

ENTERPRISE ARCHITECTURE: CRITICAL FACTORS AFFECTING MODELLING AND MANAGEMENT

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Abstract

Enterprise architecture is an important instrument to address company-wide integration both from a business and an IT point of view. Companies that choose to implement an Enterprise Architecture initiative often believe that if a description of the company's architecture exists it will automatically generate value to the company but sadly, this is usually not the case. Even if companies know that enterprise architecture is important they still have problems with modelling and management of the enterprise architecture.

The purpose of this article is two fold, to describe how an Enterprise Architecture is established and to identify the critical factors that affect the modelling and management of the Enterprise Architecture. The research is based on empirical study of two different companies: AstraZeneca and SKF. Both companies have several years of experience working with enterprise architectures and represent two completely different branches.

The critical factors found are grouped in three different areas: Management, Scope and Content. To succeed with an enterprise architecture initiative it requires top IT and business management buy-in. The scope of the enterprise architecture must be defined and agreed between business and IT. To make the enterprise architecture useful the content must have certain characteristics. To get the buy-in of the business community the business functions and processes must be included and described with relevant artefacts and in business terminology in line with the scope.

Keywords: Enterprise architecture, IT architecture, IT management, modelling, architecture models.

1 INTRODUCTION

During the last years IT has received a more central place in change processes within organisations. New organisational forms have evolved as a result of the innovative use of IT. IT management has therefore a much greater strategic role today than it had 15-20 years ago. This development has meant that IT management has gone from an emphasis on mastering the technology, developing information systems and controlling the costs of the IT department to seeing IT as an essential means to create new organisational forms with an increased ability to compete and cooperate. The strategic role of IT and its significance throughout the organisation increases complexity while at the same time increasing the need to deal with ever more conflicting demands and requirements. Architectural matters become more and more critical for the creation of successful organisations. If the organisation does not succeed in handling architectural issues, there is a clear risk that considerable resources will be invested without achieving desirable effects (Sauer et al. 2003).

To meet these challenges the enterprise architecture has grown to become one of the most important pre-requisites for a working business. It has long been known that IT architecture is important but it has been extremely difficult to find successful methods and tools to define and improve the architecture from a business point of view. Companies have no problems focusing on the information systems and technical aspects but often forget the business aspect. (Boster et al 2000). The congeries of information systems that we find in many large organisations have been characterized by a complex of problem filled “information labyrinths”, “islands of information” and “bureaucracies of information” (Magoulas et. al. 1998, Magoulas et. al. 1991). These three terms are used to describe poor enterprise architectures. Their existence is a result of the failure of enterprise architecting. Transferring new IT into practice requires an integrated approach to achieve alignment between business and IT. In that sense enterprise architecture is an important instrument to address company-wide integration both from a business and an IT point of view (Lankhorst 2004).

Even if companies know that enterprise architecture is important they have still not found a good method of documenting their enterprise architecture in a way that encourages firstly the IT organisation to use and maintain it and secondly the business community to understand and follow it. This in turn leads to a lack of knowledge within the company as to how develop and change the architecture in a controlled manor and leads to unclear relations between systems and a disconnection to the business processes. Those companies that choose to implement an Enterprise Architecture initiative often believe that if a description of the company’s architecture exists it will automatically generate value; understanding and technical prowess to the company but sadly, this is usually not the case. Enormous resources are put into creating architecture but very few succeed (Boster et al, 2000).

The purpose of this article is two fold, to describe how an Enterprise Architecture is established and to identify the critical factors which affect the modelling and management of the Enterprise Architecture. The research is based on empirical study of two different companies: AstraZeneca and SKF. Both companies have several years of experience working with enterprise architectures and represent two completely different branches. We have decided to concentrate on management issues and not on detail design or technical issues because these parts are well covered in most initiatives. Our contribution is an increased insight into the factors that will lead to the successful modelling and management of an Enterprise Architecture, based on our experiences.

The article is organised in seven sections; an introduction followed by a short description of Enterprise Architecture, then the method of research, each case study is then described one after the other. The article is concluded with a discussion and summary of the key findings.

2 ENTERPRISE ARCHITECTURE

Enterprise Architectures as a concept is becoming increasingly widespread in IT Management research and practice. Improved IT Management has been viewed as a key issue for some time (Brancheau et al. 1987, Niederman et al. 1991, Gottschalk 2000). Enterprise Architectures have therefore, for a number of years, been the focus of much academic attention due to the successful experiences of some companies and less successful experiences of others. The concept of Architecture was introduced into IT Management research at least three decades ago. The focus then was on Information Systems Architecture or Information Architecture (Zachman 1978, Bowman et al 1983, Zachman 1987, van der Poel et al. 1989). More recently research has focused on how Information Systems Architecture can be linked to Business Architecture. As a result of the research, more comprehensive architectural frameworks have emerged. These frameworks are often designated as “Enterprise Architecture Frameworks” (Spewak 1992, Williams et al. 1998, Rohloff 2005).

Enterprise architecture is an instrument to address company-wide integration and to achieve alignment between business and IT. In this sense Enterprise Architecture is defined as a coherent whole of principles, methods and models that are used in the design of the enterprise’s organisational structure, business processes, information systems, and infrastructure (Lankhorst 2004). A source of confusion is that the term ‘enterprise architecture’ sometimes refers to both the models and the actual implementation (Kaisler et. al. 2005). More often, when used, the term refers to the principles, methods and models, or in other words, the information asset base, which are required in order to design and develop the real enterprise architecture. The US Federal CIO Council defines Enterprise Architecture as (CIO Council 2001 p. 5):

“Enterprise Architecture -- a strategic information asset base, which defines the mission, the information necessary to perform the mission and the technologies necessary to perform the mission, and the transitional processes for implementing new technologies in response to the changing mission needs. Enterprise architecture includes a baseline architecture, target architecture, and a sequencing plan.”

Many groups have tried to map out and present frameworks to describe enterprise architecture. Perhaps the first and most well-known framework is the Zachman Framework (Zachman 1987, Sowa et al. 1992, Zachman 1996). Zachman’s framework for Enterprise Architecture was first published in 1987 and since then it has been discussed and developed and has also influenced many other frameworks. Zachman’s work was inspired by classical architecture i.e. architecture of buildings and the air industry which had complex systems with high demands on quality (Lyer et. al. 2004) The purpose of the framework was to describe architecture and show the factors that influence information systems. The framework shows a logical structure to classify and organise parts of a company with the aid of different dimensions, which are shown from different perspectives (Pereira et. al. 2004). Any appropriate approach, standard, role, method, technique, or tool may be placed in the framework since it can be viewed as a tool to organise any form of metadata for the enterprise. Zachman suggests that the model should constantly develop as new pieces are put in place bit by bit. This should result in rework and reconsideration of the entities and relationships within the model.

One other well-known framework is the IFIP-IFAC Task Force General Enterprise Reference Architecture (GERAM) (IFIP-IFAC Task Force 1998). The GERAM Framework defines a tool-kit of concepts for designing and maintaining enterprises for their entire life-history. The purpose is to organize existing enterprise knowledge rather than propose yet another “enterprise reference architecture”. A third framework was presented from Purdue University: The Purdue Enterprise Reference Architecture (PERA) (Rathwell et al. 1995, Williams et al. 1998).

Most enterprise architecture frameworks have in common the fact that architectural models are central and modelling is essential to describe and understand an enterprise architecture. Lankhorst (2004) argues that integrated architecture models are needed in order to achieve alignment between business and IT. According to Kaisler et al. (2005) there are three main reasons to model: (1) to visualise the

enterprise architecture, its evolution, and its generational impact on the existing architecture; (2) to depict to stakeholders the control and data flow through the architecture; and (3) to conduct end-to-end performance analyses.

During recent years there have been an increasing number of studies of enterprise architecture practice. Some of them study the formulation and implementation of enterprise architectures (Peristeras et al. 2000, Glassey 2001, Tarabanis et al. 2001), others study critical problems. According to Kaisler et al. (2005) there are three critical problems in the process of enterprise architecting: modelling, managing, and maintaining enterprise architecture. Although there is some research on practical experiences of enterprise architecting, we are far from establishing a solid empirical base for enterprise architecture. Our research will add new insights to critical factors in enterprise architecting, drawing on experiences from two large global organisations.

3 RESEARCH APPROACH

This research is based on an empirical study of modelling and management of enterprise architecture in two different companies: AstraZeneca (AZ) and SKF. Enterprise architecture is a complex phenomenon and not easy to research. Therefore progress in enterprise architecture research as well as practice can benefit from "...the drawing of specific implications, and the contribution of rich insight" (Walsham 1995 p. 79). In that sense it is advantageous to have extensive access to the case context, which is crucial when studying complex situations that require comprehensive descriptions. Our research process has been inspired by the collaborative research approach (Mathiassen 2002) and its inside/outside perspectives. Two authors of this paper are employed by and work "inside" AZ and SKF. The third author is a former employee at SKF. The fourth author is a full-time academic researcher and provides "outside perspective", which allows for more critical assessment and reflection.

The reasons for choosing the two companies: AZ and SKF was firstly because they both have several years of experience working with enterprise architectures, secondly because the companies represent two completely different branches (bearing manufacture and pharmaceuticals) they have in common that they are large multi-national companies with representation all over the world. Both need a reliable IT apparatus to compete on the global market. The members of the research group also have detailed knowledge and contacts with both companies through their work.

The research methodology is essentially interpretive case study (Walsham 1995). Data collection was primarily carried out through observations, open interviews with stakeholders, decision-makers, and project members. Analysis and comparison between data sources were facilitated by the extensive context access which let us reconfirm issues. This both strengthens validity and minimises biases. Workshops were used to validate findings and refine our understanding of certain issues.

Research rigor is a question in any case study; typical critiques target the validity of generalisation or the lack of self-criticism. However, the main objective in these two cases is to increase the understanding of enterprise architectures and how they are modelled and managed, by providing practical experiences and context characteristics.

4 ENTERPRISE ARCHITECTURE AT ASTRAZENECA

AstraZeneca is one of the world's leading pharmaceutical companies with an annual turnover of nearly 19 Billion USD and over 60 000 employees worldwide (2003). Since the merger in 1999 between Astra and Zeneca there has been a focus, within the IS-organisation, on implementing central applications at all sites (globally) to support integration and reduce cost of service management. There are a great number of applications and many are interfaced to each other, which in turn mean that the

impact of the transformation has been considerable. Simultaneously, it was decided that the IT infrastructure within AZ should be outsourced and this work has been going on in parallel. Due to these factors, there has been an increase in demand for an improved overview of all applications and their relationships in order to manage the budget and architecture (information flows and applications) more efficiently.

Today the company has reached a new stage in its development both internally and externally, where emphasis has been on integration of both applications and information. The underlying reasons behind this are partly a strong need from the business side to clean-up/survive in the growing “Information overflow” that exists today and partly due to the development in technology which has made this possible.

In all organisations, especially mature ones, it has always been a challenge to align IT strategy with Business strategy, and AZ is no exception. After the last management requirements to slim the processes and reduce costs in combination with a recent re-organisation within the IS/IT business, it has turned out to be even more important for the IS/IT department to find a better way to communicate to the business. Therefore, the question was raised: In which way is IS/IT able to support the alignment process?

We have chosen to focus on one of the initiatives to describe IT architecture within that part of R&D that is called Development. This division’s main purpose is to carry out clinical trials on volunteers or patients in an early phase before a new drug has been approved for the commercial market. The IS organisation supporting the Development phase of the R&D business is called Global Drug Development IS (GDD IS).

AstraZeneca IT Architecture - City Map

The City Map is one of AstraZeneca’s methods for visualising IT architecture, where the coloured districts (domains) represent the maturing phases of a product, while the white areas within the districts, the blocks, represents groups of houses (applications) and the coloured arrows show the flow of information between districts (Figure 1). This graphical model is a simplification of a complex situation. GDD IS has attempted to define an innovative new way of communicating to the business strategically. Within R&D Development, knowledge is the final product. With the support of many IT solutions this knowledge is documented in the submissions delivered to authorities’ world wide in expectation of receiving approval for offering a new drug to patients on the commercial market. Documentation is also generated internally within AZ in order to extend the knowledge of the organisation. Due to the great number of applications and also their different architectures there is a great focus on integration.

Any kind of strategy for integration must be based on information and its life cycle. In Development, IS has defined a concept called Information Progression Domain (IPD). These domains represent the lifecycle of information objects e.g. a product. A simple comparison would be the life of humans or animals as they pass through different periods of their development, like childhood, adolescence, adulthood and finally to old age. It is important that the IPD’s are defined so that the refinement of the information objects (not visible on the map) is kept within each IPD and not performed between them. When the description is correct, it should be possible to define obvious deliverables from each IPD to transfer to the next.

An Information Progression Domain Owner is appointed, responsible for all information within a particular domain and for setting up and maintaining interfaces to other domains. When defining the scope for a particular domain, it should be possible to define deliverables that are handed over to the next domain. One or more houses can be placed in each district, i.e. the different IT applications that support that particular area as depicted in Figure 1.

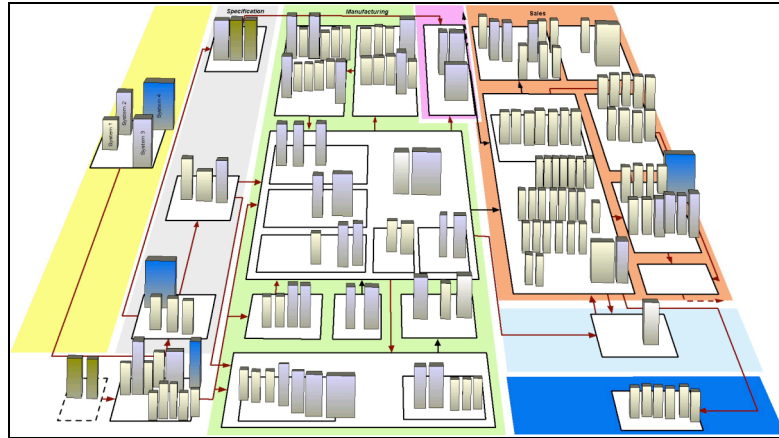


Figure 1 The City Map populated with Applications & Information flows

Arrows between the districts (domains) show information flow, red arrows show manual flow and black arrows show electronic data flow. The colour and size of the houses (applications) indicates the attributes of the application e.g. if local or global. One district may be categorised into one or several different types of blocks (white areas), e.g. the Manufacturing district above. As shown a block could consist of other blocks and/or several houses (applications).

To summarise, it is important to separate IPD's which are information domains and represent different states in a lifecycle progress while the refinement of the information objects are kept within each IPD.

Reasons for Choosing the City Map Framework

AZ identified some significant benefits of using the City Map metaphor and some minor restrictions.

Advantages of the City Map

- ☐ Not a new invention, it has been used over many years by theorists and others. The advantage is that it is easy to understand for IS/IT illiterate persons.
- ☐ It shows phases of maturity from left to right.
- ☐ It is easy to localise, point out prioritised areas on the map. Together with some other diagrams and descriptions, it can be used as a strategic planning tool.
- ☐ The map can be developed with different layers, e.g. to show the electrical cabling and plumbing under the districts i.e. technical infrastructure supporting the applications.
- ☐ It is possible to implement functionality that gives the opportunity to display more information about each application by right-clicking on a particular house.

Disadvantages of the City Map

- ☐ The City Map is not the complete solution for strategic planning, and communication with the business management.
- ☐ The time required for maintenance of the City Maps to keep them up to date could be considerable if several maps were needed for different target groups.
- ☐ It does not define the governance process.
- ☐ It does not show geographical distribution of the applications (though should be rather easy to add if needed).
- ☐ It does not show information objects explicitly.

This methodology is still under development at AZ. It has just been presented to business as a first attempt to improve alignment. However, the intention is to use the City Map in the dialogue with business on a management level to look at the current situation and discuss a possible future picture. One possible scenario for AZ would be to create an As-Is map to show the current status and then move on and produce one or several To-Be maps. In the As-Is map you are able to select different areas of the City Map (domains) and prioritise them. In the future, it will be possible to add more details to this kind of map or create other more detailed maps similar this one for other target groups.

5 ENTERPRISE ARCHITECTURE AT AB SKF

The SKF Group is the leading global supplier of products, customer solutions, and services in the business of rolling bearings and seals. In 2003 its annual turnover was more than 41 000 MSEK and slightly more than 38 000 employees worldwide. SKF has some 80 manufacturing sites distributed worldwide, with its own sales companies in some 70 countries supported by some 15 000 distributors and dealers. With its e-business marketplace and global distribution system, SKF is always close to its customers for the supply of both products and services.

Early in 2003 the Director of eBusiness & IT Strategy sponsored a project to document the IT architecture at SKF. Until then, there was only operational and user documentation available. It was also becoming apparent that there was a need to define and document the alignment of business and IT. It was perceived that the strength of such documentation would increase the ability to gain control of the Group's IT environment with the inclusion of a governance process for future development. In addition, the two analytical sources used by SKF, Meta Group and Gartner recommended documentation of this type. (Drobik 2002).

Two years previously in 2001, SKF had decided to outsource its entire IT Organisation (i.e. both applications and infrastructure) to one of the major international outsourcing companies and initiated a bid process. This, after the initial hype, became the driving force for documenting the IT architecture rather than the original reasons. It was thought that documentation of the current architecture was imperative if much of the responsibility for maintenance and development of the applications and infrastructure was to be passed on to a third party.

After a normal bid process and not due to any specific framework demands IBM was selected as the supplier to support the project. With the aid of consultants from IBM, the definition of an IT Architecture Database was initiated. The objective was to develop a framework to a stage which would secure alignment between business and IT and provide architectural guidelines for future and ongoing business initiatives.

SKF did not fully agree with the framework as proposed by IBM but modified it resulting in the model shown in Figure 2. The reasons given for changes were:

- ☐ SKF was of the opinion that there were flows of information from other sources than indicated in the IBM model.
- ☐ IT opportunities did not only originate from business requests.
- ☐ It should be a model for the development of the architecture – so if no architectural change was resulting from a project then no change to was required to the documentation.
- ☐ The IT Governance process was given increased focus in the light of the outsourcing.
- ☐ Operation and development were given less significance but increased emphasis was given to the interfaces between the framework and the external "real world" .
- ☐ Security which was missing as a separate entity in the IBM model was added due to its importance.

The final result was a Lotus Notes database containing what was perceived to be much of the relevant information of the current SKF IT Architecture. For each building block of the architecture (e.g. Business Function Model), an SKF person from the SKF Retained IT staff was allocated responsibility supported by one other retained IT staff member and one person representing the outsourcing company. The end-users of the database were identified to be IT personnel, both retained staff and from IT suppliers. It was recognised that since both the contents and the management of the repository were complex, there was a need for guidance and training before access was given to a particular user.

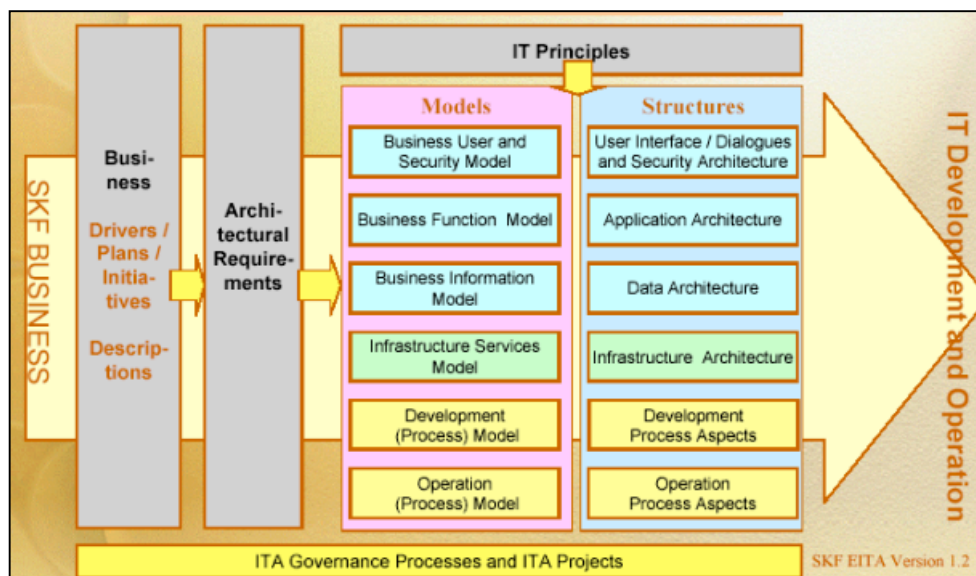


Figure 2 The SKF Enterprise IT Architecture (EITA)

SKF describes the EITA as follows:-

The SKF EITA describes all types of IT related components and the way they interact. It provides the base for short- and long-term satisfaction of SKF business requirements. It supports flexibility and innovation as needed for fast implementation of business relevant technology. It covers:

- Business Applications, Business Information and IT Infrastructure
- The whole of SKF, both globally and locally
- The SKF interaction with external partners and sources of knowledge and information

The objective of SKF's EITA is for that it becomes the foundation for managing and controlling the effectiveness of IT implementations. The scope included applications that support the processes, interfaces between applications, infrastructure and the governance organisation. It is divided into business oriented and IT oriented aspects to be able to document the inherent link between IT and the Business needs, i.e. the value of IT.

External influences on EITA that should also be documented were business drivers, plans and initiatives that in turn are influenced by SKF business strategies and IT opportunities. The SKF Business Strategy is the basis for the IT Strategy which is the foundation of the IT Principles. IT Opportunities, IT Related Projects and of course current IT Operations influence the IT Architecture Governance Process.

Reasons for choosing the SKF EITA Framework

The EITA was to be aligned with SKF's business strategies and needs leading to the following benefits:

- ☐ Reduced the time-to-market of new IT applications.
- ☐ Order in the House, enabling flexibility and readiness for new IT-initiatives.
- ☐ Safer operations: Higher availability, stability and reliability.
- ☐ Process efficiency.
- ☐ Reduction of future e-business infrastructure and systems operation costs.
- ☐ Avoidance of costly ad hoc solutions.

It was decided that five major business initiatives were to drive the development of the EITA. These were Supply Chain Application Integration (SCAI), Product Life-Cycle Management (PLM), Customer Relationship Management (CRM), Data Warehouse (DW) and the development of SKF's web site SKF.com. In addition, it was decided to only include IT information in the repository. The decision to omit business processes and other business oriented information was based on advice from the consultants involved. For documenting, the enterprise architecture IBM proposed a framework of its own, loosely based on the Zachman Framework and also suggested the use of a Lotus Notes database as the container for the documentation.

At the time of this article the desired result had not yet been achieved despite many man-weeks of effort. It has been exceedingly difficult to populate the database with information and convince users of the value of maintenance. Sarbanes Oxley initiatives have both overlapped and distracted focus from this project.

6 CRITICAL FACTORS

In this section we discuss the critical factors affecting modelling and management of enterprise architectures. We have grouped the critical factors around three areas that have shown to be central in the creation of an enterprise architecture, namely, Management, Scope and Content.

A successful Enterprise Architecture initiative requires top IT and business **MANAGEMENT** buy-in. Without this there is no driver to establish the documentation and the processes to keep it a living being. Besides deciding on a framework scope, it is important to have a governance structure in place to manage the process. This means not just governance of the framework itself, but safeguarding the alignment with other processes managing the enterprise lifecycle, e.g. investment and development processes. We believe the existence of such a process is imperative. The CIO Council describes a comprehensive process including implementation and maintenance of an Enterprise Architecture as the Enterprise Life Cycle (CIO Council 2001).

The establishment of an Enterprise Architecture is a long term investment, where it is difficult to show the benefits for the business management in the short term. The business manager has an operational focus whereas the EITA requires a long term strategic focus. This fact needs to be taken into consideration when involving the business and selling the initiative to management. At SKF the connection to the development process (projects) and the investment process has not yet been fully achieved. At AZ they have not yet reached a decision point on how to use the City Map in the long term.

We think the *raison d'être* for enterprise architecture must be known to the organisation. The logic for focusing on enterprise architecture is that it is the mechanism to create competitive advantage. If this

is not accepted then the chance of success is minimal. Many enterprises focus only on the framework and fail because they have not considered how to implement and maintain the architecture once defined. In our study SKF did not relate the changes to the architecture to the development process which modified it through projects. A review process was put into place, with an Architecture Board, but it considered only IT issues and the resulting review outcome did not result in an updated documentation of the architecture. In the AZ case they have decided not to implement an EITA at all but rather to develop the City Map to fill the void between IT and business as this is where the greatest need is and where the greatest value is achieved. More investments in IT architecture are expected to happen in the near future but at present it has not been decided in which way.

To document an enterprise architecture fully for any organisation is a massive task that demands certain criteria are fulfilled. The work must be managed as a major project by all definitions of a major project. It should be run as such with a project plan defining scope, sponsors, business objectives, and an implementation plan, training objectives, acceptance criteria and operational guidance. At SKF the roll out failed due to the volume of work that was entailed in generating the initial documentation and the lack of a target architecture to give meaning to the effort.

When implementing the enterprise architecture one is exposed to all the difficulties of implementing of any IT application. This means that there are no shortcuts. A successful implementation demands planning, training, communication and all the other components for a successful IT implementation. Training should not only be carried out during the implementation but also be provided to the stakeholders who should invest in the initiative.

The effects of outsourcing are not yet widely appreciated nor accounted for in frameworks. When a company has completely outsourced its IT, as in the case of SKF, or partially (infrastructure) in the case of AZ, the task of maintaining the documentation of the architecture takes on much greater dimensions. The maintenance process has to take into account that the development of the IT architecture may be the responsibility not just one but of several IT suppliers and that, the governance process is contractual with a strong focus on cost.

The **SCOPE** of the Enterprise Architecture to be documented is probably the most crucial factor affecting the success or failure of the whole initiative. By scope we mean which part of the organisation, which parts of the IS and which parts of the IT should be included in the initial project to create an enterprise architecture. The enterprise should have a clear understanding of why they need such architecture documentation at all and who will benefit from it. There must be an “As-is” documentation of the current architecture, an IT strategy, target architecture and a plan of how to reach it. (CIO Council 2001).

Many confuse Enterprise Architecture with IT architecture - i.e. they leave out the business part and think they have Enterprise Architecture. This was certainly the case at SKF. If the documentation produced is only of interest to the IT it will not survive. The business must be involved in the definition of the scope which initially should be a small part of the business and then increase step by step taking into consideration at each step the difference in focus between IT analysts and business people. The scope of the project should lead to a documentation that is of interest to both business and IT, is easy to access and distribute. This could in turn lead to a separate organisation being created to focus on Enterprise Architecture and the alignment of business and IT.

Projects in general fail when they try to take on too much. Success is dependent on establishing the development and maintenance process and then taking small steps. There are major differences between mature companies and newly started ones. New companies have no legacy and can start from scratch when describing their architecture whereas mature companies have an existing architecture that can be a massive task to document as was the case with SKF. In a large enterprise it would be sensible to start with a smaller business unit or one major process. We found that AZ was more successful as they in fact chose a much smaller scope than SKF who attempted to document the entire IT portfolio but not the processes.

There is a difference of opinion whether the approach to develop an enterprise architecture should be 'Top down' or 'Bottom Up' but what is most important is not to swallow the elephant in one go. The task of documenting it from top (business) to bottom (technology) or vice versa can be massive, take it gradually and start by prioritising the most important areas, reviewing the results before extending the scope. The most important issue is that both business and IT are involved and committed to the result.

To make the enterprise architecture useful and easily understood the **CONTENT** must have certain characteristics. To get the buy-in of the business community the business functions and processes must be included and described with relevant artefacts and in business terminology in line with the scope. The use of graphical artefacts to facilitate ease of understanding is of great importance. To omit the business functions and processes means that the enterprise architecture is reduced to a technical information source rather than a documentation to aid the alignment of business and IT to be used as a competitive mechanism.

The Enterprise Architecture documentation should contain IT principles (Boar 1999). The principles must/should be defined in a language that is easily understood by all the interested parties and not too detailed. Detailed principles tend to be considered more as rules or standards. Principles must guide the development of the architecture not restrict it. This does not mean there should not be rules or standards at the detailed/development level but at the architectural level, they should be broader to allow for innovation, in our opinion standards do not imply alignment nor should an EA restrict the road to the Target Enterprise as this means to reach it could change considerably due to new technologies.

Not everyone is interested in the information documented in an enterprise architecture. The content should be based on those identified as the future users. This identification of users should also lead to the identification of suitable artefacts. AZ chose a graphical model based on the architecture of a city in the same way Zachman bases his model on the building of a house. The result was a layered documentation, which could be made available for different types of stakeholders. SKF chose text based artefacts based on a template, rather than various graphical models and diagrams, which put much greater demands on the user and on those endowed with the initial documentation. Documenting legacy systems, by those not part of the original design, is not a trivial task. To not document, the target architecture is really to not understand the concept of Enterprise Architecture at all.

We suggest that artefacts should be as easy to understand as possible and based on the role of the persons who will use the artefact. So a process owner/business responsible should find artefacts written in business terms or in graphical models. Examples of artefacts are the Business Function Model, KIVIAT chart Capability Maturity Model, User Group Functionality Specification, Icon Templates. We think the content should be targeted at roles that have use for the documentation and not at users in general that have little or no interest. The level of detail should be adjusted accordingly. To support a structured documentation the architecture should be supported by a set of standard templates that can be used to define certain areas of the architecture.

7 KEY FINDINGS

What are the critical factors that affect the modelling and management of an Enterprise Architecture so that it will be successful? Our key findings are grouped in three main areas and provide recommendations in order to increase the chance of success of making the Enterprise Architecture easier to understand, access, distribute and maintain. Our case studies provide more insight into the problems and difficulties in establishing an Enterprise Architecture.

MANAGEMENT - Get top management buy-in, implement a governance process, align with other processes e.g. investment, aim for long term strategic focus, use as a competitive instrument, run as a several projects (step by step), consider new trends e.g. outsourcing. Ensure the Business and IT

strategies are defined, understood, and aligned and that the organisation is aware of its responsibilities concerning the documentation. This means in fact ensuring that the upkeep of the enterprise architecture becomes a part of the day to day business and organisation.

SCOPE - Start small and use a stepped approach but keep in mind to include As-is documentation of the architecture, an IT strategy is needed, as well as a “To-Be” or Target architecture and a sequencing plan. The scope should be agreed between business and IT and result in useful deliverables.

CONTENT - Choose relevant artefacts for the intended users and use easily understood language e.g. business terms for business people. Target the content on the users of the framework and make extensive use of graphical documentation e.g. UML, rather than text. Use templates for maintaining structure.

Finally, to model and manage an enterprise architecture a conscious choice of a framework is essential. In both of our empirical cases there was no conscious choice of framework. A framework should be chosen with the end-product in mind and focus should be on the alignment of business and IT. The framework should be chosen so that it leads to the required result that was intended in the scope definition and the choice of artefacts to populate the framework should make it easy to comprehend. The framework should give the required degree of structure to build a cohesive picture of the ‘As-is’ architecture. The risk of not choosing a framework or choosing an unsuitable framework can lead to ineffectiveness, unclear objectives and reduced ability to reach alignment of business and IT. Even if a suitable framework is chosen the risk of failure could be considerable if expectations are too high and scope too broad.

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