An architectural approach to IT–business alignment

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Abstract

Information technologies have evolved from their traditional back-office role to a strategic resource role that can not only support but also shape business strategies. Still, different analytical sources indicate that only a small number of projects complete on-time and on-budget, leading to initially specified goals and results. The main problem is the creation and formalization of an IT–business alignment mechanism which for over a decade has been ranked as a top-priority management concern and is widely covered in theoretical literature. However, the field is dominated by conceptual studies, while there is little research on practical ways to achieve the alignment. Moreover, most of the existing research focuses on the alignment assessment using questionnaire methods based on the subjective judgement of IT and business executives. From this point of view, Enterprise Architecture development as a methodological approach to the mutually aligned business and IT architectures' design, represents a suitable tool for solving this problem. However, most of the existing EA approaches do not distinguish between different IT–business alignment perspectives. This paper attempts to provide practical guidance for IT–business alignment as well as strategic guidance for EA development by integrating the traditional Strategic Alignment Model and the TOGAF framework.

Key words: IT–business alignment, Enterprise Architecture, SAM, TOGAF, Alloy Analyzer.

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Introduction

In the context of today's dynamic, highly competitive business environment, it is crucial for a company's survival that it acquire a high level of strategic flexibility, which, in turn, requires agile organizational structure and processes, and, therefore, flexible underlying information system architecture. As research into global IT trends shows [1], there has been a consistent increase in IT budgets across various companies for the last four years (*Figure 1*).

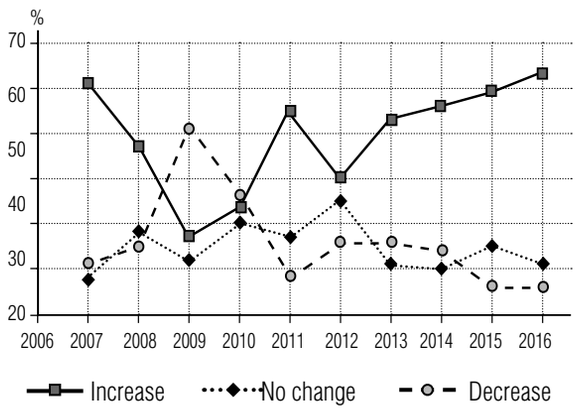


Fig. 1. IT budgets (based on the data provided in [1])

But as the IT project budgets increase, their success rates do not rise. Research into IT project delivery results conducted by the Standish Group (http://www.standishgroup.com/) in 2015 on 50,000 IT projects around the world indicates that only 30% of projects reviewed completed on-time and on-budget, with all features and functions as initially specified. Meanwhile, 52% of the projects examined completed over-budget, over the time estimate, and with fewer features and functions than originally specified. Overall, across all companies, the average cost overrun was 189% of the original cost estimate, and the average time overrun was 222%, which, obviously, does not contribute to return on IT investments. Moreover, 19% of projects were cancelled at some point during the development cycle.

Thus, IT, or as it sometimes called digital, strategy is not just about automating existing processes, or making cost savings, or managing complex systems using information technologies. As the Harvey Nash/KPMG CIO Survey states, "the real value of digital strategy lies in how you stitch digital technologies together to create competitive advantage and business growth" [2]. The real problem stands in the grade of coherence between IT and business strategies.

In fact, the strategic alignment of business and information systems has consistently been reported as one of the key concerns of business and IT managers across different industries. From this point of view, it represents an important issue in the field of organizational modeling of enterprises. According to research on international IT management trends [1], the alignment issue has held its position in the top-three key concerns of IT managers since 2000, along with business agility, productivity and cost reduction (*Figure 2*).

As one can see, the problem of IT cost reduction has never risen above fourth place, confirming the fact that business leaders do realize and admit the possible contribution of IT

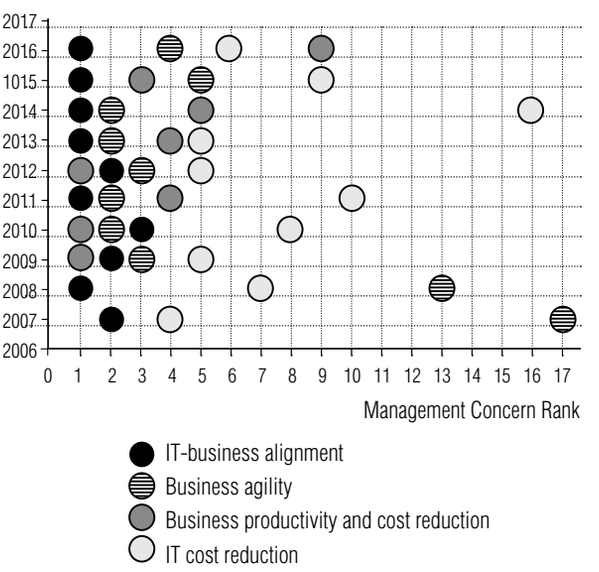


Fig. 2. Top IT management concerns (based on the data provided in [1])

to the organization's value chain and are ready to spend resources on IT projects, but only if there is a positive return on IT investments, which directly depends on the degree of coherence between IT and business within an organization.

The trend is caused by benefits alignment may provide, as well as risks entailed by misalignment. IT–business alignment enables an organization to enhance its flexibility and maximize return on IT investments, which, in turn, leads to increased profitability and sustainable competitive advantage. Thus, failure in leveraging IT may have a considerable negative effect on a firm's performance and viability [3–7].

This paper offers an approach to IT–business alignment based on the TOGAF framework and the Strategic Alignment Model. It is organized as follows: Section 1 summarizes the theoretical background relevant for the approach proposed; Section 2 presents the linkage between the main components of SAM and TOGAF frameworks; in the final section, conclusions are drawn and areas for future research are identified.

1. Theoretical background

An extensive body of research has been conducted on the nature of the IT–business alignment, criteria for its evaluation and approaches to address the issue. IT–business alignment can be determined as "the extent to which the IS strategy supports and is supported by the business strategy" [8] or as "the degree to which the IT mission, objectives and plans support and are supported by business mission, objectives and plans" [9].

However, many researchers consider alignment to be not a static state that can be measured at a single point in time but rather a continuous process of adjustment of business and IT domains [6, 8, 10, 11].

One of the most fundamental and well-recognized alignment frameworks is the Strategic Alignment Model (SAM) [6, 12]. *Figure 3* is a schematic representation of the SAM illustrating an integration of the business domain, consisting of business strategy and organizational infrastructure and processes, and the IT domain represented by IT strategy and IS infrastructure and processes. The authors distinguish between two types of domain integration:

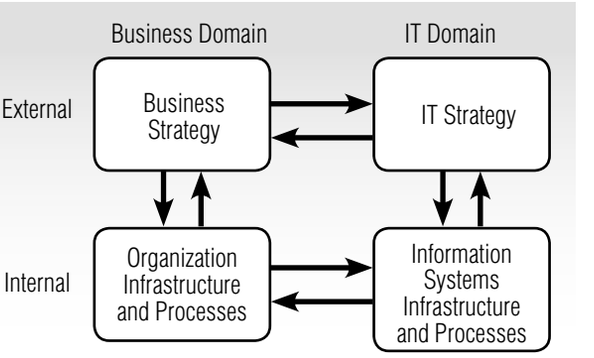


Fig. 3. Strategic Alignment Model (adapted from [12])

1. Strategic integration (of external business and IT domains): the link between business and IT strategies reflecting the capability to leverage IT strategy to both shape and support business strategy;

2. Operational integration (of internal business and IT domains): the link between organizational infrastructure and processes and IS infrastructure and processes reflecting coherence between internal customer requirements and expectations and the delivery capability within the IS function.

In order to ensure the right balance between the choices made across all four domains, it is vital to review multivariate, cross-domain relationships. SAM distinguishes between four dominant cross-domain relationships called alignment perspectives (*Figure 4*) based on the premise that strategic alignment can only be attained when three of the four domains are in alignment. Therefore, changes in one domain affect at least two of the three remaining domains.

The four alignment perspectives may be divided into two groups, based on what kind of a strategy (business or IT) is considered as a driving force.

1. Perspective One: Strategy execution. Business strategy is the driver of both organization and information systems design choices. Strategy is formulated by the top management and executed by the IS management;

2. Perspective Two: Technology transformation. Business strategy drives the development of supporting IT strategy and corresponding IS infrastructure and processes. Business managers seek to identify the best possible IT competencies to support the business strategy. IT managers are responsible for efficient design and implementation of the IS architecture consistent with the IT strategy chosen;

3. Perspective Three: Competitive potential. IT strategy is the driving force of new products and services fostering business strategy and organizational infrastructure and processes modifications. IS management identifies and interprets trends existing in the IT environment that may be considered as opportunities to gain competitive advantage or as a threat to the company's market position. Business executives are able to articulate how to leverage emerging IT capabilities to transform business strategy;

4. Perspective Four: Service level. IT strategy drives the development of IS infrastructure and processes with corresponding implications for the organizational infrastructure and processes. IT executives seek to provide the best possible service to the internal client by developing and implementing the appropriate basis for IS architecture redesign. Business managers are responsible for IT resource allocation and project prioritization.

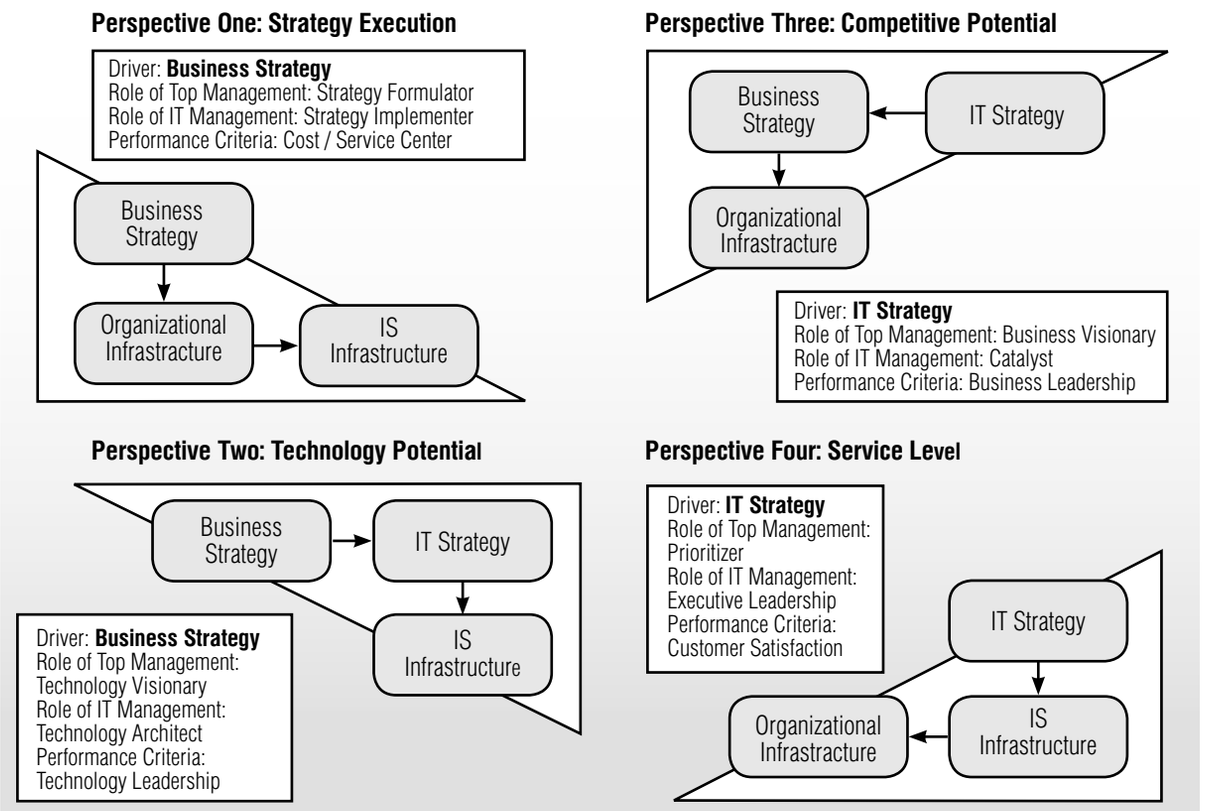


Fig. 4. Alignment perspectives (adapted from [12])

After alternative strategic choices within the four dominant alignment perspectives have been analyzed and evaluated, one or more perspectives should be selected and adopted as the driving force of organizational transformation towards strategic alignment.

The original Strategic Alignment Model is purely conceptual. Therefore, model extensions were later proposed. Thus, in [8] the original SAM was reviewed in a more practical perspective, identifying the major enablers and inhibitors of IT–business alignment, but the model itself was not elaborated. The SAM was also expanded with additional domain components related to information and knowledge management [13] and then combined with the Integrated Architecture Framework in order to enhance practical applicability of the alignment concept. Still, no tool was offered for misalignment detection or capture if alignment processes needed to be established within each of the four alignment perspectives.

This need may be filled by the concept of Enterprise Architecture, which is defined as a set of models and definitions describing the structure of an enterprise, its subsystems and the relationships between them, terminology to employ and guiding principles for design and future evolution [14]. EA development is a continuous iterative process which may be approached using EA frameworks including tools, techniques, process model, artefact descriptions and guidance for EA design.

An integration of the EA framework with the traditional SAM may contribute to the solution of the problems mentioned. We believe that although different in scope, they may complement each other.

Thus, as an attempt to fill the gap in practical guidance for IT–business alignment using SAM as well as in strategic guidance for EA development using EA framework, we propose to combine Henderson and Venkatraman's SAM with The Open Group Architecture Framework (TOGAF) [15].

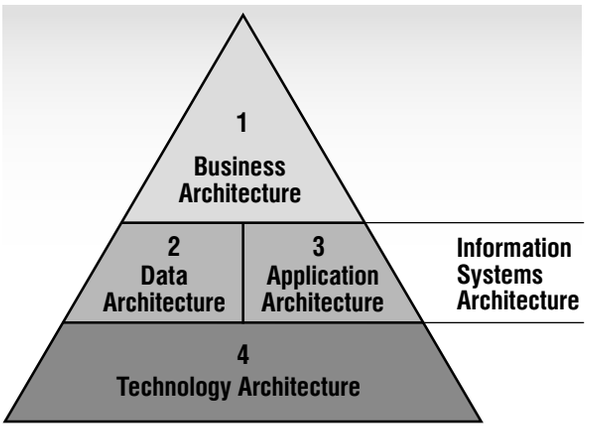


Fig. 5. Architecture domains according to TOGAF [15]

The framework supports four architecture domains that are commonly accepted as subsets of an overall Enterprise Architecture (*Figure 5*):

1. Business Architecture (business strategy, organization structure and processes, business governance);

2. Data Architecture (structure of organization's data assets and data management resources);

3. Application Architecture (application portfolio);

4. Technology Architecture (software and hardware capabilities including IT infrastructure, networks, communications, standards, etc.).

In this framework, the Data Architecture and Application Architecture domains form the Information Systems Architecture domain.

TOGAF is based on an iterative process model called Architecture Development Method (ADM), consisting of different phases, each provided with its own objectives, approaches, inputs, steps (activities) and outputs [15]:

✦ Preliminary Phase. Preparation and initiation activities required for Enterprise Architecture design including customization of TOGAF and definition of the Architecture Principles.

✦ Phase A: Architecture Vision. Development of a high-level vision of the capabilities and business value to be delivered as a result of the proposed Enterprise Architecture.

✦ Phase B: Business Architecture. Development of a Business Architecture supporting the approved Architecture Vision; namely, description of the product / service strategy, organizational, process, information and geographical aspects of the business environment.

✦ Phase C: Information Systems Architectures. Development of the Information Systems (Data and Applications) Architecture supporting the agreed Business Architecture and Architecture Vision.

✦ Phase D: Technology Architecture. Development of the Technology Architecture supporting the chosen Information Systems (Data and Application) Architectures as well as Business Architecture and Architecture Vision.

✦ Phase E: Opportunities and Solutions. Identification of projects, programs and / or portfolios that effectively deliver the Target Architectures identified in previous phases.

✦ Phase F: Migration Planning. Planning the transition from the Baseline to the Target Architectures by finalizing a detailed Implementation and Migration Plan.

✦ Phase G: Implementation Governance. Development of the implementation architectural oversight.

✦ Phase H: Architecture Change Management. Establishment of architecture change management procedures.

It is also important to note that the framework has strong documentation support: each of the ADM phases is provided with a set of templates (catalogs, matrices, diagrams, deliverables). For example, the first phase may take advantage of the "Business Principles, Goals, Drivers" and "Architecture Vision" templates; the second may employ "Architecture Definition" and "Architecture Requirements Specification" templates and so on [15].

From the IT–business alignment point of view, TOGAF presents the same disadvantages as most EA design methodologies: it follows the predefined scheme supposing "top-down" EA design, from business strategy and structure to information systems supporting infrastructure. It does not take into consideration different alignment perspectives while different situations of IT–business misalignment require different approaches to EA design.

In this way, TOGAF and SAM integration may contribute to the problems mentioned above; being different in the scope these methodologies complement each other:

✧ EA design process may incorporate diverse alignment perspectives when guided by SAM;

✧ SAM may be operationalized using methodologies, tools and techniques provided by the EA framework.

2. An integration of the Strategic Alignment Model and the TOGAF framework

Table 1 demonstrates the link between the main SAM components (four integration domains) and TOGAF methodology (EA domains).

Table 1.

Correspondence of SAM and TOGAF domains

Strategic Alignment Model domains	TOGAF domains
External and internal business domains	Business Architecture
Internal IT domain	Application, Data and Technology Architecture
External IT domain	no clear match

As one can see, SAM's external IT domain does not seem to have a clear match because TOGAF does not explicitly determine the IT strategy or its essential components such as IT vision, goals and objectives, justification of IT investments etc. However, it is reasonable to assume that the IT strategy is formulated and

implemented (which may constitute a broad and fertile field of future research) as part of the overall TOGAF's Information Systems Architecture domain.

Our proposal consists in the following: each TOGAF architecture domain is covered by some ADM phases. A, B, C (Data), C (Application) and D are used to develop baseline and target Business / Data / Application / Technology Architectures and analyze the gap between them. Thus, ADM phases A–D may be used to detect the misalignment between SAM's business and IT domains and identify the target aligned architectures. Then, the next ADM phase E allows us to identify ways of eliminating misalignment by identifying projects, programs and/or portfolios that effectively deliver the target aligned architectures. Finally, ADM phases F–H guide the alignment implementation (the transition from the baseline to the target architectures).

Hence, the proposed framework may be used to measure the alignment by identifying interrelationships and establishing correspondence between artifacts delivered by ADM phases in different SAM's integration domains. *Figure 6* illustrates the application of SAM's "Strategy Execution" alignment perspective to the TOGAF framework for misalignment detection.

We can affirm that external and internal business domains are considered aligned if every goal and objective identified by the ADM phase A's "Driver / Goal / Objective Catalog" is covered with some services in the ADM phase B's "Goal / Objective / Service Diagram". Consequently, internal business and IT domains are considered aligned if these services are covered by some applications defined by the ADM phase C's "Application / Function Matrix". This, in turn, should operate the data from the ADM phase C's "Application / Data Matrix" and be based on the technologies identified by the ADM phase D's "Application / Technology Matrix". If, for example, "Driver / Goal / Objective Catalog" contains some goals which are not covered by the "Goal / Objective / Service Diagram", then some new business processes should be introduced in order to implement the business strategy.

Moreover, the proposed framework may be used to create new strategies, structures and processes already aligned across business and IT domains. *Figure 7* illustrates the application of SAM's "Competitive Potential" alignment perspective to the TOGAF framework for cre-

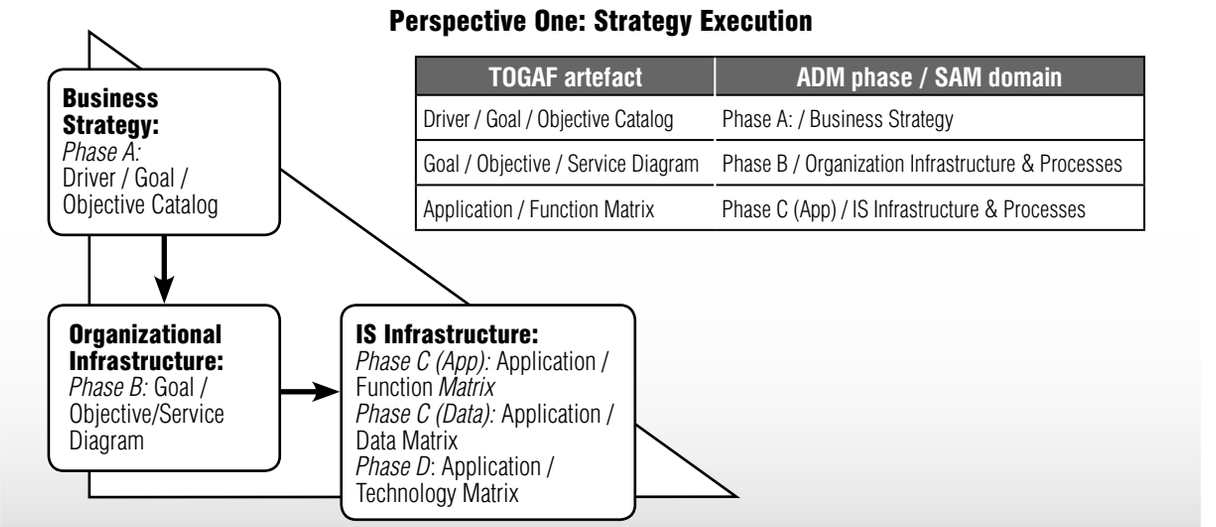
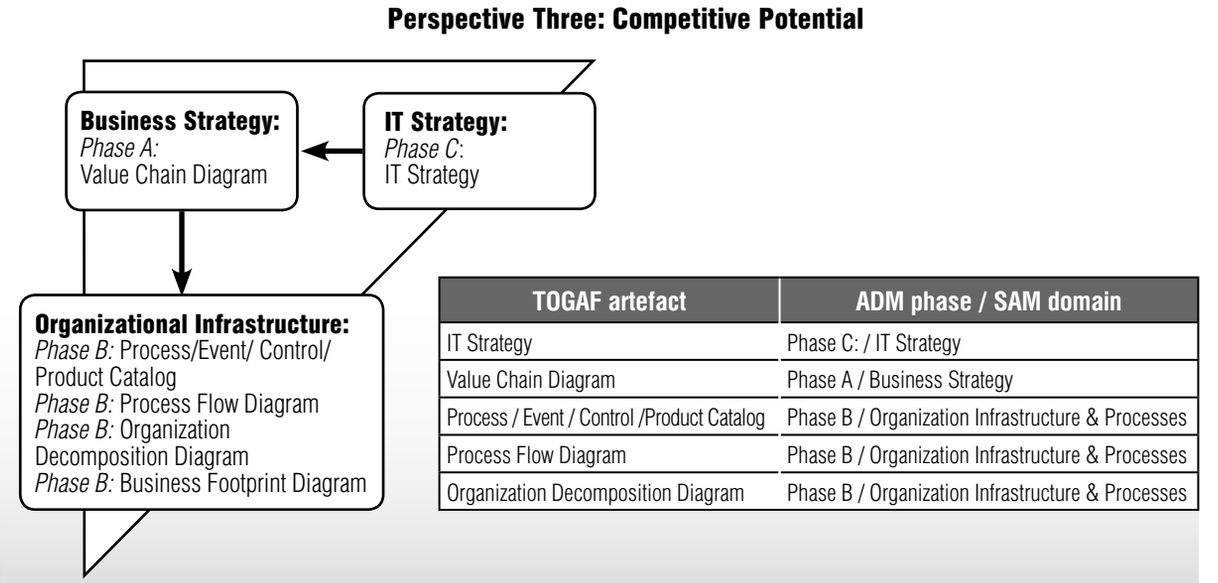


Fig. 6. SAM "Strategy Execution" alignment perspective and TOGAF



TOGAF artefact	ADM phase / SAM domain
IT Strategy	Phase C: / IT Strategy
Value Chain Diagram	Phase A / Business Strategy
Process / Event / Control /Product Catalog	Phase B / Organization Infrastructure & Processes
Process Flow Diagram	Phase B / Organization Infrastructure & Processes
Organization Decomposition Diagram	Phase B / Organization Infrastructure & Processes

Fig. 7. SAM "Competitive Potential" alignment perspective and TOGAF

ating new business capabilities by leveraging IT opportunities. In this case, if, for example, some production operation is automated, then there will be process changes which should be reflected in the ADM phase B's "Process / Event / Control / Product Catalog" and "Process Flow Diagram". And the organizational structure may change: the department manually performing the operation which is to be automated may be disbanded; this should be reflected by the ADM phase B's "Organization Decomposition Diagram".

The formalization of our proposal may be realized by means of Alloy language (*http://alloy.mit.edu/alloy/*) which presents the following main characteristics:

✦ a structural modelling language, based on first-order logic, for expressing complex structural constraints and behavior of relational models;

✦ a constraint solver that provides fully automatic simulation and checking of relational models.

An Alloy model represents a collection of constraints that describes (implicitly) a set of structures, for example, all the possible interdependencies and interrelationships between the layers of Enterprise Architecture. Alloy's tool, the Alloy Analyzer, is a constraint solver which may be used both to explore the model by generating sample structures, and to check properties of the model by generating counterexample.

In the context of the approach proposed, the Alloy language and tool may be used to model and analyze a system consisting of artifacts (system structures), delivered by the ADM phases of TOGAF within diverse alignment perspectives, and their interrelationships and interdependencies (system constraints).

Conclusion

In this paper, we establish formal criteria for IT–business alignment by integrating the Strategic Alignment Model with TOGAF. The approach presented, unlike some previous studies (e.g. [16]), allows us to consider the alignment of IT and business components of EA within different alignment perspectives where the driving force is either the business strategy affecting organizational and IT design choices, or the IT strategy fostering business

strategy and organizational changes. Further research activities follow but are not limited to the following branches:

1. specification of each ADM phases' inputs and outputs for each of the SAM's alignment perspectives;

2. formalization of the contents of the IT strategy document;

3. formalization of the alignment assessment model for the resulting EA evaluation;

4. practical application of the proposed framework, taking into account such business factors as industry sector, organizational size and type of strategic positioning. ■

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