Supporting Business and IT Alignment by Modeling Business and IT Strategy and its Relations to Enterprise Architecture

Knut Hinkelmann

FHNW University of Applied Sciences and Arts
Northwestern Switzerland
Olten, Switzerland
e-mail: knut.hinkelmann@fhnw.ch

Alex Pasquini

University of Camerino
Camerino, Italy
e-mail: alex.pasquini@unicam.it

Abstract—In this study, the literature on strategic alignment, strategy modeling and infrastructure architecture modeling has been analyzed and a prototype has been developed for modeling business strategy and IT strategy as well as the relationship between. This modeling technique allows improving the business and IT alignment based on the Strategic Alignment Model of Henderson and Venkatraman. The modeling language is an extension and adaptation of the Business Motivation Model of OMG. The elements, which constitute the overall strategy, can belong to a business view, an IT view or to both. Due to this feature, it is possible to visualize the IT view (IT strategy) or the business view (business strategy) of the generic strategy separately. A concrete example shows how a strategy may be developed.

Keywords-Strategic Alignment; Strategic Alignment Model; Business and IT alignment; Business Motivation Modeling; Business Strategy, IT Strategy; Enterprise Architecture

I. INTRODUCTION

Information technology (IT) is ubiquitous in today's enterprises. Nearly every business process and function is based on information systems and IT is a means to increase business performance. Indeed, effective utilization of IT can provide organizations with a competitive advantage [1]. Furthermore, recent years have seen a strong growth of investment in the IT sector due to regulations and standards such as the Sarbanes-Oxley Act (SOX) and BASEL III [1].

Sabherwal et al. [2], [3] showed a positive relationship between business and IT. In particular they showed the positive influence of IT on business performance (see also [4]). Many companies, however, are unable to exploit the business value of IT investments. According to Akpan [5] "Information Technology is currently experiencing a credibility gap; this is the gap resulting from IT's inability or failure to realize its full value-creation potential". He further writes that the "absence of strategic alignment is believed to be the main reason many organizations do not obtain value from IT investments" [5].

Strategic alignment "is the degree to which IT applications, infrastructure and organization enable and shape the business strategy and processes, as well as the process to develop this" [6]. Firms, which have a good management of strategic alignment, are considered to be agile and able to quickly adapt their requirements based on the external environment.

In this research we contribute to the alignment of business and IT which has been ranked as a top IT management concern by the annual IT Trends study of the Society for Information Management is most of the last 10 years [4], [7]. We developed a modeling method that allows making visible the dependencies between business strategy and IT strategy. The method is based on the seminal work of Henderson and Venkatraman on strategic alignment [8]. The modeling language adapts and extends the Business Motivation Model (BMM) of the OMG [9] thereby tackling two main shortcomings:

- In order to support strategic alignment, the dependencies between business strategy and IT strategy should be made explicit while still allowing to focus on each of the strategies separately.
- BMM is well suited for modeling the business strategy, but it lacks support for modeling IT strategy. It only includes placeholders to relate motivation elements to organization units and business processes but does not have relations to IT entities.

In the next chapter we provide a literature review showing the basic concepts that are relevant for our research. In the subsequent chapter we then explain our modeling method. The implementation is described in chapter 4. In chapter 5 we explain the evaluation of the modeling technique. In the final chapter we summarize the results and present the conclusion.

II. LITERATURE REVIEW

In this chapter we first introduce the Strategy Alignment model and then show how it relates to enterprise architecture modeling. Finally we introduce the business motivation modeling.

A. Strategic Alignment Model

The Strategic Alignment Model of Henderson and Venkatraman [8] distinguishes four components (see Figure 1).

- **Business Strategy:** The business strategy "is defined in terms of the choices pertaining to the positioning of the business in the product-market arena."[10].

- **IT Strategy:** The IT strategy "is defined in terms of the choices pertaining to the positioning of the business in the information technology marketplace."[10]
- **Organizational infrastructure and processes:** this domain "is defined in terms of the choices pertaining to the particular internal arrangements" and "the design of management structure and work processes"[10].
- **IS infrastructure and processes:** this domain contains all the components related to the IT infrastructure and applications used in the organization. IS infrastructure and processes "are defined in terms of choices pertaining to internal arrangements and the processes that determine the range and types of I/S products and services delivered to the organization."
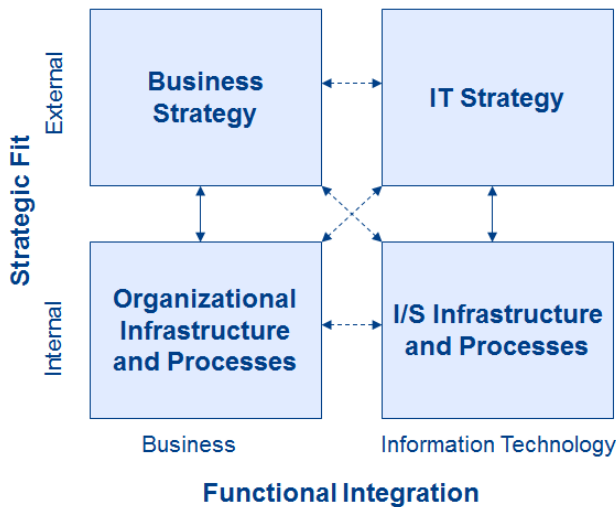

Figure 2. Alignment perspectives of the Strategic Alignment model [8]

B. Enterprise Architecture

Lankhorst defines Enterprise Architecture as "a coherent whole of principles, methods, and models that are used in the design and realization of an enterprise's organizational structure, business processes, information systems, and infrastructure" [14].

Enterprise Architecture (EA) has become more widespread since the mid-1980s with the work of John Zachman [15]. According to [16] Enterprise Architecture (EA) "has only recently begun to transform from an IT-centric exercise in mapping, controlling, standardizing and consolidating into something new - a function entrusted with creating a permanent process for alignment between IT and the business".

Nowadays there are a large number of EA frameworks (see [16] and [17]). The most widespread used according to [16] are the Zachman Framework [18] and TOGAF [19], which represent two approaches for organization architecture models: the matrix and the layered approaches. The TOGAF framework distinguishes three layers: Business, Information Systems and Infrastructure [19]. The Zachman Framework organizes the models in a matrix composed of six rows and six columns (see [20]).

- Each row represents a perspective related to the enterprise's stakeholders and each column represents an aspect of the enterprise. The rows start on top with the Executive perspective and continue with the perspectives of Business Management, Architect, Engineer and Technician. The last perspective corresponds to the enterprise itself.
- The columns represent a universal set of abstractions corresponding to the six question types: what (data), how (function), where (location), who (people), when (time) and why (motivation).

Figure 1. Strategic Alignment Model, based on [8]

.

Henderson and Venkatraman describe four perspectives for keeping the business and IT aligned (see Figure 2): Strategy Execution, Technology Transformation, Competitive Potential and Service Level.

The first two perspectives are driven by the business strategy, while the last two perspectives are driven by the IT strategy. For this research we particularly deal with the Technology Transformation Alignment and the Competitive Potential Alignment as they first align on the strategic level and then on the internal operative level.

The model presented is widely accepted, but a strong and appropriate relationship between business and IT is still hard to set. The same conclusion regarding the difficulty to reach the strategic alignment is expressed by [8], [11]–[13] who state the strategic alignment is an actual critical issue which is affecting IS and IT executives.
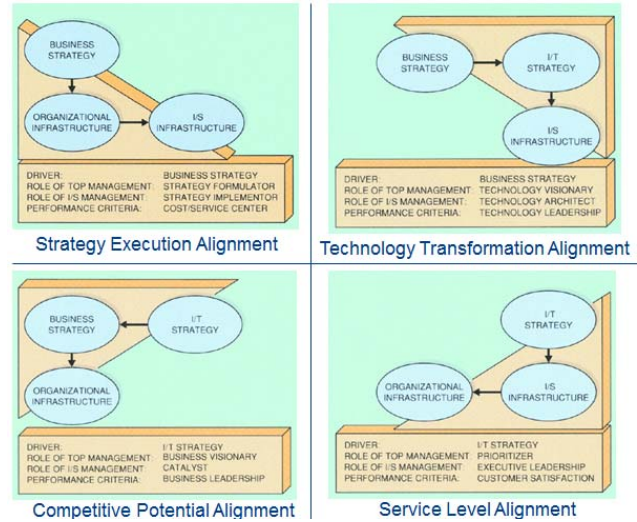
In the following we continue with the Zachman Framework because it nicely fits with the Strategic Alignment Model. Figure 3 shows the mapping of the Strategic Alignment Model to the Zachman Framework
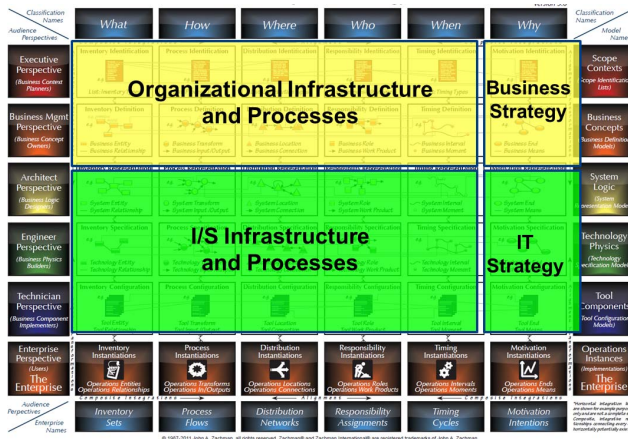

Figure 3. Mapping the Strategic Alignment Model to the Zachman Framework

The infrastructure level is represented by the first five columns ("Data", "Function", "Network", "People" and "Time"), while the last column ("Motivation") represents the strategic level. The infrastructure level can be modeled using appropriate modeling languages like BPMN for processes, UML for data.

C. Business Motivation Modeling

There are at least two well-known approaches for modeling business motivation: The ArchiMate Motivation Extension (see chapter 10 of [21] and [22]) and the OMG Business Motivation Model [9].

The Business Motivation Model (BMM) is a standard language provided by OMG for modeling business motivation. It includes the core elements which are needed to specify a strategy. Those elements are: End, Means, Influencer and Assessment.

The BMM extends the core elements with references to external elements on the business level: Organization Unit, Business Process and Business Rule. The BMM, however, lacks references to elements of the IT infrastructure [23]. In addition there is no distinction between elements representing the business strategy and the IT strategy.

These two weaknesses arise from the fact that the BMM is developed to model the business strategy as suggested by the name. The consequence of these two weaknesses is that the BMM is not coherent with the Strategic Alignment Model, and for this reason it is not possible to use the all four perspectives suggested by [8].

III. MODELING TECHNIQUE

In this chapter a new modeling technique to model business and IT strategies is described in order to solve the problems detected in the previous chapter. This new modeling technique should be able to distinguish business

and IT strategy with the related placeholders, it should clarify the relationships between business and IT elements and it should improve the strategic alignment enabling the four perspectives of the Strategic Alignment Model.

According to [24] a modeling method consists of a modeling technique and modeling mechanisms & algorithms. A modeling technique again consists of the modeling language and the modeling procedure.

In our case, the modeling language is an extension of the OMG BMM language, the modeling procedure is the application of the modeling language to make the new approach consistent with the Strategic Alignment Model. It covers all elements which belong either to the business strategy or the IT strategy as well as the references to elements of the Organizational Infrastructure and Processes as well as the I/S Infrastructure and Processes (see Figure 4)
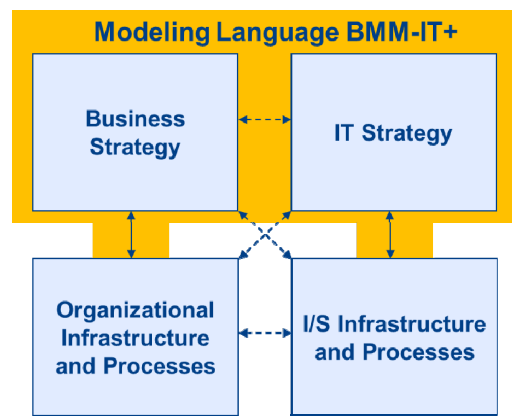

Figure 4. The coverage of the new modeling language

As mentioned above, a shortcoming of the BMM for business-IT alignment is the lack of IT placeholders. Here we adopt the BMM-IT+ approach of [23], which extends the external element of OMG BMM with the IT Entity, which links the strategic level with the IT-Infrastructure (see Figure 5).
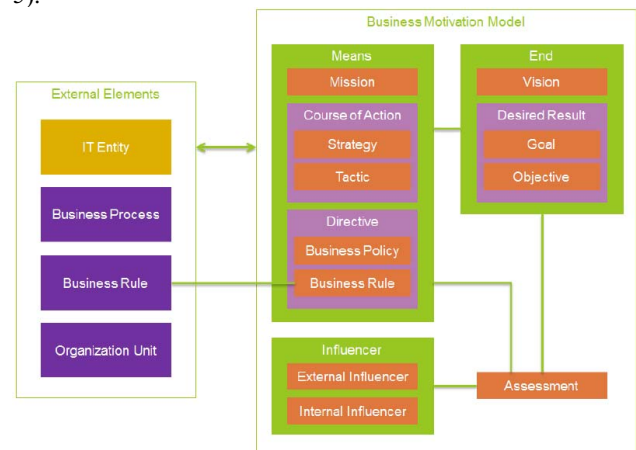

Figure 5. BMM-IT+: Extending the OMG Business Motivation Model (from [23])

IV. DEVELOPMENT

With our modeling technique it is possible to improve the transparency of dependencies through different views. It is possible to see

- the business strategy,
- the IT strategy and
- the generic strategy, which shows both strategies, distinguishing business and IT elements.

For the development of the new modeling technique, the ADOxx meta-modeling platform was used [1]. This tool consists of a development and a modeling toolkit. The development toolkit allows specifying a graphical modeling language. In particular it is possible to implement the elements of a meta-model with the related attributes and their graphical appearance. The model language is then used by in the modeling toolkit where concrete models can be created.

A. Elements

The meta-model specifies the elements described by OMG BMM in conjunction with the BMM-IT+ [21]. To distinguish the elements which belong to the business strategy from those which belong to the IT strategy, in the description of the classes, an attribute called "Viewpoint" was added. For the core elements it can be chosen between the business, IT or standard viewpoints. The "Influencer" element does not have the viewpoint attribute, because it is a neutral fact and it does belong neither to business nor to IT. The Business Process, Organization Unit and Business Rule belong to the business viewpoint. The IT-Entity belongs to the IT viewpoint because it is part of the IT infrastructure.

B. Views

In the previous section the viewpoints have been introduced. In particular three viewpoints were defined in the development toolkit:

- **Business viewpoint:** all the elements which are part of the business strategy and part of the business infrastructure are included in this viewpoint. In addition, the elements which belong neither to business nor IT perspective, are included in this viewpoint. The IT elements are not part of this set.
- **IT viewpoint:** the elements which are strictly related to the IT strategy are part of this viewpoint. Moreover, the elements which do not belong neither to business nor IT perspective are included in this viewpoint. The business elements are not part of this set.
- **Standard viewpoint:** this viewpoint is the union of the business and IT viewpoints. The aim of this viewpoint is to define the generic strategy including business and IT elements, and those which do not belong to any perspective.

To graphically distinguish the viewpoint of each element, the graphical representations of the elements involved are adaptedmodeling (see Figure 6). The elements, which belong to the business viewpoint, show the letter "B" on the top-left corner, while the elements which are related to the IT

viewpoint, show the abbreviation "IT" on the top-left corner. The elements which belong to the standard viewpoint are shown with no letter on the top-left corner.

The definition of the viewpoints in the development toolkit makes the modeling toolkit able to show part of the whole model (views), specifying in this way the generic strategy (which corresponds to the Standard View), the business strategy (which corresponds to the Business View) and the IT Strategy (which corresponds to the IT View).
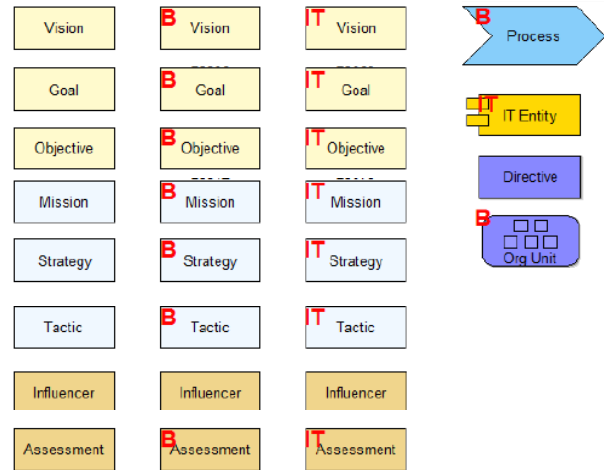

Figure 6. Elements of the adapted BMM-IT+: Views and Placeholders

V. EVALUATION

In the evaluation phase we checked whether the new modeling technique works as described in the previous chapters. The second goal of this phase is to show that the new modeling technique brings the expected benefits.

The evaluation was performed with a concrete use case. We modeled the business and IT strategy of the Master of Science in Business Information Systems (MSc in BIS) at the FHNW University of Applied Sciences and Arts Northwestern Switzerland[2].

A. Evaluating the modeling technique

The generic strategy, depicted in Figure 7, is represented by the "Standard View". All business and IT elements are shown as indicated be the "B" and "IT" letters on the top-left corner. Here the relationships between Business and IT perspectives are clear because of the viewpoints distinction and the representation of the business and IT elements in the same model (see also Figure 8).

The ADOxx modeling environment allows to show the business strategy and IT strategy separately by hiding the elements of on viewpoint. Thus it is possible, for example, to show only the business strategy by hiding the elements of the IT strategy - and vice versa.

---

[1] http://www.adoxx.org

---

[2] It should be noted that we found no explicity formulated strategy for the program. Thus, the model is based on information gathered from interviews taken with the head of the program.
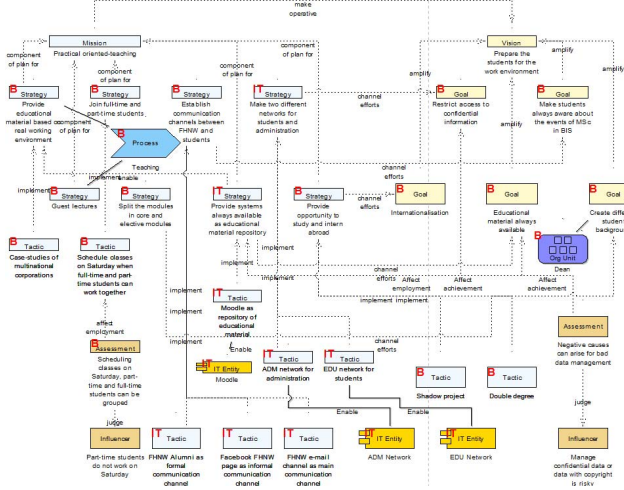
Figure 7. Standard View of the strategy modelled with the ADOxx modeling toolkit

B. Evaluating mutual influences between business and IT

The second step of the evaluation phase is to verify whether the new modeling technique brings the benefit expected. The benefit expected is the possibility to influence the business strategy from the IT perspective and vice-versa. This benefit makes the new modeling technique able to improve the business and IT alignment of the organization, since it is coherent with the Strategic Alignment Model of [1]. To do it, we made a workshop with the head of the master program. In this workshop we made changes in both the business and IT strategies. Then we used the model to identify, which aspects of the strategy (both business and IT) and which parts of the organizational and I/S Infrastructure and Processes were affected by the change.

In the following we show one example. The change is the introduction of an IT goal called "Outsource the service to provide educational material". Then the influence of this IT goal to elements of the business strategy is shown.
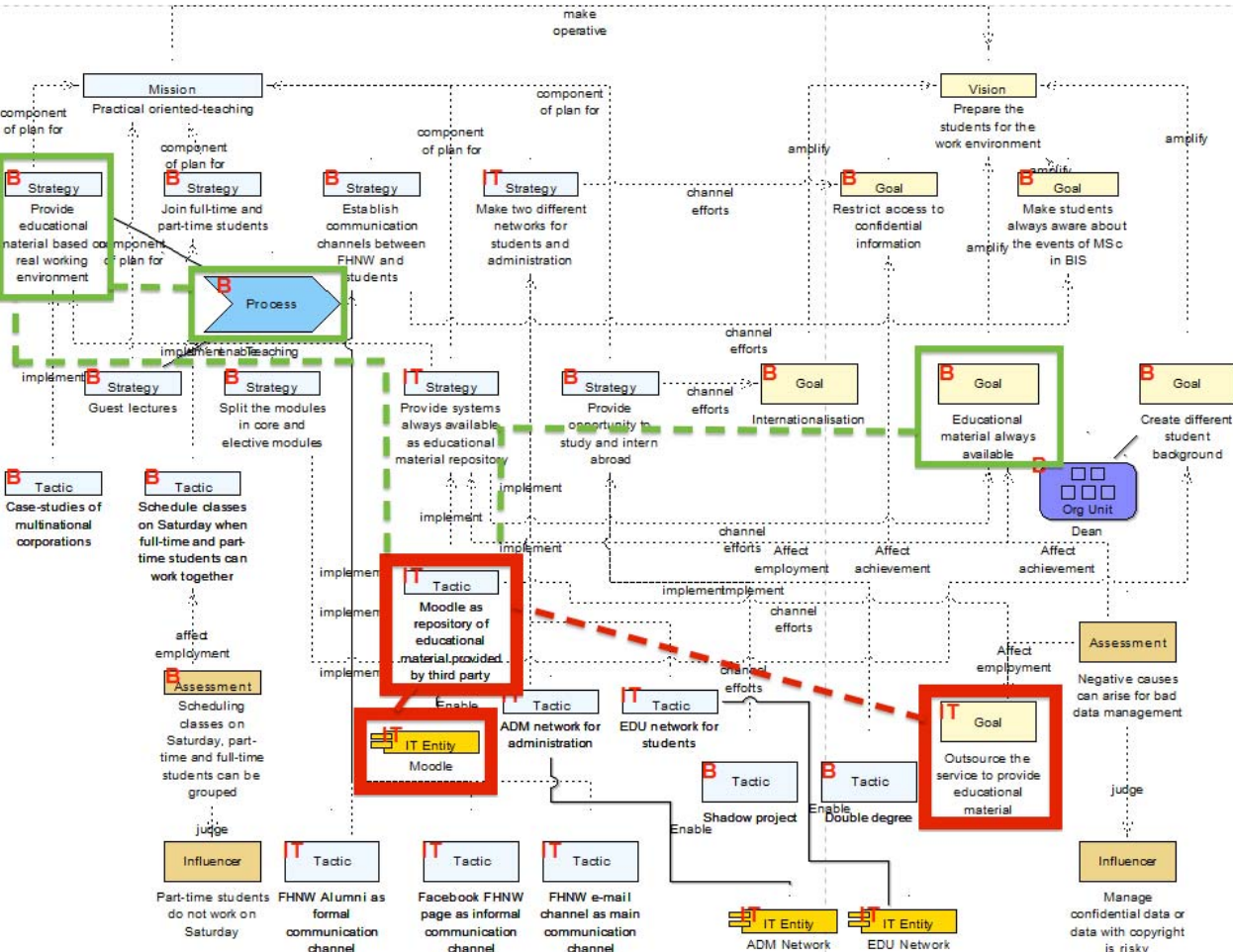

Figure 8. IT perspective influences the business perspective

153

In Figure 8 the new IT goal "Outsource the service to provide educational material" is highlighted. The goal comes from the assessment "Negative causes can arise for bad data management". This IT goal influences the Moodle e-learning system and the IT tactic "Moodle as repository of educational material provided by third party". Then this IT goal influences the business strategy "Provide educational material based on real working environment" and the business goal "Educational material always available". FHNW is not anymore responsible for the Moodle system and the related management of material, since the Moodle service is now provided by a third party. In this way the evidence that the IT perspective influences the business strategy is given.

In a similar way we evaluated how changes in the business strategy affect the IT strategy by following the relationships in the adapted BMM-IT+ model.

VI. RESULTS

This paper highlighted the current weaknesses in aligning business and IT on the strategic level. From this analysis, two points arose:

- Current motivation model languages are mainly designed to model business strategy. They can be used to model IT strategy as well, but they do not provide IT placeholders to make references from IT strategy to the infrastructure level.
- Current motivation model languages do not give the possibility to distinguish elements which belong to business view and those which belong to the IT view.

Based on this assessment we developed a technique for modeling the business and the IT strategy and their relationships. The modeling language

- adapts the OMG BMM in conjunction with BMM-IT+ [23]
- distinguishes between IT elements and Business elements.

The main contribution of this work is the development of the modeling technique, which is an extension of the OMG BMM [9], based on the adapted concept of [8]. Its purpose is to provide a common environment to develop a general strategy which includes business and IT strategies. The reasons to do that are:

- Improved transparency of the dependencies between business and IT elements;
- The opportunity to enable the bidirectional approach, allowing the IT to influence the business perspective and vice versa;
- The possibility to split the whole strategy into business and IT perspectives. Through this feature the model becomes clearer when the complexity of the whole strategy grows. Moreover this feature is useful for the implementation phase.

Further research can focus on how to relate this model to other aspects of the enterprise architecture such as risk modelling or decision modeling.

REFERENCES

[1] P. Weill and J. W. Ross, *IT Governance: How Top Performers Manage IT Decision Rights for Superior Results*. Harvard Business Review Press, 2004.

[2] R. Sabherwal and Y. E. Chan, "Alignment Strategies : Between Business IS and of Prospectors , Defenders," vol. 12, no. 1, pp. 11–33, 2001.

[3] R. Sabherwal and P. Kirs, "The alignment between organizational critical success factors and information technology capability in academic institutions," *Decis. Sci.*, vol. 25, no. 2, pp. 301–330, 1994.

[4] A. J. G. Silvius, B. de Waal, and J. Smit, "Business and IT Alginment; Answers and Remaining Questions," in *Pacific Asia Conference on Information Systems PACIS 2009*, 2009.

[5] E. O. Akpan, *Strategic Alignment: The Business Imperative for Leading Organizations*. Mustang, Oklahoma: Tate Publishing, 2007.

[6] A. J. G. Silvius, "Business and IT Alignment in Context," Universiteit Utrecht, Utrecht, 2013.

[7] Society for Information Management, "SIM IT Trends Study," 2013. [Online]. Available: https://www.simnet.org/resource/resmgr/it_trends/sim_it_trends_study_2013_-_s.pdf. [Accessed: 04-May-2014].

[8] J. C. Henderson and N. Venkatraman, "Strategic alignment : Leveraging information technology for transforming organizations," *IBM Syst. J.*, vol. 32, no. 1, pp. 472–484, 1993.

[9] OMG, "Business Motivation Model, Version 1.1," no. August. 2010.

[10] J. C. Henderson and N. Venkatraman, "Strategic alignment: a framework for strategic information technology management," 1989.

[11] J. Luftman and T. Brier, "Achieving and Sustaining Business-IT Alignment," *Calif. Manage. Rev.*, vol. 42, no. 1, pp. 109–122, Oct. 1999.

[12] J. N. Luftman, P. R. Lewis, and O. S.H., "Transforming the enterprise : The alignment of business and information," *IBM Syst. J.*, vol. 32, no. 1, pp. 198–221, 1993.

[13] P. Tallon, K. L. Kraemer, and V. Gurbaxani, "Executives' Perceptions of the Business Value of Information Technology: A Process-Oriented Approach," 2001.

[14] M. Lankhorst, *Enterprise Architecture at Work: Modelling, Communication and Analysis*. Berlin Heidelberg: Springer-Verlag, 2005.

[15] J. A. Zachman, "A framework for information systems architecture," *IBM Syst. J.*, vol. 26, no. 3, 1987.

[16] D. Minoli, *Enterprise Architecture A to Z*. Boca Raton: Auerbach Publications, 2008.

[17] D. Matthes, *Enterprise Architecture Frameworks Kompendium*. Heidelberg: Springer-Verlag, 2011.

[18] J. A. Zachman, *The Zachman Framework For Enterprise Architecture : Primer for Enterprise Engineering and Manufacturing By*, Electronic. Zachman International, 2003.

[19] The Open Group, *TOGAF Version 9.1*. Van Haren Publishing, 2011.

[20] J. A. Zachman, "John Zachman's Concise Definition of The Zachman Framework," *Zachman International*. [Online]. Available: http://www.zachman.com/about-the-zachman-framework. [Accessed: 05-May-2014].

[21] The Open Group, *ArchiMate 2.0 Specification*. The Open Group, 2012.

[22] W. Engelsman, D. Quartel, H. Jonkers, and M. van Sinderen, "Extending enterprise architecture modelling with business goals and requirements," *Enterp. Inf. Syst.*, vol. 5, no. 1, pp. 9–36, Feb. 2011.

[23] K. Hinkelmann and M. Suter, "Extending Business Motivation Modelling to Foster Regional Flexibility in IT Architecture Management," in *eChallenges e-2013 Conference Proceedings*, 2013.

[24] D. Karagiannis and H. Kühn, "Metamodelling Platforms," in *Proceedings of the Third International Conference EC-Web at DEXA 2002*, 2002.