	e.g. Security Architecture 	e.g. Timing Definition 	e.g. Rule Specification 	DETAILED REPRESENTATIONS (OUT-OF-CONTEXT)
<i>Sub-Contractor</i>	Ent = Field Rel = Address	Proc. = Language Statement IO = Control Block	Node = Address Link = Protocol	People = Identity Work = Job	Time = Interrupt Cycle = Machine Cycle	End = Sub-condition Means = Step	Implementors
FUNCTIONING ENTERPRISE	e.g. DATA	e.g. FUNCTION	e.g. NETWORK	e.g. ORGANIZATION	e.g. SCHEDULE	e.g. STRATEGY	FUNCTIONING ENTERPRISE

Figure 3: Zachman Framework (Zachman, 2007)

The different cells in the framework are populated by different models/artefacts with each communicating different parts of the enterprise.

The ZF is used by many organizations and are well accepted within the business community. Other strengths of the ZF include that this framework defines all the perspectives that an organizations needs to consider and also take all the stakeholders into consideration. ZF is also supported by many

architecture tools. As with every framework the ZF also have some weaknesses. Some of these include that a lot of different models are needed and this could cause a documentation heavy approach which in turn would cause a process heavy approach to documentation. ZF also doesn't explain the significance of the models and the interaction between the models. No step-by-step directions are given on how these models are supposed to help you implement EA in the organization. There is also no general methodology that can be applied to the whole framework.

### **2.1.2 The Open Group Architecture Framework (TOGAF)**

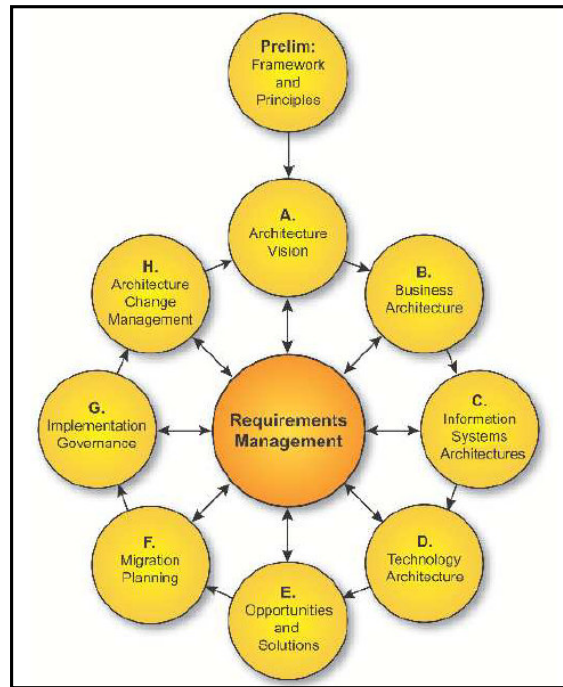
The Open Group Architecture Framework (TOGAF) is another well-known approach/framework that can be used in the development/implementation of EA. TOGAF is industry independent and it can be used by various organizations across any industry. One of the advantages of TOGAF is that it can be integrated with other frameworks. TOGAF addresses the following domains of EA:

- Business Architecture (which includes Information Architecture)
- Application Architecture
- Data Architecture
- Technology Architecture

At the centre of TOGAF is the Architecture Development Method (ADM). Please refer to Figure 4 for the TOGAF ADM cycle. Every bubble in Figure 4 is a phase which in turn is again divided into steps.

In the preliminary phase the organization must define architectural principles, scope and objectives. These will then determine the level of effort required for architecture work.

The Architecture Vision Phase provides guidelines on how you need to plan to achieve the required EA objectives. This includes ensuring all existing principle definitions are current and valid and are understood by the stakeholders involved in the project.



**Figure 4: TOGAF Architectural Development Cycle (TOGAF, 2007)**

Phase B (Business Architecture) is a prerequisite to the following architecture phases. It is important to demonstrate the value of the subsequent architecture work that will be done.

Phase C and D describe the relevant domains. What is currently used, what is needed in the future etc.

The opportunities and solution phase concerns the development of an overall implementation and migration strategy and a detailed implementation plan. Phase F prioritizes all these different implementation plans and detailed migration plan is done.

All these changes and projects need to be governed, that is Phase G. Recommendations need to be formulated for each implementation project and the necessary governance needs to be applied to each project. This is where all the information of all the different architectures comes together.

Phase H is concerned with implementing procedures to manage the changes in all the different architectures. Changes in the business environment need to be monitored.

TOGAF also contains a repository of architectural data that can aid the development of architectures as well as *Resource Base* that contains guidelines and templates for the use of ADM. The TOGAF ADM is a generic model that must be modified and adapted by each organization to suit their specific needs.

Some of the strengths of this framework includes: provided a generic and flexible methodology for EA development, and can be adapted with any other framework. It is considered the industry standard and it's a step-by-step approach.

Of course, TOGAF ADM also has some weaknesses: a very strict order of processes is required and no high level building blocks on strategic level exist. Very little to no artefacts are available on strategic positioning and strategic choices.

### **2.1.3 The framework currently in use at the University of Pretoria**

As EA is not yet being implemented as part of the strategy, no specific framework is in use for EA implementation. EA is at present being implemented purely out of an IT perspective. A framework has been introduced by the IT department called "IT Strategy" which defines the methodology used in creation of the IT strategy. The visual representation of the framework is a pyramid that illustrates all the different components of the strategy.

Three main pillars support the IT strategy:

- Enterprise Architecture.
- An IT governance structure.
- An information technology plan.

The UP's EA consists of four main components which covers the spectrum for Business Architecture, Information Architecture, Technology Architecture and Solutions Architecture. The different architecture principles are used to express the different architectures and guide IT decision-making, technology selection and implementation (Pretorius, 2005).



The framework implemented at the IT department is a good framework, but it is not applicable to the rest of the organization. The UP is in need of a framework that can be implemented through out the whole organization and support all facets of the organization.

## 2.2 “EA AS STRATEGY” APPROACH

As previously mentioned there has lately been a shift in focus towards EA value-creation in terms of strategy. By integrating EA in strategy planning, enterprise optimization can be accomplished through standardization and process integration. It also aids in strategic decision making by aligning the business strategy and vision thus ensuring ultimate improved business performance.

According to Ross *et al* (2006:8, 9), EA can be used as part of the strategy of the organization. They suggest that the following three artefacts should be the starting point for successfully implementing EA to support an organization’s strategy. Ross *et al* explains the artefacts as follows:

- 1) Operating Model – Please refer to Figure 5. The operating model describes the integration and standardization of processes in the business. Four types of operating models exist: coordination model, unification model, diversification model and replication model.

Business process integration	High	<b>Coordination</b> <ul style="list-style-type: none"> <li>Shared customers, products, or suppliers</li> <li>Impact on other business unit transactions</li> <li>Operationally unique business units or functions</li> <li>Autonomous business management</li> <li>Business unit control over business process design</li> <li>Shared customer/supplier/product data</li> <li>Consensus processes for designing IT infrastructure services; IT application decisions made in business unit</li> </ul>	<b>Unification</b> <ul style="list-style-type: none"> <li>Customers and suppliers may be local or global</li> <li>Globally integrated business processes often with support of enterprise systems</li> <li>Business units with similar or overlapping operations</li> <li>Centralised management often applying functional process/business unit matrices</li> <li>High-level process owners design standardised processes</li> <li>Centrally mandated databases</li> <li>IT decisions made centrally</li> </ul>
	Low	<b>Diversification</b> <ul style="list-style-type: none"> <li>Few, if any, shared customers or suppliers</li> <li>Independent transactions</li> <li>Operationally unique business units</li> <li>Autonomous business management</li> <li>Business unit control over business process design</li> <li>Few data standards across business units</li> <li>Most IT decisions made within business units</li> </ul>	<b>Replication</b> <ul style="list-style-type: none"> <li>Few, if any, shared customers</li> <li>Independent transactions aggregated at a high level</li> <li>Operationally similar business units</li> <li>Autonomous business unit leaders with limited discretion over processes</li> <li>Centralised (or federal) control over business process design</li> <li>Standardised data definitions but data locally owned with some aggregation at corporate</li> <li>Centrally mandated IT services</li> </ul>
		Low	High
		Business process standardisation	

Figure 5: Characteristics of the four operating models (Ross *et al*, 2006:29)

The four different quadrants all have different characteristics depending on the level of standardization and integration in the organization. The operating model chosen will have a big impact on future decisions concerning design, role of IT and the management of the business. The idea of an operating model is to give the organization a vision of how to execute strategies. When an organization has decided what operating model they currently follow, they can decide what future model they would like to be and what needs to happen in the business to achieve that.

- 2) Core Diagram – The core diagram is a one page visual representation of the core processes, data and technologies that enables the successful operation of the business. The elements of the core diagram are specific to each operating model, thus an operating model must first be decided on before a core diagram can be drawn up. The core diagram will enable the identification of core processes, data and technologies and the relationship between these elements.
- 3) Operating Maturity Model - This is a description of how the different business units operates compared to the whole organization. Architectural maturity is a measure of the shared infrastructure, local applications, relative IT investments and the enterprise system. Basically an organization must build a foundation for execution. Four stages of architectural maturity exist:
  - Business Silos Architecture – Minimal business integration and standardization occurs. The different business units, function separately from each other and support different business applications. Very little data is shared and specific IT functionality is required by different business units.
  - Standardized Technology – More shared data and infrastructure between business units occur. Standardization of hardware and technology is the main characteristic of this stage. Organizations also tend to reduce the number of software applications that

perform similar functions. This stage usually delivers significant cost savings to the organizations.

- Optimized Core – Standardization of business processes and IT applications and the elimination of redundant data come about in this stage. The optimization of data and business processes or both depends on the operating model that the business wants to follow. This stage is more challenging than the previous. Optimizing the core operations and data enables quicker integration of new products/services, facilitate innovation and aids in the smooth running of day-to-day operation.
- Business Modularity – Stage four enables strategic agility through customized or reusable modules. Very few organizations accomplish the successful implementation of this stage. In this stage, the processes that were digitized in the previous stage are refined and modularized.

## **2.3 STRATEGY MANAGEMENT**

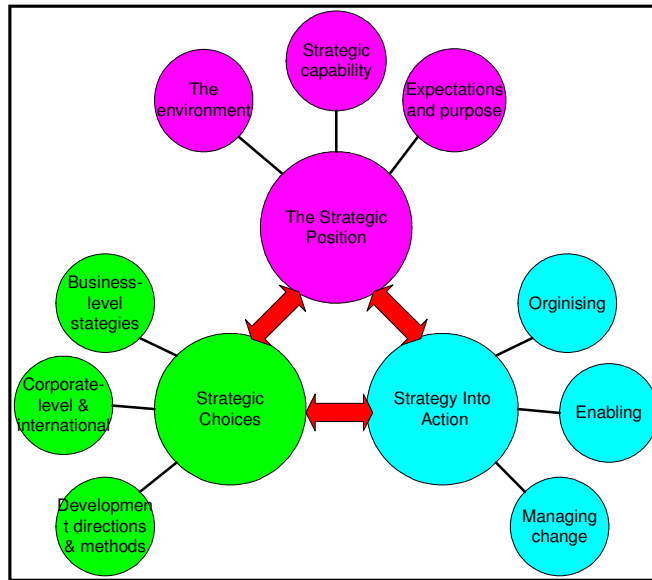
Strategic management is the management and adaptation of the business strategy during the changes in the operating environment. Strategic management involves the entire business and the integration of the different parts/departments to form a whole.

### **2.3.1 Strategy Management Components**

Strategy management consists of three core components (please refer to Figure 6):

- Strategic position – The position and performance of the organization compared to their competitors in their specific environment. It must be taken into account that the environment which an organization operates in continuously changes. This could either be a threat to an organization or could be to their advantage. Strategic positioning is about the impact of change in the environment and the impact that different stakeholders have on the strategy. Strategic capabilities must also be taken into account: What resources are available and will be needed in the future, what is the current capability and what future capabilities must be prepared for. The strategic plan is a very important artefact that can be used to determine the expectations and purpose of the business.
- Strategic choices – As the environment changes, the organization will also constantly modify their objectives and goals to accommodate the changes. The strategic position of the organization will directly influence the strategic choices that need to be made.

For an organization to stay competitive and profitable, goals have to be adapted at certain stages of development. The Operating Model, Core diagram and Operating Maturity Assessment (all discussed in the previous section) is supposed to help an organization with its strategic choices. What technologies to use, applications, the degree of integration and standardization of data and processes are only some of the decisions that need to be made.



**Figure 6: Elements of Strategic management (Johnson, Scholes, Whittington, 2005:16)**

- Strategy into action – Implementing new strategies and adapting to new environments. The strategic choices now need to be implemented, organized and managed.

Two of the three components mentioned (strategic position and strategic choices) will be used to develop the three artefacts mentioned by Ross *et al.* The modelled artefacts should then be used in combination to influence the direction of the future strategic choices and the subsequent strategic objectives (Van Rensberg, De Vries, 2008).

Strategy management is a continuous process that will span over the entire life of the business. As the business environment changes, certain modifications will have to be made to the strategy, objectives and expectations. In order for an organization to retain competitive advantage, it will have to reinvent itself from time to time and continuously monitor its progress and growth.

## 2.4 DEFICIENCIES OF THE “EA AS STRATEGY” APPROACH

Previous research has been done (De Vries, Van Rensburg, 2007) and some deficiencies have been identified with the new approach by Ross *et al* (2006). Action research was done on a group of post-graduate students that had to apply the approach at a company of their choice. They then had to validate the practicality of certain artefacts proposed in the “EA as strategy” approach.

Feedback received from the students indicated that the approach and artefacts, if used correctly, did add value to the organization, but the following problems were identified with the approach:

- EA awareness – When implementing EA at an organization, there must be an understanding of what exactly EA means. Individuals have different ideas of what EA consists of and the meaning of EA. This causes confusion of what exactly needs to happen and what the objectives are.
- Difficulties in defining an operating model - Four operating models were identified by Ross *et al* (2006:29). Students had difficulty in identifying one single operating model which suited their organization. It was determined that a thorough understanding was needed of the architecture of the whole organization before an operating model could be chosen.
- Difficulties in compiling a core diagram – The core diagram is a visual representation of only the core processes, data, information and key customers. Difficulty arose when students had to identify these core objects.

A weakness of Ross *et al* (2006) approach is that it fails to give clear directions of how to establish the degree of integration and standardization of processes, data etc. of a business.

From the above discussion, it is also clear that more information about an organization is needed before an Operating model, Core diagram and Maturity Assessment can be done. Ross *et al* (2006) doesn't identify the

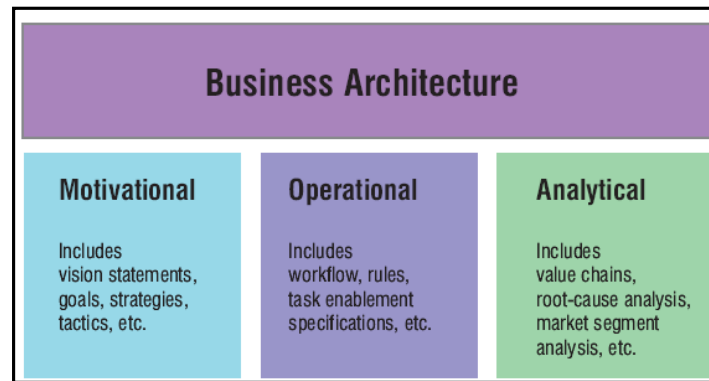
needed artefacts that could help with establishing the mentioned models/diagrams.

Many of these artefacts needed to establish the models mentioned by Ross *et al* (2006) could be derived from the Business Architecture of an organization. To understand the business rules, strategy and vision, an analysis must be done of the Business Architecture of the organization.

## **2.5 BUSINESS ARCHITECTURE**

A lot of confusion surrounds the term Business Architecture (BA). Many definitions exist for BA, some of which include:

- Enterprise Business Architecture defines the enterprise value streams and their associated external and internal relationships. It's a definition of what the enterprise must produce to satisfy all stakeholders, compete in the market and sustain the level of activity and reliability of all processes (Whittle, 2008).
- TOGAF contradicts themselves when defining BA. Sometimes they refer to BA as the rest of the Enterprise Architecture outside Enterprise IT Architecture and then they also say the following: "The business strategy typically defines what to achieve – the goal and drivers, and the metrics for success – but not how to get there. That is the role of Business Architecture."
- According to TOGAF Business Architecture Working Group (BAWG) BA is defined as: "A formal blueprint of governance structures, business semantics and value streams across the extended enterprise". BAWG believes that BA should set the business requirements that would satisfy all stakeholders, compete in a market and create sustainability.
- McWhorter (Cutter IT Journal, 2008) breaks BA into three different aspects that describe the scope, namely (1) Motivational, (2) Operational, and (3) Analytical. Figure 7 below gives a breakdown of these aspects.



**Figure 7: Aspects of Business Architecture (McWhorter, 2007:11)**

He states that BA provides the structure to help manage the knowledge an enterprise have but currently loose track of.

From above, it can be seen that no general definition exist for BA. Each organization will have their own unique definition for BA.

For the purposes of this research paper, BA will be defined as follows:

- BA contains the business rules and requirements that govern the enterprise thus enabling execution through strategy to achieve desirable results. Artefacts that help in defining the BA of an organization include: Mission and Vision statement, organizational structure, strategic plans etc. BA is also the first architecture that must be defined/undertaken because all subsequent architectures (application, data/information and technology) are build upon the business architecture.

Models and graphical representations can be used to illustrate the alignment and links between strategy, vision and corporate objectives. More important, BA should represent the business and must be understood by business designers and user, and enable business/IT integration. (Whittle, 2008)

Some elements of BA include (BizArchCommunity, 2008):

**Business Strategy** – The strategy established by top management.

**Business Capabilities** – A decomposition of capabilities of the business.

**Business Metrics** – Key performance indicators or measurements by which the organization assesses their performance.



**Business Context** – Represents context, structure and relationships of the business.

**Business Roles** – Define the users or participants relevant to certain processes.

**Business Events/Outcomes** – List of occurrences that consist of triggers and responses. Business processes are designed to respond to these events in accomplishing specific objectives.

**Business Processes** – A set of linked tasks that occur to accomplish a certain business objective.

**Business Rules** – Guidelines or constraints by which the business operates.

**Business Requirements** – A written description of business needs and specifications.

The above named elements/artefacts will give the user a clearer description of the organization, future plans and the design of the enterprise.

### 2.5.1 **Business Architecture and Strategic Management**

BA and Strategic Management is not the same thing, although there is a certain degree of 'overlap' between the two subjects.

As earlier mentioned Strategic Management consists of three components, Strategic Position, Strategic Choices and Strategy into Action. Different BA artefacts describe the strategic position of the organization and consequently directly influence the strategic choices that are made. BA plays a very big role in strategic management as it sets the foundation where upon strategic choices will be made, implemented and managed.

## 2.6 INTEGRATED ARCHITECTURE LANGUAGES

Enterprise Architecture produces many artefacts (models, diagrams and other deliverables) aimed at specific audiences. These communication tools are all developed using languages that that can be understood by the specific audience and to convey the intended purpose of the aspect being modelled.

Multiple languages exist for artefact development and the goal is to choose a language that is linkable with models in other views. Complete enterprise model development needs several languages (Vernadat,1998:3). A list of possible languages used with TOGAF can be seen in Table 3.

<b>TOGAF Architectural Activities</b>	<b>Partial List of TOGAF Recommended Artefacts</b>	<b>Proposed Modelling Language</b>
Architecture Visioning	<ul style="list-style-type: none"> <li>▪ Request for Architecture work</li> <li>▪ Initial statement of architectural work</li> <li>▪ Architecture principles</li> <li>▪ Enterprise Continuum</li> <li>▪ Architectural vision</li> <li>▪ Baseline architecture</li> </ul>	<ul style="list-style-type: none"> <li>▪ Rich pictures/English</li> </ul>
Business Architecture	<ul style="list-style-type: none"> <li>▪ Statement of architecture work</li> <li>▪ Business principles</li> <li>▪ Target business architecture</li> <li>▪ Business architecture views</li> <li>▪ Gap analysis report</li> </ul>	<ul style="list-style-type: none"> <li>▪ Rich pictures/English</li> <li>▪ UML</li> <li>▪ System Dynamics</li> <li>▪ BPMN/BPML</li> <li>▪ OCL</li> <li>▪ IDEF</li> <li>▪ ORM</li> <li>▪ EPC's (Part of ARIS)</li> </ul>
Information Architecture	<ul style="list-style-type: none"> <li>▪ Target information architecture</li> <li>▪ Information architecture views</li> <li>▪ Gap analysis report</li> <li>▪ Impact analysis report</li> </ul>	<ul style="list-style-type: none"> <li>▪ IDEF</li> <li>▪ UML</li> <li>▪ ERM</li> <li>▪ ORM</li> </ul>
Application Architecture	<ul style="list-style-type: none"> <li>▪ Target application architecture</li> <li>▪ Application architecture views</li> <li>▪ Gap analysis report</li> <li>▪ Impact analysis report</li> </ul>	<ul style="list-style-type: none"> <li>▪ UML</li> <li>▪ Structured English</li> </ul>
Technology Architecture	<ul style="list-style-type: none"> <li>▪ Technology baseline description</li> <li>▪ Technology principles</li> <li>▪ Target technology principles</li> <li>▪ Gap analysis report</li> <li>▪ Impact analysis report</li> <li>▪ Technology architecture views</li> </ul>	<ul style="list-style-type: none"> <li>▪ TOGAF Format</li> <li>▪ Rich pictures / English</li> </ul>

**Table 3: Possible Modeling Languages for TOGAF (Saha, 2007)**

At present no single modeling language exists that is capable of modeling all aspects of an enterprise. Using languages from different families can cause problems with consistency and maintenance (Saha, 2007). It is advisable to choose a modeling language that can be used for many applications across architectural domains.

A solution may be available in the near future. A modeling language is currently under construction – Unified Enterprise Modeling Language (UELM). UELM is not intended to replace existing languages but rather provide a platform/interface to enterprise modeling tools and a neutral format for exchange of enterprise models (Vernadat, 1998).

## 2.7 ARTEFACT ANALYSIS

### 2.7.1 Artefact Analysis – From Literature

Many artefacts exist in a business and every artefact is produced to deliver certain objectives for a specific group of Stakeholders/Customers. It is very important to create these artefacts in such a way that the stakeholders can understand it. As discussed in the previous section, many languages exist in which artefacts can be created (Table 4).

Following is an analysis of some business artefacts:

Artefact Name	Used to convey	Audience / stakeholders	Relationship with other models	Language
Activity Diagram	<ul style="list-style-type: none"> <li>▪ Analysis design of a business process</li> <li>▪ Design of a logical flow</li> <li>▪ Business process modeling</li> </ul>	<ul style="list-style-type: none"> <li>▪ Employees</li> <li>▪ System coordinators</li> <li>▪ Managers</li> <li>▪ Business analyst</li> </ul>	<ul style="list-style-type: none"> <li>▪ Class diagram</li> <li>▪ Organizational chart</li> <li>▪ Use case diagram</li> </ul>	<ul style="list-style-type: none"> <li>▪ UML</li> </ul>
Class Diagram	<ul style="list-style-type: none"> <li>▪ Conceptual modeling</li> <li>▪ Domain modeling</li> </ul>	<ul style="list-style-type: none"> <li>▪ Business analyst</li> <li>▪ Managers</li> <li>▪ Technical developers</li> </ul>	<ul style="list-style-type: none"> <li>▪ Activity Diagram</li> <li>▪ CRC Model</li> <li>▪ Sequence Diagram</li> </ul>	<ul style="list-style-type: none"> <li>▪ UML</li> </ul>
Organizational chart	<ul style="list-style-type: none"> <li>▪ Show the responsibility hierarchy of the organization</li> </ul>	<ul style="list-style-type: none"> <li>▪ Customers</li> <li>▪ Employees</li> <li>▪ Management</li> <li>▪ Board</li> </ul>	<ul style="list-style-type: none"> <li>▪ Operating model</li> </ul>	<ul style="list-style-type: none"> <li>▪ English</li> </ul>
Vision and Mission Statement	<ul style="list-style-type: none"> <li>▪ Conveys the mission, objectives and vision of the organization</li> </ul>	<ul style="list-style-type: none"> <li>▪ Customers</li> <li>▪ Employees</li> <li>▪ Management</li> <li>▪ Board</li> </ul>	<ul style="list-style-type: none"> <li>▪ Organizational model</li> <li>▪ Core diagram</li> <li>▪ Operating Model</li> </ul>	<ul style="list-style-type: none"> <li>▪ English</li> </ul>
Core Diagram	<ul style="list-style-type: none"> <li>▪ Shows core functions, customers and data</li> </ul>	<ul style="list-style-type: none"> <li>▪ Top Level Management</li> <li>▪ CEO</li> <li>▪ Board</li> </ul>	<ul style="list-style-type: none"> <li>▪ Operational model</li> </ul>	<ul style="list-style-type: none"> <li>▪ Pictures</li> </ul>

Artefact Name	Used to convey	Audience / stakeholders	Relationship with other models	Language
Operating Model	<ul style="list-style-type: none"> <li>Defines integration and standardization of process, data etc. of an organization.</li> </ul>	<ul style="list-style-type: none"> <li>Top Level Management</li> <li>CEO</li> <li>Board</li> </ul>	<ul style="list-style-type: none"> <li>Organizational chart</li> <li>Data models</li> <li>Class diagrams</li> <li>Component diagram</li> </ul>	<ul style="list-style-type: none"> <li>English</li> </ul>
Maturity Assessment	<ul style="list-style-type: none"> <li>Assesses the operational maturity of organization</li> </ul>	<ul style="list-style-type: none"> <li>Top Level Management</li> <li>CEO</li> <li>Board</li> </ul>	<ul style="list-style-type: none"> <li>Organizational chart</li> <li>Operating model</li> <li>Component diagram</li> </ul>	<ul style="list-style-type: none"> <li>English</li> </ul>
Component Diagram	<ul style="list-style-type: none"> <li>Logical business architecture modeling</li> </ul>		<ul style="list-style-type: none"> <li>Class diagram</li> <li>Sequence diagram</li> </ul>	<ul style="list-style-type: none"> <li>UML</li> </ul>
Data Model	<ul style="list-style-type: none"> <li>Explore relationships between entities</li> <li>Physical data design</li> </ul>	<ul style="list-style-type: none"> <li>Business analyst</li> <li>Managers</li> <li>Technical developers</li> </ul>	<ul style="list-style-type: none"> <li>Class diagram</li> <li>Data flow diagram</li> <li>Workflow diagram</li> </ul>	<ul style="list-style-type: none"> <li>UML</li> <li>IDEF</li> </ul>
Strategic plan	<ul style="list-style-type: none"> <li>A plan of where the organization is going to reach it's objectives</li> </ul>	<ul style="list-style-type: none"> <li>Top level management</li> <li>CEO's</li> <li>board</li> </ul>	<ul style="list-style-type: none"> <li>Business plan</li> <li>Mission and vision statement</li> </ul>	<ul style="list-style-type: none"> <li>English</li> </ul>
SWOT analysis	<ul style="list-style-type: none"> <li>Used to evaluate Strength, Weakness, Opportunities and threats involved in a business venture</li> </ul>	<ul style="list-style-type: none"> <li>Top level management</li> <li>CEO's</li> <li>board</li> </ul>	<ul style="list-style-type: none"> <li>Strategic plan</li> </ul>	<ul style="list-style-type: none"> <li>English</li> </ul>
GAP analysis	<ul style="list-style-type: none"> <li>Comparing actual performance to potential performance</li> </ul>	<ul style="list-style-type: none"> <li>Top level management</li> <li>Board</li> </ul>		<ul style="list-style-type: none"> <li>English</li> </ul>
Business process Modeling	<ul style="list-style-type: none"> <li>Detailed modeling of business processes</li> </ul>	<ul style="list-style-type: none"> <li>Business mangers</li> <li>Business analysts</li> <li>Technical Developers</li> </ul>	<ul style="list-style-type: none"> <li>Activity diagrams</li> <li>Work flow diagrams</li> </ul>	<ul style="list-style-type: none"> <li>UML</li> <li>BPMN</li> </ul>

**Table 4: Analysis of business artefacts**

The selection of artefacts created usually depends on the project/initiative requirements. It is also possible that some artefacts that were created for a certain audience could be useful to a wider audience. Therefore it is very important to analyze information requirements for various decisions.

When artefacts are created on an “as needed basis” corporate governance need to be in place as duplication can occur. It is also wise to decide before hand what modeling languages and tools should be used so that all modeling etc. can be done in the same manner and previous models can be adjusted and modified as needed. As preference, artefacts should be stored at one central location that is accessible to all interested parties, this will minimize data redundancy and duplication.

## 2.7.2 Artefact Analysis – UP

Not a lot of artefacts seem to be available at the UP. One major problem is that artefacts were either not created, or the created artefacts are out of date. With the implementation of the Systems Renewals Project more artefacts will have to be created to help in defining, designing and managing the new system. The following artefacts are currently available at the UP.

Artefact Name	Owners Of Model	Audience / stakeholders	Purpose	Language
Strategic Plan (2007 – 2011)	<ul style="list-style-type: none"> <li>▪ UP Top Level Management</li> <li>▪ Business Analysts</li> <li>▪ Council</li> </ul>	<ul style="list-style-type: none"> <li>▪ Employees</li> <li>▪ System coordinators</li> <li>▪ Managers</li> <li>▪ Business analyst</li> <li>▪ Management</li> </ul>	<ul style="list-style-type: none"> <li>▪ To list and prioritize important objectives.</li> <li>▪ Decide on tasks that need to happen to ensure objectives are met.</li> <li>▪ Inform stakeholders of future vision and successive tasks.</li> <li>▪ Contains benchmarks and performance indicators.</li> </ul>	<ul style="list-style-type: none"> <li>▪ English</li> <li>▪ Descriptive tabular diagram</li> </ul>
Risk Register	<ul style="list-style-type: none"> <li>▪ UP Top Level</li> <li>▪ Business Analyst, Management analysts</li> </ul>	<ul style="list-style-type: none"> <li>▪ Employees</li> <li>▪ System coordinators</li> <li>▪ Managers</li> <li>▪ Business analyst</li> <li>▪ Management</li> </ul>	<ul style="list-style-type: none"> <li>▪ List all possible risks</li> <li>▪ Supply risk rating and impact of risk</li> <li>▪ Gives info on likelihood of risk accruing</li> <li>▪ Lists responsible member of executive</li> </ul>	<ul style="list-style-type: none"> <li>▪ English</li> </ul>
Strategic Calendar	<ul style="list-style-type: none"> <li>▪ Management (Prof A.P Melck)</li> </ul>	<ul style="list-style-type: none"> <li>▪ Employees</li> <li>▪ Senior Management</li> <li>▪ Council</li> <li>▪ Business Analyst</li> </ul>	<ul style="list-style-type: none"> <li>▪ Indicate chronological events in the development and monitoring of faculty and support service plans and agreements.</li> <li>▪ Scheduling of meetings</li> <li>▪ Give executives and senior management overview of events</li> </ul>	<ul style="list-style-type: none"> <li>▪ English</li> <li>▪ Calendar Format</li> </ul>
Vision and Mission Statement	<ul style="list-style-type: none"> <li>▪ UP Management and Council</li> </ul>	<ul style="list-style-type: none"> <li>▪ Customers</li> <li>▪ Employees</li> <li>▪ Management</li> <li>▪ Council</li> </ul>	<ul style="list-style-type: none"> <li>▪ Conveys the mission, objectives and vision of the organization.</li> </ul>	<ul style="list-style-type: none"> <li>▪ English</li> </ul>
Faculty Plans and Agreements	<ul style="list-style-type: none"> <li>▪ Vice-Principles (Prof R.M Crewe)</li> <li>▪ Deans</li> </ul>	<ul style="list-style-type: none"> <li>▪ Top Level Management</li> <li>▪ Faculties and Faculty employees</li> <li>▪ Council</li> </ul>	<ul style="list-style-type: none"> <li>▪ Informative plan by each faculty relating how, when and what they will be doing, their objectives and vision.</li> <li>▪ Gives clear</li> </ul>	<ul style="list-style-type: none"> <li>▪ English (Toolkit compiled by BIRAP)</li> </ul>

			<ul style="list-style-type: none"> <li>▪ indication of what can/should be expected from each faculty</li> <li>▪ Provide history</li> </ul>	
Empowerment Framework	<ul style="list-style-type: none"> <li>▪ Management (Prof N.J Grove - Director, Dr Lazenby, Prof Sinclair, Prof Van Aswegen, Mr. Camphor)</li> </ul>	<ul style="list-style-type: none"> <li>▪ Management</li> <li>▪ Board</li> <li>▪ Employees</li> </ul>	<ul style="list-style-type: none"> <li>▪ Gives policy's on HR processes and shared services.</li> <li>▪ Create more efficiency, productivity and increased cost savings</li> </ul>	<ul style="list-style-type: none"> <li>▪ English</li> </ul>
Business Plan	<ul style="list-style-type: none"> <li>▪ Management</li> <li>▪ Council</li> </ul>	<ul style="list-style-type: none"> <li>• Management</li> <li>• Employees</li> <li>• Council</li> </ul>	<ul style="list-style-type: none"> <li>• Gives a clear description of business plan</li> </ul>	<ul style="list-style-type: none"> <li>• English</li> </ul>
Organizational Structure	<ul style="list-style-type: none"> <li>▪ Council</li> </ul>	<ul style="list-style-type: none"> <li>▪ Management</li> <li>▪ Employees</li> <li>▪ Council</li> <li>▪ Customers</li> </ul>	<ul style="list-style-type: none"> <li>▪ To show responsibility hierarchy of organization.</li> </ul>	<ul style="list-style-type: none"> <li>▪ English</li> </ul>
Use case narrative and diagram	<ul style="list-style-type: none"> <li>▪ Analysts</li> </ul>	<ul style="list-style-type: none"> <li>▪ Top level management</li> <li>▪ Employees</li> <li>▪ Council</li> </ul>		<ul style="list-style-type: none"> <li>▪ UML</li> </ul>
Business Process and Product Matrix	<ul style="list-style-type: none"> <li>▪ Management</li> </ul>	<ul style="list-style-type: none"> <li>▪ Top level management</li> <li>▪ Employees</li> <li>▪ Council</li> <li>▪ Customers</li> </ul>	<ul style="list-style-type: none"> <li>▪ To show product mix</li> </ul>	
Resource Allocation Model	<ul style="list-style-type: none"> <li>▪ Management (Mr. J.S.J Nel)</li> <li>▪ Business Analysts</li> </ul>	<ul style="list-style-type: none"> <li>▪ Executive Management</li> <li>▪ Council</li> <li>▪ Top Level Management</li> </ul>	<ul style="list-style-type: none"> <li>▪ Help with decisions regarding resource allocation</li> </ul>	<ul style="list-style-type: none"> <li>▪ English</li> </ul>

**Table 5: Artefact analysis of UP**

As can be seen from above, a selection of artefacts are available at UP, but these artefacts are difficult to understand and hard to come by. Although some of these artefacts add value to the organization, many of these don't serve a very good purpose. The reader will have to go through all the artefacts and have a clear understanding of the organization before gaining any knowledge from them.

Little integration exists between artefacts. One critical shortcoming of the mentioned artefacts is that the links are not explicated/made visible in a format that will highlight deficiencies or miss-alignment. Last mentioned visualization of deficiencies could help UP management in making strategic decisions concerning optimization and alignment.

When looking at an artefact like the UP Strategic Plan, it would add value to the organization if the goals and objectives could be linked down to the different faculties and support services. This will enable management to detect deficiencies and miss alignment. Currently this link doesn't explicitly exist and there is no way to visually represent the traceability.

Detailed information is available on the Data Architecture and Technology Architecture. The current Application Architecture at the UP is not well documented. Confusion exists about what software is used where, exactly where the new software bought from Oracle will be implemented and when the implementation will occur. The phase-out of old software still needs to be planned and documented.

Previous research done by Jacomine Grobler and Anton de Klerk incorporated the development of an operating model and core diagram. Some deficiencies have been detected with their approach, which was based on the 'EA as Strategy' approach of Ross *et al.* An objective of this project is to develop certain models/artefacts in a tool that would help UP management to make strategic decisions.

## 2.8 TOOLS

Tools support the communication of different architectures through creating graphical representations, artefacts, diagrams and reports. Absence of a single language that represents all the different architectures has given rise to a variety of tools that support enterprise engineering.

Most tools today support more than one reference architecture and the goal is to select a tool that can be used as much as possible across all domains of the enterprise. It is very difficult to find a tool that will provide for all EA development capabilities, thus organizations usually select a set of tools to accomplish this.

The UP is in need of a tool that will help management to make future strategic choices. The selected tool must clearly link artefacts, be able to highlight deficiencies and miss-alignment with different approaches followed by the UP.

Following is a discussion of some tools that could be appropriate to use by the UP. These tools were selected based on merits of desired functionalities. It is a prerequisite that these tools must have some sort of visualization capabilities, it must be easy to use and most important, be capable of delivering models/artefacts that would support/help with future strategic decision-making.

### 2.8.1 Oracle Business Process Analysis (BPA) Suite (ARIS)

This is a tool that models business processes and convert then into IT executables. Oracle BPA is based on the ARIS Design Platform that helps an organization to design, model, simulate and optimize business processes. Oracle BPA consists of the following components:

- Business Process Architect.
- Business Process Repository.
- Business Process Simulator.
- Business Process Publisher.



The benefits of using this tool are that it uses various standard based notations and templates such as BPMN, UML etc. It also supports other frameworks like Zachman, TOGAF, NAF and Archimate as well as its own ARIS framework.

Oracle BPA supports numerous import and export options and can exchange information with other systems like SAP HR.

This tool enables enterprise-wide process design and optimization and can be used to describe organizational structures, data structures and IT structures.

In light of the System Renewals Project and the acquisition of software made from Oracle, the Oracle BPA tool was considered and researched for possible use at UP. By purchasing this tool, the UP is guaranteed of service and support and users will find it easy to use if they are all ready comfortable with the other Oracle software.

## **2.8.2 System Architect**

System Architect is a Microsoft Visio add-in that allows users to access models from Microsoft Visio for advanced analysis and reporting. System Architect enables the building of architectural models across all five domains: Strategy, Business, Information, Systems and Technology.

The primary functions of this tool are: process and organizational modelling as well as software and system modelling.

System Architect supports the following:

- Interface with other applications like MS Office, MS Visio, XML and text, ERP vendors and XMI.
- Customized frameworks (example Zachman).
- Business Modeling with BPMN.
- IDEF and UML.
- Data Modeling, Structured Analysis & Design.

Systems Architect was considered as a possible tool, because the university already purchased a certain amount of licences for this program. Currently a course is available at UP that teaches students about its different uses and functionalities.

### **2.8.3 Microsoft Visio**

MS Visio is used to communicate complicated systems, processes and data. Visio supplies a wide variety of templates like process flowcharts, network diagrams, database models..... etc. to help with modelling.

MS Visio supports the following:

- UML.
- Data flow.
- Organizational diagrams.
- A variety of drawing objects etc.

MS Visio is easy to use and has a variety of applications. It is also the tool of choice presently being used at the UP for modelling purposes.

### **2.8.4 ABACUS**

The ABACUS toolset and methodology is designed to model and analyse enterprises across people, technology and process. The toolset consists of the following applications:

- ABACUS Standard – In this application the user can do organizational modelling, process and business modelling, and technology and application modelling. Imports or exports can be made from Visio, Excel, XML etc. Impact analysis queries, reporting and constraint checking can be done.
- ABACUS Designer – User can create tailored or re-usable frameworks from existing libraries or from scratch. Supports existing libraries like BPMN, DFD, TOGAF, Zachman, ERD, UML etc.

- ABACUS Professional – In this application analysis and quality assessment can be done. Uses metrics like performance, reliability, agility etc. and comparative analysis can also be done. The libraries contain over 1000 standard solutions to accelerate the raw data gathering process.
- ABACUS Publisher – Used to publish models, diagrams etc. on external (internet) or internal networks.

Many different queries and analysis can be done with ABACUS. The user can easily run a query to analyse the level of integration and standardization of processes and applications within an organization. Vertical “solution architecture” can be viewed to see different business models of different departments with their applicable applications, main processes, services etc.

ABACUS was selected as possible tool because, it can be used to model base-line architectures and metrics to provide decision-making support. The main advantage of the ABACUS tool, is that it can be used to answer questions about architectural changes in an organization. A great selection of graphical displays exists that can be adjusted to suit the audience for which it is intended.

Please refer to Appendix A for price quotation.

### **2.8.5 Evaluation Criteria**

Every tool discussed is unique, and each tool has certain sets of pro’s and cons. The evaluation criteria will be based on the needed output of this project.

It is essential for the success of this project to select a tool that will be able to assist UP management in future strategic decision-making. This includes that the tool must be able to create artefacts/models, that it will highlight deficiencies and be able to link other artefacts together.

The selected tool must support more than one reference architecture and the goal is to select a tool that can be used as much as possible across all domains of the enterprise.

The following evaluation criteria will be used:

1. Technical/Functional feasibility

- Ability to create links between different components – Tool must be able to create links between different artefacts/models.
- Ability to visualize links – Through visualization, deficiencies can be highlighted.
- Support a variety of frameworks and languages – As the university has not yet identified a framework or methodology to use, the tool must support a variety of frameworks, languages ... etc.
- Capabilities.
- Adaptability – Corrections must be easy to make and the changes made must be automatically updated throughout the system.

2. Operational feasibility

- Ease of use.
- Documentation/Tutorial/Training
- Support all domains in an enterprise – Can this tool be used across all architectures of an enterprise?

3. Service and Support.

4. Cost of Software.

A decision matrix with weighted averages will be used to evaluate the selected tools.

## **2.8.6 Tools currently being used at UP**

The tool most widely used for modelling at UP is Microsoft Visio. The EA governance committee made a decision that MS Visio would be used as the standard modelling tool. This decision was based on the current skill level of resources and the tight timelines of the Systems Renewal Project.

The problem with using MS Visio is that it is purely a tool used to draw models. MS Visio cannot be used to link artefacts or do analysis. Different queries can not be run in MS Visio which makes it redundant when making strategic decisions.

Not a lot of modelling has been done at the UP and artefacts are not readily available. The different existing artefacts are hard to find due to them all not being stored in the same place.

### **3. RESEARCH DESIGN**

The whole objective of this project is to design models/artefacts that could be used to help UP Management make future strategic decisions. The initial starting point was to look at the models mentioned by Ross *et al.* and determine if these would add any value to the organization and help with strategic decision-making. Research has shown that the models defined in this approach weren't sufficient to make future strategic decisions. Although these artefacts (Operating Model, Core Diagram and Maturity Assessment) would add value to any organization, there are too many deficiencies associated with these models, making them ineffective.

When implementing EA in an organization certain artefacts need to be available/exist to give the user/users a holistic view of the enterprise. This will enable the users to make informed decisions about EA implementation. Various artefacts are available at UP as discussed in the artefact section (2.7.2).

#### **3.1 FRAMEWORK OF CHOICE FOR THIS PROJECT**

In light of the research done, it is of the utmost important for an organization to decide on a framework to use. For the successful completion of this project, it is not necessary to select a framework for the UP, but rather to identify possible frameworks that could be used.

As previously mentioned, the IT department developed their own framework called "IT Strategy". Although this is a good framework to use at the IT department, it is not applicable to the whole organization and fails to provide the ability to model strategy and business architecture components.

The TOGAF framework discussed can be a possible framework to use but it will have to be adapted to suit UP. TOGAF gives step-by-step directions for each phase of implementation. It also gives a clear description of what the needed inputs are and what outputs are desired form each phase. TOGAF is an easy to follow framework that can be adopted by any organization.

### 3.2 TOOL OF CHOICE FOR THIS PROJECT

Extensive research has been done on what tools, language and artefacts are needed at the UP to help with future strategic decision-making. Now that enough background information is available, a decision must be made about a possible tool to use.

It was decided that a decision matrix would be used to evaluate the different tools researched. Evaluation criteria were chosen that would support the research question – ‘Finding a tool that will deliver artefacts that could be used to support future strategic decision-making’. Please refer to Table 6 for the decision matrix. Explanations of the evaluation criteria can be viewed in section 2.8.6.

Evaluation Criteria	Weight	ARIS	Systems Architect	MS Visio	ABACUS
<b>1) Technical/Functional feasibility</b>					
1.1 Create links	20	17	17	0	19
1.2 Visualization of links	15	12	14	0	14
1.3 Support frameworks/languages	20	18	17	15	19
1.4 Capabilities	10	7	7	5	8
1.5 Adaptability	5	4	3	5	4
<b>2) Operational feasibility</b>					
2.1 Ease of use	10	7	8	10	8
2.2 Documentation/training	10	9	9	8	8
2.3 Domain Support	20	16	17	8	18
<b>3) Service and Support</b>	10	9	10	8	8
<b>4) Cost</b>	10	8	5	10	8
<b>Total</b>	130	107	108	69	112

**Table 6: Decision Matrix**

Considering the above decision matrix, the ABACUS toolset is the most viable tool to be used in this project. ABACUS discussed in section 2.8.5, can be used to model and analyze different parts of an organization, different architectures and the enterprise as a whole. The models developed can assist in future strategic decisions and can be used to analyse the impact of

possible changes to the enterprise. This is a tool that could be very beneficial to UP.

As mentioned previously the aim of this project is to create artefacts that would help UP Management make strategic choices.

It was decided that the ABACUS toolset would be used for the next part of this project, which entails the development of artefacts to support decision-making.

### **3.3 RESEARCH DESIGN CONCEPT VALIDATION AT UP**

The UP is divided into three main business processes, Research, Learning & Teaching, and Community Engagement which spans over all the faculties and support services. All three of these processes have their own goals and objectives, which supports the core goals and objectives of the UP. Each faculty and support service was instructed to deliver a Strategic Plan that contains their own goals and objectives. These in turn are meant to support the different core business processes (Teaching & Learning, Research and Community Engagement) goals and objectives.

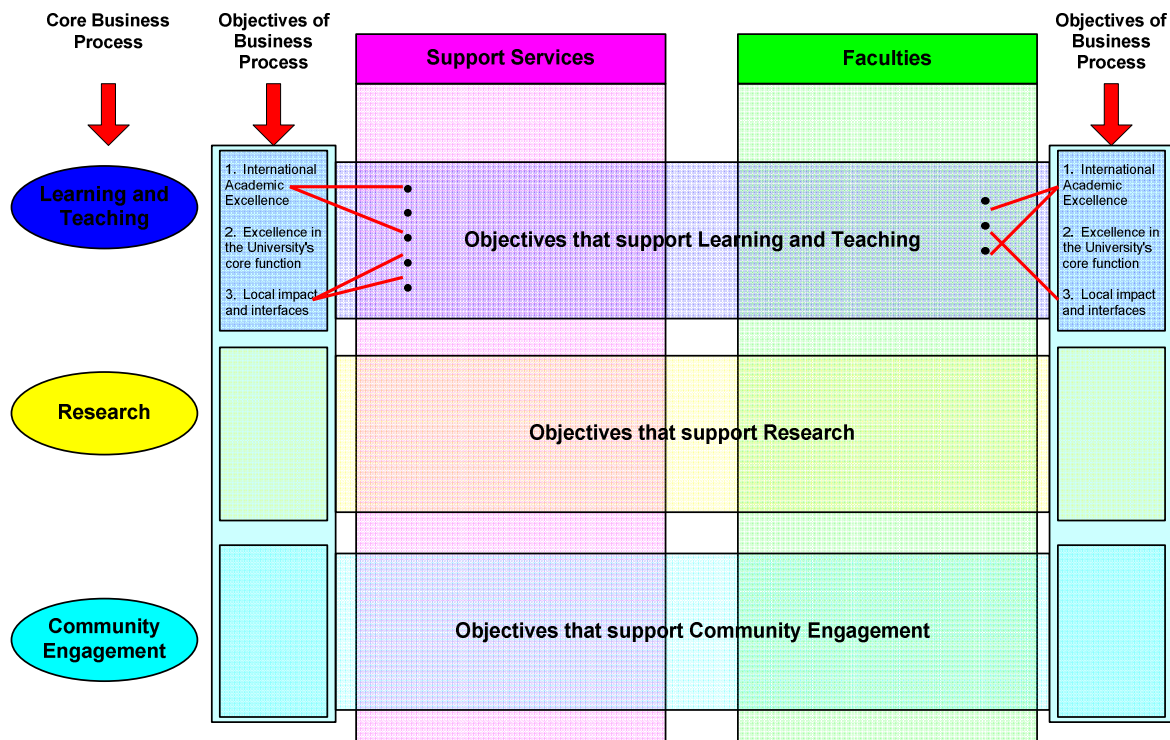
It was determined that it would add value to the UP if an artefact could be created that would link the different goals/objectives of each department (faculties and support services), to the different goals/objectives of the core business processes. By connecting the different lower level goals/objectives to upper level goals/objectives, management would be able to determine:

- What department's objectives don't align with the main UP objectives.
- Where deficiencies exist regarding departmental objectives.
- Where extra resources should be allocated.
- Where extra development is needed.
- Where any miss-alignment may exist.



This would help management enhance strategic alignment of departments with the strategies of the UP. This artefact will add value to the organization if all three business processes are modelled across the different faculties and support services.

One faculty, namely the Faculty of Engineering, Build Environment and Technology and one support service namely the Department of Information Technology Services, will be used to demonstrate the links between goals and objectives. The artefacts created will be used to demonstrate and evaluate the idea behind the research project. All results and models will be discussed in the next section. Please refer to Figure 8 for a visual representation of what will be done in these models.



**Figure 8: Artifact visualization**

The above figure gives a visual representation of what these models will show. For the purpose of this research project, modelling of the first artefact will only be done for the Learning and Teaching business process. The chosen faculty's goals/objectives will be linked to the core business process (Learning & Teaching) goals/objectives. The core business process goals/objectives will then in turn be linked to the main goals/objectives of the UP.

For the second artefact, the support service's goals/objectives will be linked to the main goals/objectives of the UP.

The objectives not linked will then be flagged, making it possible for the user to identify inefficiencies and miss-alignments.

This visualization of inefficiencies could help UP management in making strategic decisions in terms of optimization and alignment of goals and objectives.

## **4. RESEARCH RESULTS**

As previously mentioned the ABACUS toolset was chosen to develop the described artefacts. The aim of these artefacts is to visually represent the links between lower and top level objectives/goals to evaluate alignment.

Firstly a run through will be given about the data used to build these artefacts (4.1). Following an explanation of how the UP base model was constructed will be given (4.2) and there after the artefacts will be discussed (4.3 and 4.4).

### **4.1 DATA USED TO POPULATE ARTEFACTS**

#### **4.1.1 Data concerning the UP thrusts**

Following a top-down approach, the researcher firstly defined the main strategic thrusts and goals of the UP. As mentioned in section 2.1, the strategic plan is based on eight strategic thrusts, namely:

1. Academic excellence.
2. A people-centred University.
3. Excellence in the University's core functions.
4. Excellence in the University's support services.
5. Local impact.
6. Transformation.
7. Interfaces.
8. Sustainability.

Numerous objectives support the eight thrusts, which in turn is again supported by various initiatives.

#### **4.1.2 Data concerning the Learning and Teaching business process**

As already mentioned, Learning and Teaching is one of the core business processes of the university and this business process will be involved in the first artefact. The information regarding goals/objectives concerning Learning and Teaching were taken from the Management Model. The following five goals were identified for the period 2007-2011:

1. Internationally competitive and recognized curriculum and innovative T&L methods.
2. Similar academic standards and effective management of Learning and Teaching.
3. Excellence in Learning and Teaching and priorities in the Risk Register.
4. Effective management of Continuing Education.
5. Monitor progress in achieving goals.

Again, some of these goals are supported by certain objectives and initiatives.

#### **4.1.3 Data concerning faculties and support services**

Little information was made available to the researcher concerning departmental and faculty strategic plans. Two strategic plans were made available to be used for the research project.

The strategic plan of the Faculty of Engineering, Build Environment and Technology, was researched to identify objectives concerning the Learning and Teaching process. Although objectives weren't explicitly named, the following was selected by the researcher based on information contained within the plan:

1. Align programs with international best practices and accreditation of programs.
2. Increase international recognition & visibility of academics and students.

3. Increase number of graduates.
4. Optimize programs - Support and enrich teaching activities.
5. Monitor student achievements.
6. Match resources with demand of programs.

The Department of Information Technology Services used the following alignment matrix to define their alignment with the UP strategic thrusts. This information was used to populate artefact two.

UP Strategic Thrusts		Academic Excellence	Quality	Local Impact	Transformation	People centred orientation	Innovation	Interfaces	Sustainability
IT Strategy Guidelines									
EBS1	Client orientation and empowerment	■	□		□	■		□	■
EBS2	Service orientation	■	□		□	■		□	■
EBS3	Risk	□	□						■
EBS4	Adaptability and agility	□	□	□	□	■	■	□	□
EBS5	Quality	■	■					□	■
EBS6	Sustainability	■	■	□		□		□	■
EBS7	Innovation	□	□			□	■	□	□
EBS8	Application of appropriate technology	□	■	■	□	□	□	■	■

**Key:** □ -slightly aligned    □ - somewhat aligned    □ - significantly aligned    ■ - totally aligned

**Figure 9: Alignment Matrix (Pretorius, 2008:6)**

As can be seen from the above alignment matrix, different UP strategic thrusts are used than the eight thrusts as stipulated in the UP strategic plan.

## 4.2 POPULATING THE UP MODEL

ABACUS is designed to model all architectures within an organization. When opening a model in ABACUS, a model tree is visible. The researcher populated the model tree using all available information. Please refer to Figure 10 for the populated model tree. In Appendix C, the rest of the UP model tree and its construction can be seen.

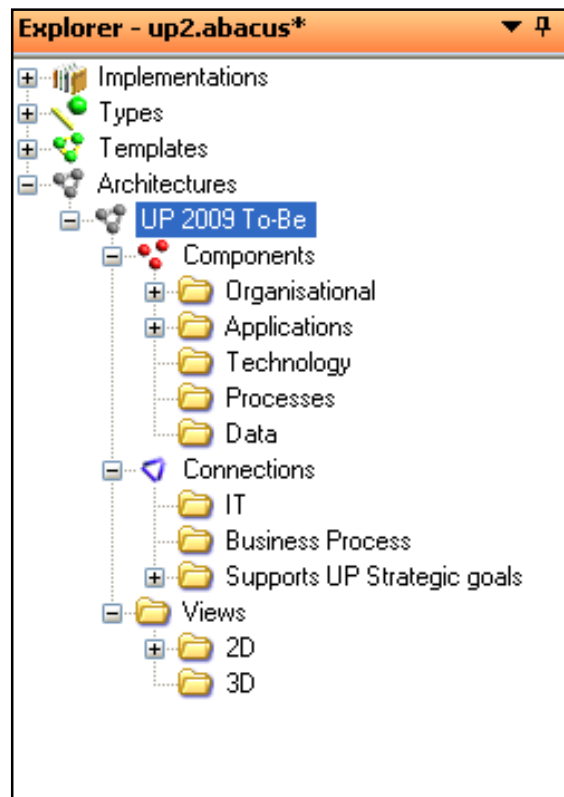
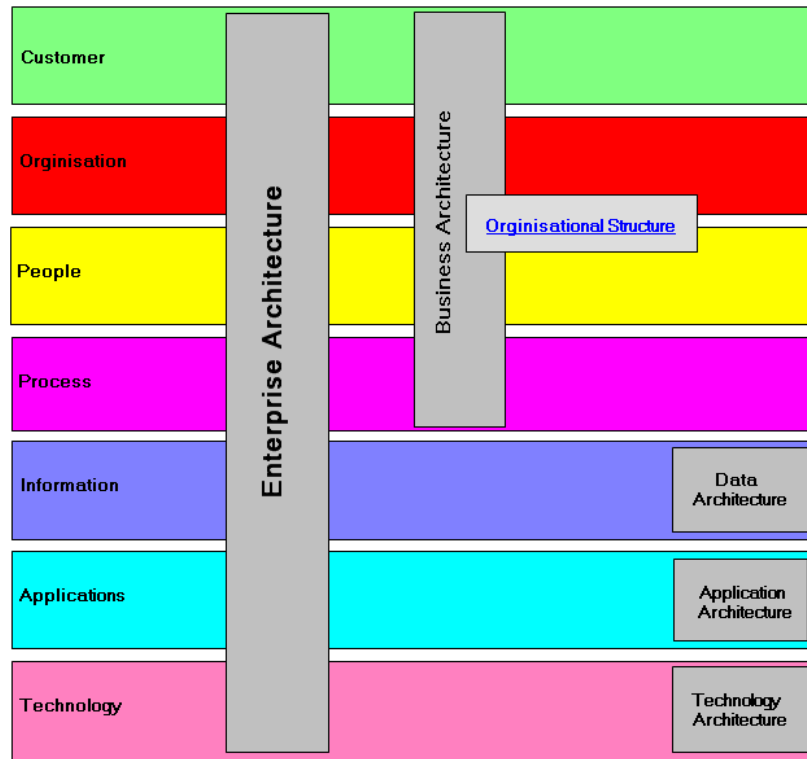


Figure 10: UP Model Tree

All the different architectures and element within the organization need to be linked in some or other base-model/framework, so that the user can get a holistic view of the organization. Within ABACUS a variety of templates exist which includes TOGAF, Zachman ....etc. The researcher used the TOGAF template and designed the base-model/framework as can be seen in Figure 11.



**Figure 11: UP Framework**

The different coloured blocks; Customer, Organization, People, Process, Information, Applications and Technology are the core components of the organization. The different architectures that span across the core components of the business are represented by the grey blocks:

- Business Architecture – This architecture contains information that concerns customers, the organization, people and processes.
- Data Architecture – Contains all the data components.
- Technology Architecture – Contains all the technology components like servers, switches, printers, connections ...etc.
- Application Architecture – Contains all the information about the different applications being used by the organization.

The Enterprise Architecture block spans over the whole organization, this represents the integration between all components and architectures and their links with each other. EA serves as the blue print or master plan of the organization.

Once the components of the organization are completely populated and the needed connections are formulated, the base-model/framework can be used to drill down to all the different parts of the organization.

### **4.3 THE GOALS AND OBJECTIVE ARTEFACT – ARTEFACT ONE**

As previously mentioned, only a certain aspect of the organization will be modelled for this project. The first artefact will mainly focus on the Business Architecture element and more specifically the goals and objectives of the UP.

As a limited amount of information is available, only one faculty namely the Faculty of Engineering, Build Environment and Technology will be used to demonstrate the linkage discussed. This is also only done for the Learning and Teaching business process. Please refer to Figure 12 for artefact one.

As can be seen from Figure 12, a visual vertical cut can be created that shows how the different goals of the faculty support the goals of Learning and Teaching which in turn support the strategic thrusts and objectives of the UP. By doing this, UP management can determine where inefficiencies exist and where possible corrections can be made to increase performance and alignment.

When studying the artefact, it can be seen that in this instance, clear alignment does exist between lower level and top-level goals and objectives. This may not however always be the case. If this artefact is completely populated using all other faculties and support services data, it may become clear that some miss-alignment is present, these can then be investigated and possible adjustments or corrections can then be made.



# Strategic Thrusts and Objectives of the University of Pretoria

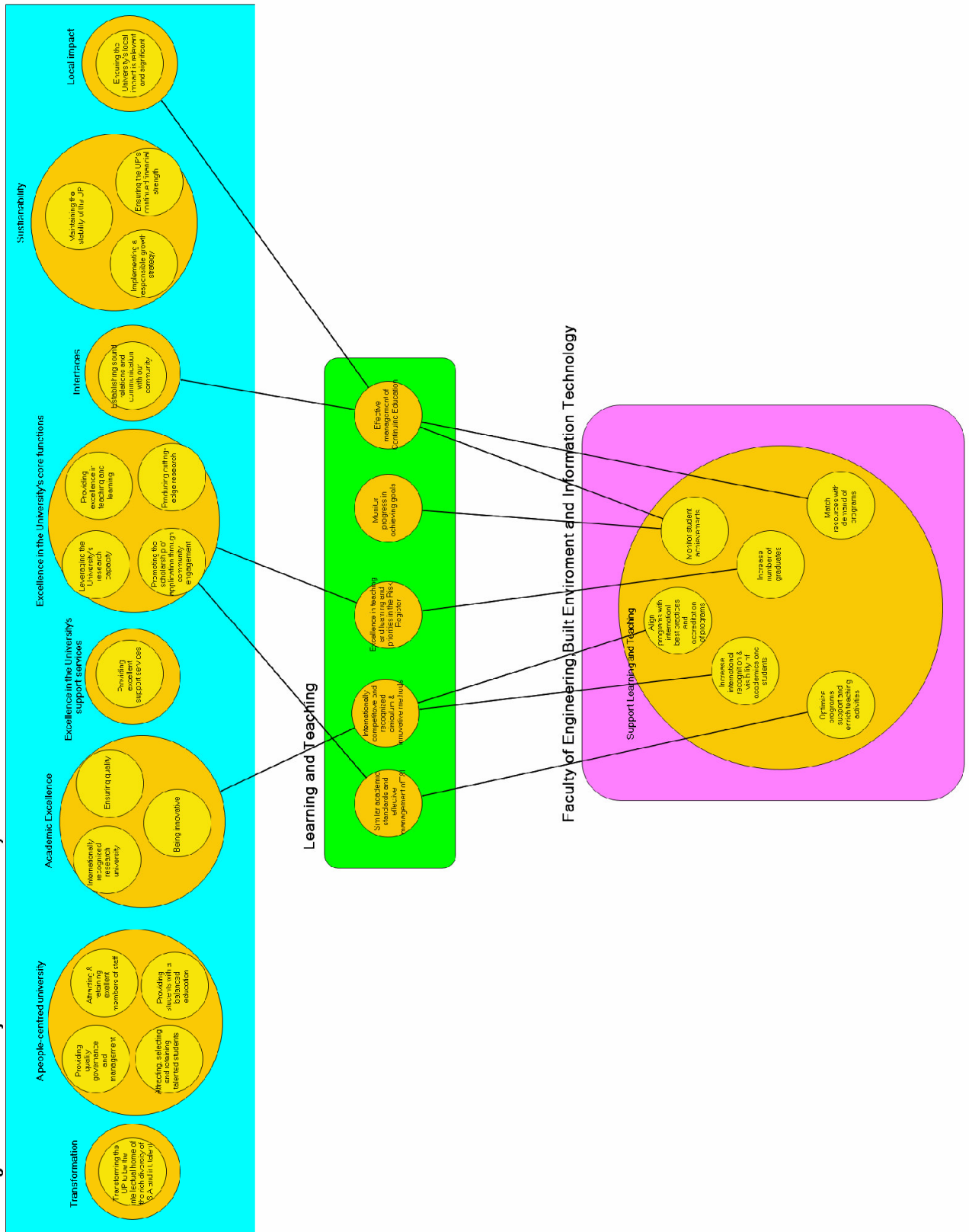


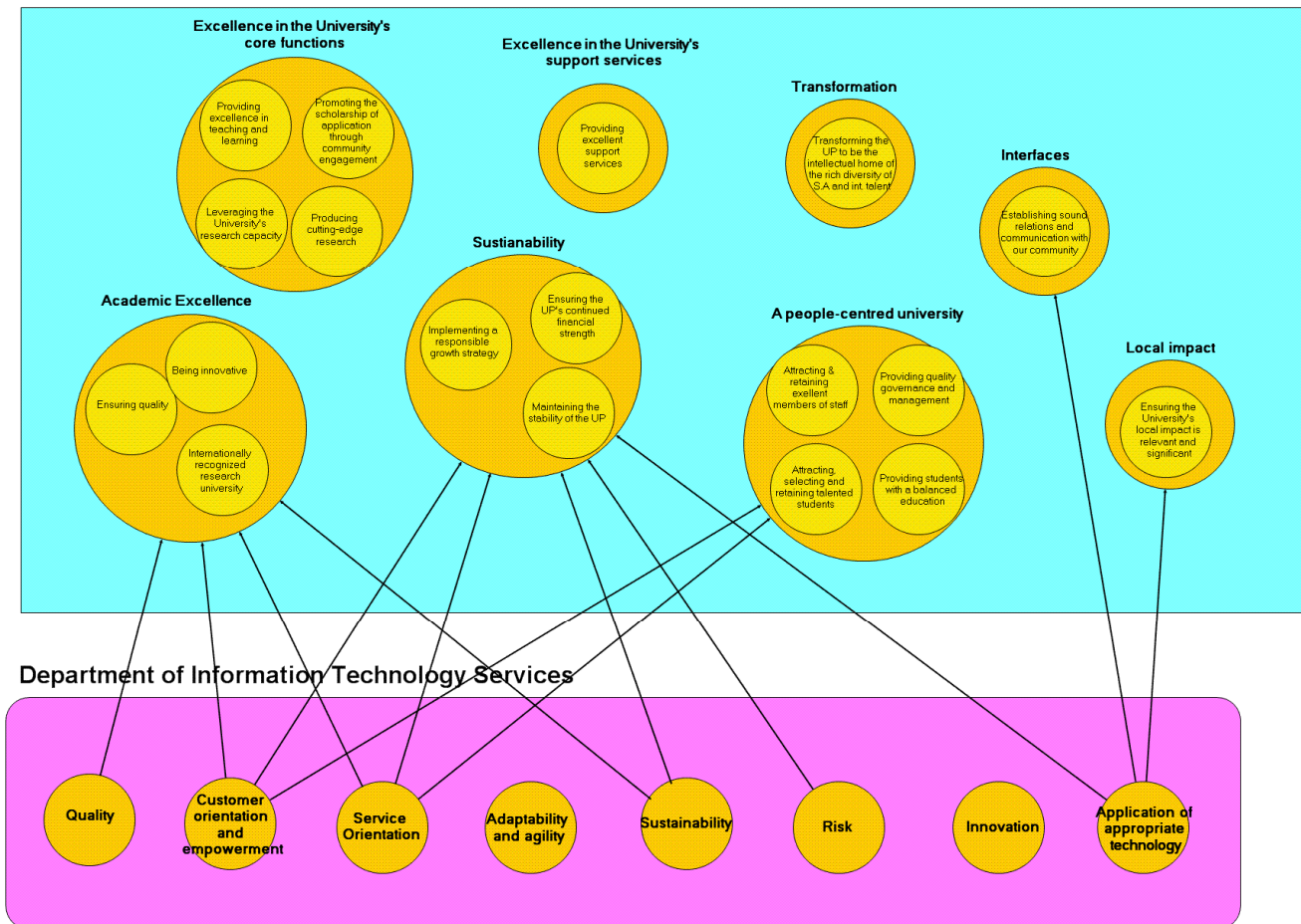
Figure 12: Goals and Objectives Support – Artefact one

## 4.4 THE GOALS AND OBJECTIVE ARTEFACT – ARTEFACT TWO

The second artefact will depict logical links between the objectives of the Department of Information Technology Services and the main strategic thrusts of the UP. This second artefact will also focus on the Business Architecture element and more specifically the goals and objectives of the UP.

Please refer to Figure 13 for artefact two.

### UP Strategic Thrusts and Objectives



The vertical cut created, shows the current alignment of lower to top-level goals/objectives. In ABACUS, various 'cuts' can be made to display a variety of views of the organization.

## 4.5 RESULTS CONCLUSION

ABACUS is an amazing tool that can be used for many purposes. Models can be populated by either using the model tree or by visually building the model using different blocks, connectors...etc. When the enterprise model is fully populated, ABACUS can be used to create a variety of views of an organization, which includes a vertical cut displaying strategy alignment thorough out the whole enterprise.

The artefacts created and discussed in the previous section, are very basic and low level. Although not a lot of information was available, the researcher already highlighted certain deficiencies. These artefacts can be enlarged by adding different metrics to the different goals/objectives, adding constraints..ect. Initiatives can also be added which support specific, predefined objectives. By doing this the user can get a holistic view of the enterprise and all the different supporting elements.

Various performance analyses can be done using ABACUS as well as simulation modelling.

The researcher found the software to be very user friendly and applicable to the research question.

## 5. RECOMMENDATIONS

As Enterprise Architecture is seen solely out of an IT perspective, the researcher would urge UP management to consider implementing EA in an enterprise wide perspective. By integrating EA with strategy planning, enterprise optimization can be achieved through standardization and integration of processes. If the UP utilize EA enterprise wide and as part of the strategy, alignment of business strategy and vision would ensure ultimate improved business performance.

In light of the research done, the researcher strongly recommends that the UP must decide on a suitable framework to be used, as no framework or methodology is currently followed. A suitable framework will help the UP to integrate and design architectures and thus optimise the organization as a whole.

One single/common modelling tool must be selected for modelling purposes. A variety of tools is currently available and the ABACUS toolset is strongly recommended. With ABACUS, different architectures across an organization can be modelled and linked to give a holistic view of the organization. Different artefacts can be created and connected which will enable management to make future strategic decisions. Employees must be motivated to use the modelling tool and thus standardization of models and future integration of models will lack complication.

Strategy alignment is probably one of the most important subjects within an organization. The researcher noticed that very few formal links are created that explicitly connects the different levels of objectives and goals with each other. A gap exist between alignment of top and lower level goals/objectives and no visual representation of these alignments exist. The artefacts discussed in section 4 would add value to the UP and enable management to identify problematic areas and miss-alignment. The visual representation is also a better means of communication and thus the researcher would suggest that the model be populated with data from all the other faculties and support services.

## 6. CONCLUSION

Many changes are currently happening at the University of Pretoria. This is a great opportunity to re-evaluate the UP's current position, strategy and aim.

Alignment of the Strategic Objectives, Future Goals and Strategy with business and technology initiatives throughout the company can be accomplished by implementing EA on an enterprise level. This will not only create more value for the organization but will also establish a solid foundation for execution of strategic decision-making.

The creation of artefacts that could be used by management to make strategic decisions will add value to the organization. The goals and objectives alignment artefacts designed and discussed can be very helpful to UP management, these could be used to optimize goal and objective alignment through out the enterprise.

In conclusion, the researcher believes that the project was a major success as all of the objectives of the project were met. The concept of using ABACUS to demonstrate alignment between lower and top-level goals/objectives was successful and it was established that it would add value to the organization.

## APPENDIX A



**From:** Supplier: Avolution Pty Ltd  
 Address: 10 Grandpont Place  
 Oxford OX1 4NH  
 UNITED KINGDOM  
 ABN / Tax ID: 31 098 348 960

## ABACUS Internal-Use Quotation

**Recipient:** University of Pretoria

**Date:** 12 June 2008

**Supplier Ref:** UPSA-001

**Attention:** Marne de Vries

**Recipient Ref:**

**ABACUS pricing details for Internal use only are as follows:**

ITEM	DESCRIPTION	QTY	UNIT PRICE (ZAR)	DIS- COUNT	AMOUNT (ZAR)
1b	ABACUS Standard User License (stand-alone)	1	R 29,990.00	30%	R 20,993.00
4	ABACUS Designer Add-On User License *	1	R 29,990.00	30%	R 20,993.00
11	1 Years Maintenance at 20% of Unit Prices	1	R 11,996.00	0%	R 11,996.00

**TOTAL EXCLUDING TAXES: R 53,982.00**

**INCL. DISCOUNT OF: R 17,994.00**

## APPENDIX B



# Applications

## **PeopleSoft Student and Academic Administration Suite**

- PeopleSoft Enterprise Student Administration
- PeopleSoft Enterprise Campus Self-service
- Business Intelligence focusing on Student information

## **PeopleSoft Financial Suite**

- 'General' Financials
- Procurement Related
- External Contracting and Project Management
- Facilities and Asset Management
- Financials Business Intelligence

## **PeopleSoft Human Capital Management (HCM) Suite**

- Core HCM(PeopleSoft Enterprise Human Resources)
- Additional HCM modules
  - (PeopleSoft Enterprise iRecruitment
  - PeopleSoft Enterprise Self-Service Human Resources
  - PeopleSoft Enterprise Directory Interface
  - PeopleSoft Enterprise ePerformance)
- HCM Business Intelligence

## **PeopleSoft Customer Relationship Management (CRM) Suite**

- PeopleSoft Enterprise Marketing
- PeopleSoft Enterprise HelpDesk
- PeopleSoft Enterprise Multi-channel Communications
- PeopleSoft Enterprise CTI (Computer telephony Integration)

## **Enterprise Performance Management Warehouse (EPM) Suite**

- Financial Warehouse
- Supply Chain Warehouse
- HCM Warehouse
- CRM Warehouse – analytical tool as well

## **Tools**

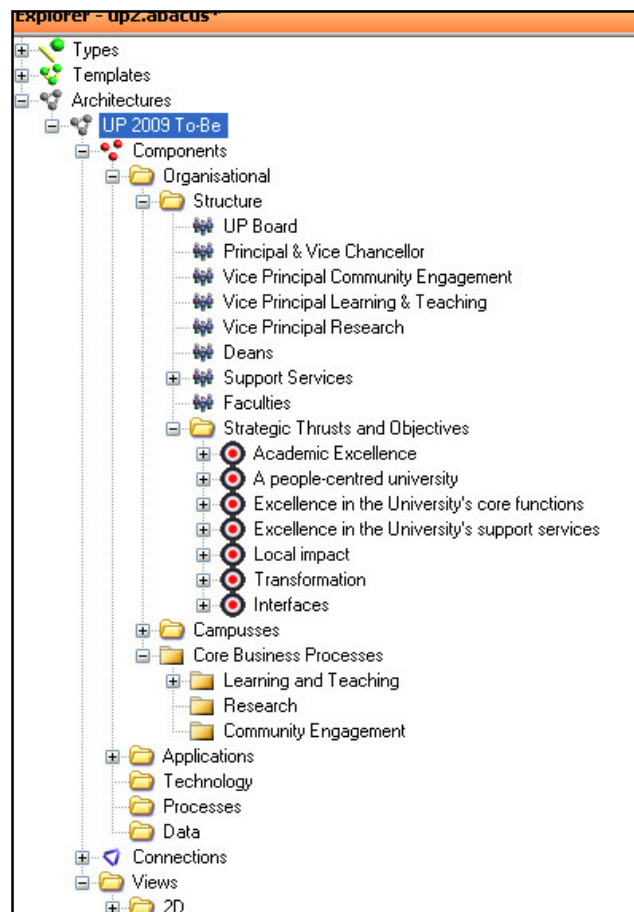
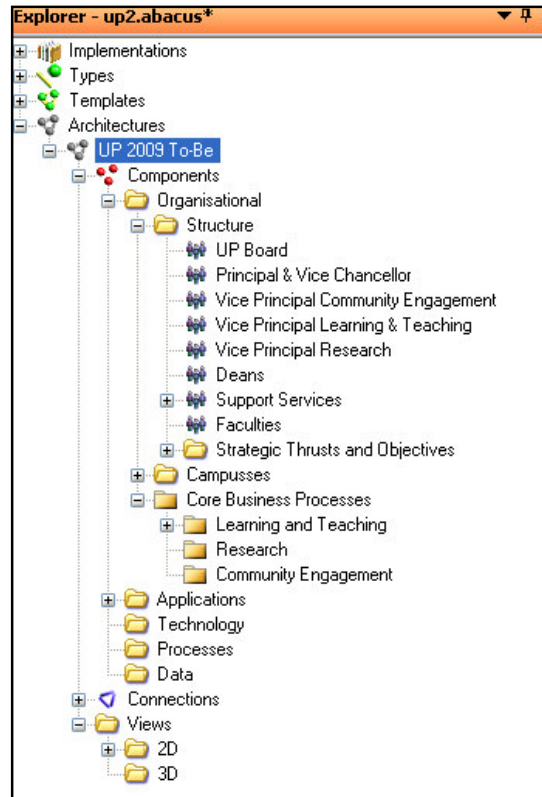
**Oracle's Business Intelligence Suite Enterprise Edition (ex Siebel)**

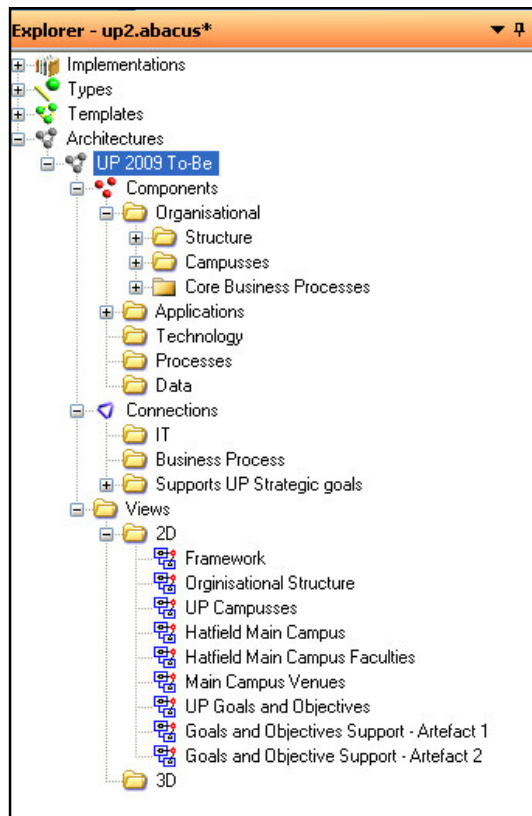
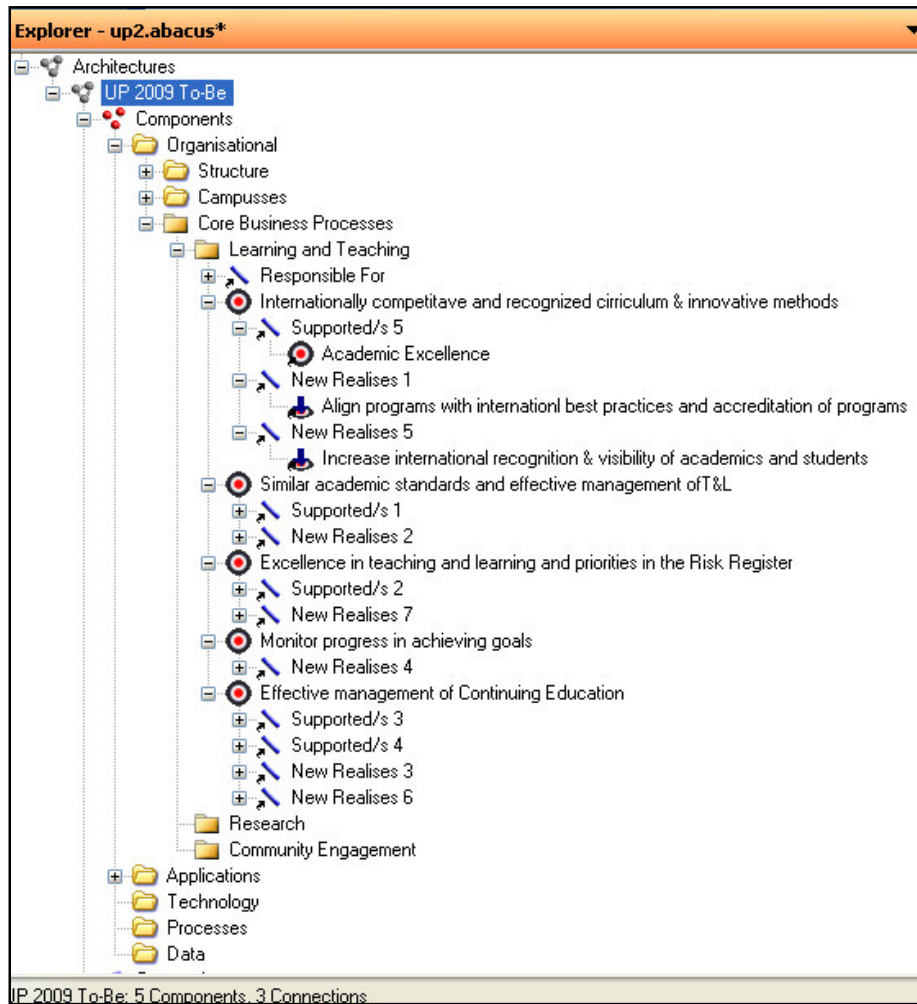
**Oracle's Enterprise Content Management Suite (ex Stellent)**

**Fusion Middleware**

## APPENDIX C

## UP Tree as constructed in ABACUS





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