Meta-modelling the Strategic Alignment Model for Aligning Information Systems Support to Specific Application Domains

Oscar Avila[1] and Virginie Goepp[2]
[1]*Department of Systems and Computing Engineering, School of Engineering, University of Los Andes, Bogotá, Colombia*
[2]*INSA de Strasbourg-Icube, Strasbourg, France*

Keywords: Information System, Metamodel, Strategic Alignment, Strategic Alignment Model (SAM), Specific Domain.

Abstract: In the current competitive worlwide market, Information Systems (IS) are today necessaries in order to support specific application domains or business areas that can give a strategic advantage to organizations. In this context, IS alignment that exists when the IS and business goals and activities are in concordance, becomes crucial. Several approaches have been proposed for building IS alignment. However, for aligning IS support to specific application domains it is necessary to deal with their specific characteristics. Reviewing the literature, IS alignment approaches addressing these specific characteristics have been proposed by extending the Strategic Alignment Model (SAM) (Henderson and Venkatraman, 1993). Nevertheless, means for building new models from the SAM constitutive elements have not been proposed yet. To cope with this lack, we propose two metamodels: the SAM static view metamodel and the SAM dynamic view metamodel. The instantiation of these metamodels enables the build up of new models addressing the alignment of IS support to specific application domains.

1 INTRODUCTION

In recent years, the emergency of a competitive worlwide market and other evolutive forces have impacted several industrial sectors resulting in increased competitiveness needs. These challenges have encouraged the development of flexible Information Systems (IS) supporting specific application domains such as manufacturing, finance, knowledge management that can give a strategic advantage to companies.

As a result the role and importance of such IS have changed significantly over time shifting from simple activity and business process support to competitive advantage provider (Gao et al., 2008; Wu and Ellis, 2000). To meet this objective IS strategic alignment that studies the link between the IS and the business organisations goals and activities, becomes crucial. It exists when both elements are in harmony (McKeen and Smith, 2003). Thus, it is not surprising that executives rank alignment for almost 30 years as a top priority and major concern (Luftman and Ben-Zvi, 2011).

Several approaches have been proposed for building IS alignment (Avila et al., 2009; Ullah and Lai, 2013). Most of them address general characteristics related to Business and Information Technologies (IT) domains. However, for aligning IS support to specific application domains it is necessary to deal with their specific characteristics. Indeed, these domains are characterized by: (i) the heterogeneity of the activities involved in their processes (Goepp et al., 2008; Kalpic and Polajnar, 1997); (ii) the range of users that are various and not experts in IT. As a result they have specific needs that have to be taken into account through personalization in usability and functionality (Fan and Poole, 2006); and (iii), the need for integration between the IS support to these domains and other systems, infrastructures and facilities of the company (i.e. manufacturing infrastructures, ERP systems, ...) (Lin et al., 2012). In this way, generic IS alignment approaches are no suitable as they do not address these specificities. As a result approaches for aligning IS support to specific application domains are necessary.

Reviewing the literature, IS alignment approaches for specific application domains have been proposed mainly by extending the Strategic Alignment Model (SAM) (Henderson and Venkatraman, 1993). The SAM draws a distinction between the external perspective of IT (IT strategy) and its internal development (technology infrastructure and IT processes). From this point of view, the SAM explicitly gives a

Avila O. and Goepp V..
Meta-modelling the Strategic Alignment Model for Aligning Information Systems Support to Specific Application Domains.
DOI: 10.5220/0005568300940099
In *Proceedings of the 12th International Conference on e-Business* (ICE-B-2015), pages 94-99
ISBN: 978-989-758-113-7

strategic role to and structures IT to support the external positioning of the company. The same rational can be applied to specific application domains by applying the SAM constitutive elements to these domains. However these elements have not been formalized yet and there are no means of facilitating the creation of new specific models for specific domains. Indeed, existing extensions such as (Goedvolk et al., 2000; Maes, 1999; Sun and Chen, 2008) extends the SAM from scratch, without following any extension formalism or logic, what prevents the fully exploitation of the whole SAM characteristics for alignment.

Therefore the objective of this paper is to provide means for supporting the building of models for aligning IS support to specific application domains that can give a strategic advantage to the company. Such means consist in two metamodels of the SAM which allows the construction of new models by the instantiation of its constitutive elements. To succeed in, firstly we analyse the SAM and its existing extensions in order to extract their constitutive elements. Then, from these elements, we define the two SAM metamodels: (i) the metamodel of the SAM static view (or SAM structure) and (ii) the metamodel of the SAM dynamic view (or SAM alignment sequences) which constitutes means for the construction of new models by instantiating them. This paper presents our proposal as follows: Section 2 presents the SAM model. Section 3 analyses SAM extensions. Section 4 describes the SAM metamodels. Finally, section 5 concludes the paper and outlines future work.

2 THE STRATEGIC ALIGNMENT MODEL (SAM)

2.1 The SAM Structure

The SAM (Henderson and Venkatraman, 1993) is structured in terms of three classes of concepts:

- Domains: two domains are involved: Business and IT;
- Perspectives or levels: these split domains into two subdomains: external (strategy) and internal (structure);
- Components: each subdomain is further detailed through three components describing the set of decisions to be taken in the alignment border: scope, competencies and governance in the external level; infrastructure, skills and processes in the internal level.

2.2 SAM Building Blocks and Alignment Sequences

The SAM is conceptualized in terms of two fundamental characteristics of strategic management also called building blocks (Henderson and Venkatraman, 1993):

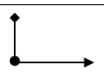
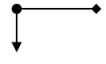
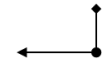
- Strategic fit: the interrelationships between external and internal levels of a domain and
- Functional integration: integration between the Business and the IT domains. On the internal level, it is named operational integration. On the external level, the link between Business and IT strategies refers to strategic integration.

According to (Luftman et al., 1993), a domain can be classified according to its position in an alignment sequence as (i) Anchor domain; (ii) Pivot domain; (iii) Impacted domain. In (Henderson and Venkatraman, 1993) four alignment sequences are provided that address strategic fit and functional integration. They follow three building rules:

- Alignment rule A: An alignment sequence deals with a cross-domain relation in the form of a strategic fit and a functional integration, implying three domains.
- Alignment rule B: An alignment sequence runs from the anchor domain to the impacted domain through the pivot domain.
- Alignment rule C: the SAM considers only planned sequences as a result the anchor domain takes place at the external level.

The four proposed sequences are described in Table 1 in which we represent the anchor domain with a square, the pivot domain with point and the impacted one with a triangle.

Table 1: SAM alignment perspectives adapted from (Henderson and Venkatraman, 1993).

Name of the perspective	Perspective	Anchor domain
Strategy Execution		Business strategy
Technology Transformation		Business strategy
Competitive Potential		IT strategy
Service Level		IT strategy

2.3 SAM Explotatiton Works

The SAM has attracted a lot of researchers. The works related to the use and exploitation of the SAM, can be divided in three main research streams: (i) enhancement of the SAM use through additional exploitation processes; (ii) application of the SAM to other research fields and (iv) SAM extensions.

The first stream tries to operationalize the SAM for management purposes at a strategic level. For example, in (Luftman et al., 1993) the SAM and the four planned sequences are exploited in order to choose the IT strategy and planning method that the best fits to a given sequence. In (Luftman, 1996), the model is reviewed in order to identify enablers and inhibitors to alignment within organisation. In (Avison et al., 2004), the SAM is completed with a set of steps helping managers to identify the current level of alignment with the business and also to control future alignment.

The second research stream is more recent and consists in using the SAM as a framework exploited for a specific concern or coupled with other fields. First, in the area of inter-organizational IS alignment, the SAM is used as a basis to tackle this specific kind of alignment (Neubert et al., 2011) and (Sun and Lai, 2011). Second, the SAM is replaced in other research fields such as enterprise architecture design (Lopata et al., 2012; Van Eck et al., 2004; Wang et al., 2008) or ITIL (Information Technology Infrastructure Library) (Esmaili et al., 2010; Kashanchi and Toland, 2006).

Last, the SAM has been extended in order to give a more strategic role to specific application domains or business areas and deal with their specific characteristics. Among the extensions of the SAM we can find the Generic Framework (Maes, 1999), the Integrated Architecture Framework (IAF) (Goedvolk et al., 2000), the Unified framework (Maes et al., 2000) and the Knowledge Management Strategic Alignment Model (KMSAM) (Sun and Chen, 2008). An analysis of these extensions is made in order to verify the potential contributions of these works to our goal. Thus, for each extension, we present how the extension was performed and its features and objectives.

3 THE SAM EXTENSION WORKS

3.1 The Generic Framework

Maes proposes in (Maes, 1999), the Generic Framework that aims at separating the issues related to information management to these related to IT support, while providing a central role to information. This framework is a double extension of the original SAM: (i) The first extension consists in replacing the internal level (structure and process) of the original SAM by two new levels: the “structure” and “operations” levels. The structure level, allocated to the centre, plays the role of “hub” between the formulation of long-term strategic vision (strategy level) and the performing of organizational short-term operations (operations level). (ii) The second extension adds a new domain, namely, “Information / Communication” (I/C) which seeks to separate the issues related to information management to these related to IT support, while giving a central role to the information.

The only subdomains remaining unchanged in this extension are Business strategy and IT strategy. Other subdomains contain modified components from those proposed in the original SAM. However, the content of different components of the generic framework are not detailed and remain therefore fuzzy.

3.2 Integrated Architecture Framework (IAF)

The Integrated Architecture Framework (IAF) (Goedvolk et al., 2000) aims at supporting Enterprise Architecture work. It is a three dimension framework. The first dimension represents the domains that are taken into account. There are four domains. As, for the generic framework, the information domain is added. The IT domain is further divided into information system and technology infrastructure. The second dimension is the levels addressed. There are three: the contextual level related to the external level of the SAM and the conceptual, logical and physical levels related to the internal level of SAM. They correspond to design phases. The third dimension introduces specific concerns, for example, Governance and Security. Both concerns aim at integrating related issues at the four framework domains. This framework does not describe the characteristics of its dimensions, domains or levels.

3.3 The Unified Framework

The unified framework (Maes et al., 2000) combines the generic framework and the IAF. Both frameworks have different purposes. The generic framework is a tool for management, enabling to position and interrelate the different aspects of information management and hence of the business-IT relationship. The IAF is a design tool, aiming at the development of mutually aligned business and IT system through a unified architecture. As a result, the unified framework contents both management and design components. The

columns of the unified framework are the same as for the IAF but renamed technology systems and technology infrastructure. The rows detail the management concerns with the three levels of the unified framework (strategy, structure, operations). The third dimension represents the design concerns. The contextual design level is mapped to the strategy level. The conceptual, logical and transformational design levels are mapped to the structure level. Here, the SAM structure is refined with additional domains and levels and further extended with an additional dimension.

3.4 Knowledge Management Strategic Alignment Model (KMSAM)

The KMSAM (Sun and Chen, 2008) is the result of a study made by the authors on the importance of aligning Business, Knowledge Management and IT strategies. According to this study, the alignment of these three strategies can lead to improve knowledge management and organization performance. This extension involves: (i) A new external domain to the original SAM, i.e., the knowledge management strategy, which nature is not detailed (ii) Two alignment sequences between the new external domain (knowledge management strategy) and the two external domains originally defined in the SAM (Business strategy and IT strategy). The interpretation of the two alignment sequences is described as follows: (i) On the one hand, the alignment between the IT strategy and the Knowledge Management strategy is interpreted by the authors as the choice of IT support for knowledge storage and the creation of knowledge networks. (ii) On the other hand, the alignment between Business strategy, IT strategy and Knowledge Management strategy is interpreted as the development of knowledge resources (models, networks, etc.) to articulate the implementation of the Business strategy within the organization, while using the most adapted IT.

3.5 Analysis of the SAM Extensions

Works previously studied aim at extending the structure of the original SAM and providing alignment sequences. Works extending the SAM structure add new:

- Domains: Works adding new organizational domains like (Maes, 1999; Goedvolk et al., 2000; Sun and Chen, 2008) attempt to give a more strategic role to these domains, taking advantage of their features, to improve the performance of the organization or strengthen its position on the market.
- Levels or perspectives: Works adding new perspectives or levels to the original SAM (Maes, 1999; Sun and Chen, 2008) intend to synchronize strategic objectives, placed externally and generally defined to long-term, and the deployment of resources, placed internally and generally defined to medium / short term.
- Dimensions: The only work adding a new dimension is the IAF (Goedvolk et al., 2000). It aims at integrating concerns related to "governance" and "security" to the 4 domains proposed in this framework.

These works do not detail the nature or composition of the dimensions, levels or domains added. Indeed, the generic framework is the only work describing the components that constitute the added domains. However, this description is fairly general and does not specifically detail the decisions and activities related to each component.

Concerning the alignment sequences, the extension works, with exception of the KMSAM, do not provide new ones for aligning the new domains to those already existing in the original SAM. The KMSAM provides two alignment sequences for integrating the Business, Knowledge Management and IT strategies. However, these alignment sequences do not support the implementation and execution of these strategies because the internal level is not taken into account.

3.6 Towards the SAM Metamodels

A metamodel abstracts the concepts and relations of a specific domain and represents the structure of this specific domain defining what can and cannot be expressed in the models (Kühne, 2006). Typically, the process of models and metamodels construction follows a chronological order where the metamodel is created before the model. However, in some contexts this is not the case (Gómez et al., 2012).That is the case of IS alignment context, in which the construction of the SAM and its extensions models did not follow this order. In fact, the SAM was proposed by replicating the Business domain structure in order to build up the IT domain. Therefore, as the Business domain involved two levels (external and internal) and three components at each level, the IT domain includes: two levels with three components at each level. Furthermore, as we argued in the last subsection, the SAM extensions for specific applications were built up mainly by replying this same logic.

In order to facilitate the construction of new SAM extensions we propose to metamodel the SAM structure and alignment sequences. Indeed, the instantia-

tion of the resulting metamodels will allow the building of the structure for specific IS alignment models as well as the proposition of specific alignment sequences. To succeed in we undertake the following work in the next section: (i) An analysis of the structure of the original SAM and its extensions, what we call the SAM static view, in order to identify their structure principles and provide the static metamodel view. (ii) An analysis of the alignment sequences of the original SAM, what we call the SAM dynamic view, in order to find out their building principles and provide the dynamic metamodel view.

4 THE SAM METAMODELS

A metamodel is a way to describe the elements of the reality and the valid ways to relate them (Bézivin, 2005). Thus, using metamodels is very pertinent in the IS alignment field as alignment models need to be built by following semantic concepts representing components, issues, concerns.

4.1 Static Metamodel View

As we showed in the last section, the static view of the SAM and its extensions includes structure elements such as: domains, levels, concerns and components. In fact, the SAM domains are devised by levels and are characterised by components on which concerns must be addressed. We propose thus to take into consideration four structure elements for the static metamodel view (see Figure 1):

- Domain: representing functional areas, organisational areas, organisational viewpoint etc.
- Level: dividing domains and giving them abstraction or implementation hierarchy.
- Component: complex constituent grouping decisions with similar characteristics for the domains.
- Concern: representing matters or issues (governance, security, etc.) on related components.

4.2 Dynamic Metamodel View

As we showed previously, alignment between SAM domains involves the following conceptual elements that we take into consideration for the dynamic view metamodel (see Figure 2):

- Building block: relationship representing alignment between two domains or two levels.
- Alignment sequence: cross domain relationship that involves more than one building block.

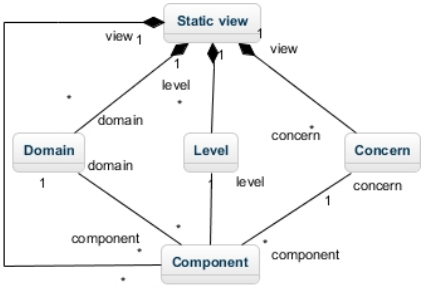


Figure 1: Metamodel of the SAM static view.

- Role: characterising domains in the alignment sequence.
- Building Rules: principles that governs the construction of alignment sequences.

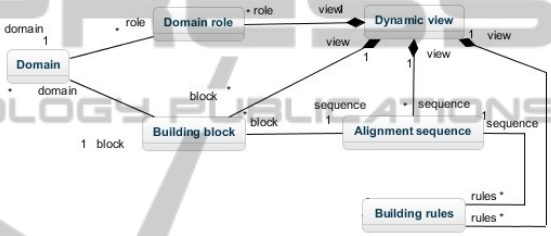


Figure 2: Metamodel of the SAM dynamic view.

5 CONCLUSIONS

IS alignment is a crucial concern for many companies seeking the best value from their IT investments. To succeed, analyst need models on which they can rely. In this boarder, our objective here is to provide means to work out such models that are adapted to specific concerns and application areas such as manufacturing, product design or finance. Therefore we propose to extract the metamodels of the SAM that is one of the most widespread models of alignment. On the one hand we build the static metamodel view formalizing the concepts of domain, level, component and concern. This view enables the formalization of the decisions that have to be made to build strategic alignment. On the other hand we propose the dynamic metamodel view. It formalizes alignment building blocks, domain roles and building rules for building specific alignment sequences. These represent the way the decisions are interrelated during alignment. These metamodels are a first step to create new alignment models for specific areas or concern. However to show their applicability it is necessary to address a study case and to facilitate the building of

new models and alignment sequences from them to implement a software tool.

REFERENCES

Avila, O., Goepp, V., and Kieffer, F. (2009). Understanding and classifying information systems alignment approaches. *Journal of Computer Information Systems*, 50(1).

Avison, D., Jones, J., Powell, P., and Wilson, D. (2004). Using and validating the strategic alignment model. *The Journal of Strategic Information Systems*, 13(3):223–246.

Bézivin, J. (2005). On the unification power of models. *Software & Systems Modeling*, 4(2):171–188.

Esmaili, H. B., Gardesh, H., and Sikari, S. S. (2010). Strategic alignment: Itil perspective. In *Computer Technology and Development (ICCTD), 2010 2nd International Conference on*, pages 550–555. IEEE.

Fan, H. and Poole, M. S. (2006). What is personalization? perspectives on the design and implementation of personalization in information systems. *Journal of Organizational Computing and Electronic Commerce*, 16(3-4):179–202.

Gao, X., Li, Z., and Li, L. (2008). A process model for concurrent design in manufacturing enterprise information systems. *Enterprise Information Systems*, 2(1):33–46.

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

Goepp, V., Kiefer, F., and Avila, O. (2008). Information system design and integrated enterprise modelling through a key-problem framework. *Computers in Industry*, 59(7):660–671.

Gómez, P., Sánchez, M., Florez, H., and Villalobos, J. (2012). Co-creation of models and metamodels for enterprise architecture projects. In *Proceedings of the 2012 Extreme Modeling Workshop*, pages 21–26. ACM.

Henderson, J. C. and Venkatraman, N. (1993). Strategic alignment: Leveraging information technology for transforming organizations. *IBM systems journal*, 32(1):4–16.

Kalpic, B. and Polajnar, A. (1997). Model of the holistic information integration of an enterprise. *Strojarstvo*, 39(6):275–280.

Kashanchi, R. and Toland, J. (2006). Can itil contribute to it/business alignment? an initial investigation. *Wirtschaftsinformatik*, 48(5):340–348.

Kühne, T. (2006). Matters of (meta-) modeling. *Software & Systems Modeling*, 5(4):369–385.

Lin, H. W., Nagalingam, S. V., Kuik, S. S., and Murata, T. (2012). Design of a global decision support system for a manufacturing sme: towards participating in collaborative manufacturing. *International Journal of Production Economics*, 136(1):1–12.

Lopata, A., Ambraziunas, M., and Gudas, S. (2012). Knowledge based mda requirements specification and validation technique. *Transformations in Business & Economics*, 11(1):248–260.

Luftman, J. and Ben-Zvi, T. (2011). Key issues for it executives 2011: cautious optimism in uncertain economic times. *MIS Quarterly Executive*, 10(4):203–212.

Luftman, J. N. (1996). *Competing in the information age: strategic alignment in practice*. Oxford University Press.

Luftman, J. N., Lewis, P. R., and Oldach, S. H. (1993). Transforming the enterprise: The alignment of business and information technology strategies. *IBM systems journal*, 32(1):198–221.

Maes, R. (1999). *A generic framework for information management*. Universiteit van Amsterdam, Department of Accountancy & Information Management.

Maes, R., Rijsenbrij, D., Truijens, O., and Goedvolk, H. (2000). *Redefining business: IT alignment through a unified framework*. Universiteit van Amsterdam, Department of Accountancy & Information Management.

McKeen, J. D. and Smith, H. A. (2003). *Making IT Happen: Critical Issues in IT Management*. Wiley.

Neubert, G., Dominguez, C., and Ageron, B. (2011). Interorganisational alignment to enhance information technology (it) driven services innovation in a supply chain: the case of radio frequency identification (rfid). *International Journal of Computer Integrated Manufacturing*, 24(11):1058–1073.

Sun, K. and Lai, W. C. (2011). Isam-based interorganization information systems alignment process. In *Computer Science and Service System (CSSS), 2011 International Conference on*, pages 1358–1361. IEEE.

Sun, S.-Y. and Chen, Y.-Y. (2008). Consolidating the strategic alignment model in knowledge management. *International Journal of Innovation and Learning*, 5(1):51–65.

Ullah, A. and Lai, R. (2013). A systematic review of business and information technology alignment. *ACM Transactions on Management Information Systems (TMIS)*, 4(1):4.

Van Eck, P., Blanken, H., and Wieringa, R. (2004). Project graal: Towards operational architecture alignment. *International Journal of Cooperative Information Systems*, 13(03):235–255.

Wang, X., Zhou, X., and Jiang, L. (2008). A method of business and it alignment based on enterprise architecture. In *Service Operations and Logistics, and Informatics, 2008. IEEE/SOLI 2008. IEEE International Conference on*, volume 1, pages 740–745. IEEE.

Wu, B. and Ellis, R. (2000). Manufacturing strategy analysis and manufacturing information system design: Process and application. *International Journal of Production Economics*, 65(1):55–72.