Towards an Enterprise Architecture based Strategic Alignment Model

An Evaluation of SAM based on ISO 15704

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Keywords: Strategic Alignment Model, SAM, Business/IT Alignment, Enterprise Architecture, ISO 15704.

Abstract: The Strategic Alignment Model (SAM) remains one of the most relevant and cited models aiming at helping managers to achieve business/IT (Information Technology) alignment. Several alternative approaches extend or improve this model. A notable stream of research suggests applying Enterprise Architecture principles complementarily or independently to the SAM. We analyze these proposals and argue that they are sometimes fuzzy and hard to compare because they all use a specific structure or vocabulary making the objectivation of their strengths and weaknesses difficult. Some common vocabulary and concepts such as those of the ISO 15704 standard on Enterprise Reference Architectures and Methodologies are needed to make their comparison rigorous. We report on our ongoing research, using this standard to analyse the SAM.

1 INTRODUCTION

Most organizations nowadays rely heavily on Information Technology (IT) applications and technologies to perform their business. Since some years now, the question of how to best use IT to and drive the business activity and support strategy is a concern of managers. The activity tackling this issue (as well as the desirable state resulting from it) is called strategic alignment or Business-IT Alignment (BITA).

The Strategic Alignment Model (SAM) (Henderson et al., 1993) remains one of the most relevant and cited models aiming at helping managers to achieve BITA. However, some limitations to that model have been identified. Several improvements have hence been proposed, including the possible benefits of applying Enterprise Architecture (EA) principles. Other EA approaches for BITA not directly connected to the SAM have also been proposed. In this paper, we briefly analyze these proposals and argue that (1) some remain hard to apply in practice because of lack of precise guidelines, (2) some forget about some important insights from the SAM, (3) each approach has specific strengths and weaknesses, and, last but not least, (4) they are hard to compare because each approach uses a specific structure or vocabulary making the objectivation of their strengths and weaknesses difficult.

Some common vocabulary and concepts are needed to make the comparison and evaluation of the approaches rigorous. The (ISO 15704, 2000) standard for Enterprise Reference Architectures and Methodologies provides these standard elements. As a first illustration of the use of that standard to clarify some aspects of EA frameworks for BITA, we evaluate the SAM with respect to the requirements of ISO 15504. We show what kind of insights can be gained from this analysis.

In section 2, we provide an overview of the SAM, discuss its limitations and strengths and describe extensions that have been proposed. Then we describe and evaluate approaches proposed at the crossroad of BITA and EA (section 3). This analysis highlights the need for a rigorous comparison and clarification of these approaches. Therefore in section 4, as a showcase, we analyse the SAM in the light of the (ISO 15704, 2000) standard before to conclude in section 5.

Goepp V. and Petit M..
Towards an Enterprise Architecture based Strategic Alignment Model - An Evaluation of SAM based on ISO 15704.
DOI: 10.5220/0004564003700375
In *Proceedings of the 15th International Conference on Enterprise Information Systems* (ICEIS-2013), pages 370-375
ISBN: 978-989-8565-61-7

2 THE STRATEGIC ALIGNMENT MODEL

2.1 SAM Overview

The SAM detailed in Henderson (1993) is an attempt first to refine the range of strategic choices managers face to achieve strategic alignment; and secondly to explore the way these choices inter-relate in order to guide management practices (Smaczny, 2001). It consists of four areas of strategic choices defined by (cf. Figure 1):

- *Domains*: Business and Information Technologies (IT);
- *Levels*: (that split domains): external (strategy) and internal (structure) ,
- *Components* (that characterize and compose each level): scope, competencies and governance in the external level; infrastructure, skills and processes in the internal level.

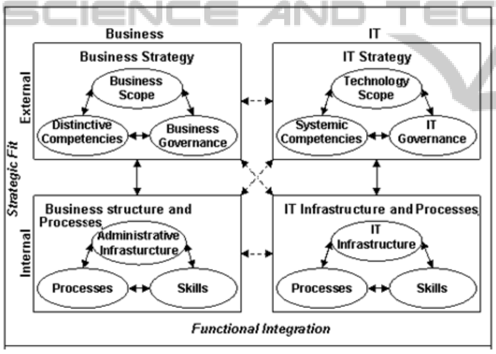

Figure 1: Strategic Alignment Model adapted from (Henderson et al., 1993).

The model is conceptualized in terms of two building blocks (Henderson et al., 1993):

- *Strategic fit:* the interrelations between external and internal levels of a domain and
- *Functional integration:* integration between the "Business" and the "IT" domains.

The SAM recognizes the need for cross domain relationships. As a result the detailed alignment perspectives work on the premise that strategic alignment can only occur when three of the four domains are in alignment. So, an alignment perspective draws a line through three of the four domains. Depending on the order in which the different building blocks (strategic fit and functional integration) are achieved, the SAM proposes four alignment perspectives: strategy execution, technology transformation, competitive potential and service level. They all begin at the external level.

2.2 SAM Advantages, Drawbacks and Improvement

The SAM has attracted a great deal of interest in the research community. It is the most widespread and accepted framework of alignment (Wang et al., 2008). However, the model remains particularly conceptual and the four alignment perspectives are mainly descriptive of the companies' strategic behaviour regarding their use of information and communication technologies. Therefore several authors underline the difficulty to apply the model in practice. For Reix (2000) this difficulty is linked to the fact that the model does not consider explicitly time and history. According to van Eck (2004), neither the choice between the four alignment perspectives nor the way to reach given alignment goals are guided. In the same line, Avison (2004) states that it is important that the SAM provides practical benefits, even if few works detail how a manager should use the SAM in practice other than to understand this framework conceptually. Fimbel (2006) synthesizes some features of the SAM that make it difficult to apply from a management point of view. For example, he states that the model encompasses a "rationalistic and sequentialistic view" of IS and strategic management that reduce these activities to decision making and preparation. Therefore, a certain set of works intend to improve the model. Within this set we identify two main research streams: (i) management-oriented frameworks; (ii) EA-oriented ones. The first is out of the scope of this paper and therefore not detailed here.

The second category proposes to use the principle of EA in order to improve or complement the SAM. These researches focus only on the SAM structure which is modified through splitting the domains and levels or through integration of additional dimensions. This is the case of the generic framework (Maes, 1999), the IAF (Integrated Architecture Framework) (Goedvolk et al., 2000) and the unified framework (Maes, 2000) that couples the generic framework and the IAF. The proposition of (Wang et al., 2008) is also based on the SAM and completed with a method dedicated to work out a specific EA for BITA. However, these proposals have two main drawbacks. First, they do not integrate the alignment perspective concept of the SAM. Secondly, they do not fully exploit the EA field. Indeed, the additional elements of these frameworks are not described formally in terms of modelling constructs for example.

In our view, EA seems to be a relevant direction for structuring BITA, the next section details the related works.

3 ENTERPRISE ARCHITECTURE

3.1 Business/IT Alignment with EA

When dealing with the notion of architecture, the most widespread definition is the one from the ISO/IEC/IEEE 42010 (2007) that defines "architecture" as: *"The fundamental organization of a system, embodied in its components, their relationships to each other and the environment, and the principles governing its design and evolution."* The open group architecture TOGAF (TOGAF, 2009) embraces this vision but the concept has two meanings depending on the context: (1) A formal description of a system, or a detailed plan of the system at component level to guide its implementation, or (2) The structure of components, their inter-relationships, and the principles and guidelines. Here, we focus on the second view of architecture. This view is consistent with BITA concerns. Therefore several authors propose to exploit the concept of EA for BITA. There are two research streams (i) proposition of specific EAs for business IT/alignment, (ii) exploitation/completion of existing EAs.

3.1.1 Proposition of Specific EAs

The first stream is the most widespread and consists in structuring BITA around dimensions, layers or levels. The number and kind of layers vary from a given architecture to another. Generally these sets of layers are coupled with specific processes dedicated to guide the achievement of BITA. We identify the following: GRAAL (van Eck et al., 2004; Wieringa et al., 2003), BITAM (Chen et al., 2005) and SEAM (Wegmann, 2007). It is interesting to note that contrarily to those mentioned in section 2.2, these proposals are not based strongly on the SAM and propose a different structure.

(van Eck et al., 2004; Wieringa et al., 2003) define the GRAAL framework in order to operationalize the business/IT problem for software architects. It consists of four architecture dimensions on which a system can be described: (i) *Lifecycle*, (ii) *Aspects,* (iii*) Service layers, (iv) Refinement.*

Even if a part of the dimensions proposed are kept implicit and therefore not exploited, GRAAL is the most detailed architecture we analyse. (Wieringa et al., 2003) suggest a top-down design approach for aligning the five layers of the GRAAL framework. They use a number of interdependent architecture descriptions drawn from the higher layers to the lowers ones searching equivalence between elements composing the different descriptions, keeping thus coherence.

BITAM (Business IT Alignment Method) (Chen et al., 2005) couples business analysis and architecture analysis. It defines three layers of a business system: Business model, Business architecture and IT architecture and proposes to manage three kinds of alignment between the layers: the business model to the business architecture, the business architecture to the IT architecture and the business model to the IT architecture. On this basis BITAM provides a set of twelve steps for managing, detecting and correcting misalignment. Misalignments are defined as improper mappings between the layers. Once misalignments have been detected, alignment strategies are selected and adopted in order to restore coherence in the mappings. The concept of layer is not defined. It can be interpreted in terms of domains that have to be aligned.

SEAM (Systemic Enterprise Architecture Methodology) (Wegmann et al., 2007) is an EA methodology structured in organisational levels. An organisational level describes the enterprise from the viewpoint of one or more specialists. SEAM considers four organisational levels: the business level, the company level, the operation level and the technology level. Each level describes either what currently exists (as-is) or what should exist (to-be) by using modelling techniques. This approach does not prioritise any of these levels to initiate or drive alignment. The alignment process is iterative and has three kinds of development activities: Multi-level modelling, Multi-level design and Multi-level deployment.

3.1.2 Exploitation of Existing EAs

The second stream consists in extending existing EA approaches and using them to support BITA. (Fritscher and Pigneur, 2011) propose an EA framework elaborated by extending the ArchiMate EA (Lankhorst, 2005) in order to incorporate lacking business model concerns, such as those tackled by the Business Model Canvas (Osterwalder and Pigneur, 2010). The resulting architecture includes three main layers (corresponding to a refinement of the three layers of ArchiMate): (i) *Business model*, (ii) *Application Portfolio* and (iii) *IT Infrastructure*. Modelling constructs to be used in order to describe the enterprise on all levels include those of ArchiMate plus those of the Canvas. The resulting architecture is richer than ArchiMate for dealing with business aspects but does not covers the IT strategy domain of the SAM. The approach also does not provide a precise method for ensuring alignment among layers but the way the layers may correspond is suggested by the application of the approach on a particular case study.

Another example is the work of (Cuenca et al., 2011). They define a set of five IS (Information System)/IT components that has to be included in EAs in order to support BITA; e.g. strategy definition in earlier life-cycle or application and services portfolio. In order to complete existing EAs building blocks are formalized and their links with traditional modelling construct described. The approach is interesting as it tries to formalize building blocks required for business IT/alignment. However, the analysis of exiting EA is very coarse and the set of components proposed is not justified.

3.2 Discussion

The works concerning BITA with EA are puzzling as there are as much architectures as authors. There is little consensus on the structure of an EA, among others on the dimensions that have to be included. Recurrent concepts of layer, level, viewpoint, abstraction are used without clarification of their signification, their necessity and their complementarity for achieving BITA.

Each architecture has its strengths and weaknesses. There is a need to evaluate and compare them in order to be able to select the best candidate for a particular BITA effort, or from a research point of view, to identify their potential improvements and combinations into a better one. However, because of the imprecisions about the definitions, this comparison is difficult to make.

One way to clarify these aspects is to use a standard. Standards are established through consensus building and represent a common view of a particular problem and can therefore naturally play the role of a common reference.

In this paper, similarly to (Cuenca et al., 2011), we propose to exploit the (ISO 15704, 2000) for this purpose. This standard describes requirements for enterprise-reference architectures and methodologies. The scope of the standard covers *those constituents deemed necessary to carry out all types of enterprise creation projects as well as any incremental change projects required by the enterprise throughout the whole life of the enterprise*. We consider that Business-IT alignment fits nicely into this scope.

As a first step to clarify EA-based approaches to alignment, in the sequel of the paper, we will use (ISO 15704, 2000) as a mean to evaluate the SAM as a reference architecture and methodology. Indeed, to the best of our knowledge, there are currently no approaches that combine the structure of the SAM and that fully exploit the principles of EAs.

4 EVALUATING SAM

4.1 Requirements for EA

The (ISO 15704, 2000) provides three kinds of requirements:

- *Applicability and coverage* describing the scope of a given EA considering the type of enterprise (generality) and the supported enterprise life-cycle stage (design and/or operation);
- *Concepts* describing the type of concepts that the EA enables to represent;
- *Components* describing the elements that compose the EA (methodologies, modelling languages, tools, …).

In the next section we analyse, according these requirements, the SAM of Henderson (1993).

4.2 SAM Analysis

The SAM fulfils the applicability and coverage requirements. Indeed, its scope is clear: *“defining the range of strategic choices managers face, during business IT/alignment, and exploring how they interrelate”* in order to provide alignment perspectives that define the role of management. In other words it is targeted at all classes of enterprises for the specific BITA concern. It is design driven as it provides management practices.

Concerning the concept requirements, we map the different components of the SAM to the type of concept defined in the standard (see upper part of Table 1). Some components are easy to map such as the skills in the IT and business domains. They correspond to human oriented concepts. For other components the descriptions that the SAM provides are not precise enough and can therefore be interpreted in different ways. For example, the processes in both domains could include technology oriented concepts (if the used technologies are part of the processes description), even it is not stated explicitly in the SAM descriptions. In this case the cell contains “?”. Even if the business and IT

Table 1: Mapping between SAM components with concept and modelling views requirements from (ISO 15704, 2000).

	Business						I/T					
Components	Business Scope	Distinctive competencies	Business Governance	Administrative Infrastructure	Processes	Skills	Technology Scope	Systemic competencies	I/T Governance	Architectures	Processes	Skills
Concepts												
Human		?	?	x		x		?	?	?		x
Process					x						x	
Technology		?			?		x	x		x	?	
Mission-fulfillment			x		x				x		x	
Control-fulfillment					x						x	
Views												
Function					x						x	
Information	x				x		x			x		
Resource		x	x		?	x	x	x	x	x		x
Organisation			x	x					x		?	

domains have the same component structures, the concept mapping can be different, if we base strictly on the SAM description. This is highlighted in the table with the cells in grey. For example, the IT architectures focuses on the portfolio of applications, the configuration of hardware, software and so on. Therefore, we map this component with technology and eventually with human oriented concepts. In comparison the administrative infrastructure focuses exclusively on human oriented concepts. Last but not least the business scope and distinctive competencies in the SAM find no equivalent in the standard requirements. This is not surprising as the SAM is a model dedicated to BITA, it has to integrate the company's positioning on the market. This is not mandatory for ISO 15704:2000 compliant EAs because its focus is more on (internal) enterprise engineering.

The analysis of the modelling view requirement is very interesting. It enables to reinterpret the way the SAM is organised according to domains (business/IT), levels (internal/external) and components (three for each sub-domain). Indeed, according to (ISO 15704, 2000), a modelling view allows presenting different subset of an integrated model to the user. These subsets enable to highlight relevant questions while hiding others. From this point of view, the domains, levels and components can all be considered as modelling views. These are not properly speaking integrated but put side by side, they provide a complete model of the strategic choices linked to BITA. The domains and levels can be considered as views that are useful either for a particular purpose (e.g. define strategy, design internal organisation) either for a stakeholder role (e.g. top business, IT manager, operations manager). Inside these sub-domains we interpret each of the twelve components of the SAM as a model-content based view (focusing on some specific type of model content).

The standard states that a model-based reference EA shall include at least four of such views: function, information, resource and organisation. These views are not detailed in the ISO 15704:2000 standard, therefore we use the definition and related modelling constructs provided in the (ISO 19439, 2006) and (ISO 19440, 2007). As a result we map them to the components of the SAM (see lower part of Table 1). On the external level the function view is not included. This seems logical as on this level the SAM intends to describe the arena in which the company competes. Here, the function view that considers processes, activities and their inputs and outputs is not useful. We consider that the business scope can be modelled partly by defining enterprise objects corresponding to enterprise products or services. Therefore, it is mapped to the information view. In the IT domain, the technology scope includes concepts related to the information and resources views. On the internal level, the business domain relates to all four views. The IT internal one does not include explicitly aspects related to the organisation view. This could however be the case at least for the processes ("?" in lower part of Table 1).

The life-cycle and life history requirements are not explicitly addressed in the SAM. It would be possible to elicit life cycle activities from the description of alignment perspectives and the role of each domain in the perspective (anchor, pivot, impacted). In this way life-cycle phases that are pertinent for BITA could be defined independently from the levels avoiding the confusion between internal/external and abstraction levels.

From the genericity requirement point of view, the SAM provides generic concepts. So, it enables to support generic, partial and particular models. The SAM does not fulfil the other component requirements of the standard: it includes no methodology, no modelling languages and no tool.

5 CONCLUSIONS

In this paper we exploit the (ISO 15704, 2000) to analyse the conformance of the SAM to EA frameworks and methodologies requirements. The analysis is not always easy to perform because of the sometimes imprecise definitions of the SAM that often require interpretation. Regarding conformance, the SAM meets the applicability and coverage requirements.

Concerning the concepts, it covers to some extent all required aspects (human, process, technology, mission-fulfilment, control fulfilment) and provides additional ones specific to BITA (mainly business scope and distinct competencies). According to (Henderson et al., 1993) the business and IT domains of the SAM shall have the same structure, our analysis shows that they do not exactly address the same aspects. The use of the ISO standard pushes to clarify the nature of the dimensions the SAM proposes. We interpret them as modelling views (model content and purpose). Even if the four mandatory views of ISO (function, resources, organisation, and information) are not explicitly defined in the SAM, each of them is somehow addressed.

Concerning the components, apart from the type of model supported, the SAM does not provide any of life-cycle, methodology, modelling languages and tool. This is consistent with the SAM's limitation already identified in the literature. Our analysis makes them more explicit, structured and objective. It also underlines the relation between SAM perspectives and the ISO notion of lifecycle. This provides an interesting future research direction.

We also plan, in the future, to further analyse the other approaches mentioned in the paper. In this way their comparison and the evaluation of their conformance to the standard requirements will be possible, leading to the identification of clear directions for their improvement or selection.

REFERENCES

Avison, D., Jones, J., Powell, P., Wilson, D., 2004. Using and validating the strategic alignment model, *Journal of Strategic Information Systems, vol. 13,* issue 3, p. 223-246.

Chen, H. M., Kazman, R., Garg, A., 2005. BITAM: An engineering-principled method for managing misalignments between business and IT architectures, *Science of Computer Programming,* vol.57, issue 1, p.5-26.

Cuenca, L., Boza, A., Ortiz, A., 2011. Architecting Business and IS/IT Strategic Alignment for Extended Enterprises, *Studies in Informatics and Control, vol. 20, issue 1*, p. 7-18.

Fimbel, E., 2006. Besoins de modélisation de l'alignement stratégique des S.I.: le cas d'entreprises du secteur agroalimentaire, *in Colloque ENITIAA, Nantes, France.*

Fritscher, B., Pigneur, Y., 2011. Business IT alignment from business model to enterprise architecture, in Lecture Notes in Business Information Processing, *Advanced Information Systems Engineering Workshops (CAiSE 2011 Workshops), London, p. 4-15.*

Goedvolk, H., van Schijndel, A., van Swede, V., Tolido, R., 2000. The Design, Development and Deployment of ICT Systems in the *21st Century: Integrated Architecture Framework (IAF),* Cap Gemini Ernst and Young.

Henderson, John C., Venkatraman, N., 1993. Strategic alignment: leveraging information technology for transforming organizations*, IBM Systems Journal, vol. 32, issue 1, p. 4-17.*

ISO 15704, 2000. Industrial automation systems - Requirements for enterprise-reference architectures and methodologies.

ISO 19439, 2006. Enterprise integration - Framework for enterprise modelling

ISO 19440, 2007. Enterprise integration -- Constructs for enterprise modelling.

ISO/IEC/IEEE 42010, 2007. Systems and software engineering - Architecture description.

Lankhorst, M., 2005. Enterprise architecture at work: Modelling, communication and analysis, Springer.

Maes, R., 1999. A Generic Framework for Information Management, Prima Vera Working Paper, *Universiteit Van Amsterdam.*

Maes, R., Rijsenbrij, D., Truijens, O., Goedvolk, H., 2000. Redefining Business–IT Alignment through A Unified Framework, *in Universiteit Van Amsterdam/Cap Gemini White Paper.*

Osterwalder, A., Pigneur, Y., 2010. Business model generation: a handbook for visionaries, game changers, and challengers, Wiley.

Reix, R., 2000. Information system and organization management (in French), Vuibert, Paris.

Smaczny, T., 2001. Is an alignment between business an information technology the appropriate paradigm to manage IT in today's organisations?, *Management decision,, vol. 39, issue 10, p. 797-802.*

TOGAF, 2009. The Open Group Architecture Framework -Version 9.1 [available online http://pubs.opengroup.org/architecture/togaf9-doc/arch/ last access 4th September 2012].

van Eck, P., Blanken, H., Wieringa, R., 2004. Project GRAAL: Towards operational architecture alignment, International *Journal of Cooperative Information Systems, vol. 13, issue 3,* p. 235-255.

Wang, X., Zhou, X., Jiang, L., 2008. A method of business and IT alignment based on enterprise architecture, in *IEEE International Conference on Service Operations and Logistics, and Informatics,* p. 740-745.

Wegmann, A., Regev, G., Rychkova, I., Lê, L. S., De La Cruz, J. D., Julia, P., 2007. Business and IT alignment with SEAM for enterprise architecture, in 11th IEEE International Enterprise Distributed Object Computing *Conference, EDOC 2007,* Annapolis, MD, p. 111-121.

Wieringa, R. J., Blanken, H. M., Fokkinga, M. M., Grefen, P. W. P. J., 2003. Aligning application architecture to the business context, in Conference on Advanced Information System Engineering *(CAiSE 2003), Klagenfurt/Velden, Austria,* p. 209-225.