Evaluating Business-IT Alignment in the Enterprise Architecture Context

AISA Project Report

Version: 1.1	Date: 4.12.2007
Author: Eetu Niemi & Tanja Ylimäki	Status: Final

Abstract

In this report, the concept of business-IT alignment is extensively discussed according to literature. Particularly, the various definitions, components, models and benefits, as well as the practical aspect of the alignment concept, are discussed. Furthermore, the concept is addressed in the EA domain, and approaches for its evaluation are described.

Contents

1 Introduction

Alignment between business and IT has been considered important in organizations for over 15 years (Luftman 2000). As a high degree of alignment has been associated with improved business performance by empirical evidence (Chan, Huff ym. 1997; Papp 1999), it is not surprising that business-IT alignment, or business-ICT alignment, has been continuously considered as one of the top concerns of company executives such as CIOs (Luftman 2000; Luftman, Kempaiah ym. 2006) and a great number of studies have been conducted on the subject so far (Luftman 2000; Chan 2002). Alignment has also been considered as one of the key benefits or potential objectives of Enterprise Architecture (EA) (Morganwalp & Sage 2004; Ross & Weill 2005; Goethals, Snoeck ym. 2006; Kluge, Dietzsch ym. 2006; Niemi 2006), a recent approach for organizational management and development.

EA provides a holistic view of an organization, consisting of the viewpoints of business, systems, information and technology (see e.g. de Boer, Bosanque ym. 2005; Kaisler, Armour ym. 2005; Jonkers, Lankhorst ym. 2006). It is widely recognized by academics and practitioners alike, as stated to provide a great number of positive business impacts, including the alignment and integration of strategy, people, business and technology (Morganwalp & Sage 2004; Goethals, Snoeck ym. 2006). However, the relationship between business-IT alignment and EA has not been thoroughly or holistically studied, even though several studies have attempted to clarify the relationship between alignment and various architectural viewpoints, such as business, systems and technology (see e.g. Maes, Rijsenbrij ym. 2000; Slot 2000; Zijden, Goedvolk ym. 2000; Pereira & Sousa 2003; Chen, Kazman ym. 2005; van der Raadt, Hoorn ym. 2005; Wegmann, Balabko ym. 2005; Strnadl 2006; Versteeg & Bouwman 2006; Zarvic & Wieringa 2006).

Moreover, business-IT alignment in itself is a complex issue and difficult to evaluate (Chan, Huff ym. 1997; Chan 2002). Consequently, even a consensus on the concept itself and its characteristics has not been reached (Henderson & Venkatraman 1989; Maes, Rijsenbrij ym. 2000; Avison, Jones ym. 2004; Silva, Plazaola ym. 2006), although numerous definitions (Luftman, Lewis ym. 1993; Reich & Benbasat 1996; Luftman 2000; Maes, Rijsenbrij ym. 2000), models (Henderson & Venkatraman 1993; Chan, Huff ym. 1997; Luftman 2000; Maes, Rijsenbrij ym. 2000; Cumps, Viaene ym. 2006) and metrics (Chan, Huff ym. 1997; Papp 1999; Luftman 2000; Chan 2002; Cumps, Viaene ym. 2006; Tan & Gallupe 2006) have been proposed. Even though the literature on the subject is extensive, numerous researchers argue that it does not, for the most part, provide useful implications to practice (Ciborra 1997; Maes, Rijsenbrij ym. 2000; Avison, Jones ym. 2004; Cumps, Viaene ym. 2006). Nevertheless, evaluating the state of business-IT alignment in organization is important both in understanding the relationship between business and IT, and improving alignment between them (Luftman 2000).

In this study, we aim to explore and discuss the concept of business-IT alignment and its evaluation, particularly in the context of EA. In addition, we also aim to discuss on methods for improving and evaluating alignment in organizations.

Systematic literature review was used as a research method. Initially, a keyword search in four high-quality academic databases[1] and Google Scholar by keywords "business", "IT" and "alignment" simultaneously. A preliminary set of potentially relevant literature was identified by the search. Subsequently, the literature was charted for references, and forward and backward search (see e.g. Levy & Ellis 2006) utilized to obtain deeper and wider literature background.

This report is organized as follows. First, the concept is extensively discussed on the general level (Section 2). Second, potential interpretations of the concept in the context of EA are discussed (Section 3). Third, methods and models for evaluating business-IT alignment in organizations are described (Section 4). Finally, Section 5 concludes the report.

[1] Academic Search Elite (EBSCO), Electronic Journals Service (EBSCO), Science Direct (Elsevier) and Web of Science (ISI)

2 Concept of Business-IT Alignment

This section discusses the various views of business-IT alignment from literature, including definitions, characteristics, components, benefits, and attainment. Moreover, a brief summary is included.

2.1 Definitions

Many definitions for alignment between business and IT have been proposed in literature. However, the definitions typically miss the complex and extensive nature the phenomenon, and hence do not encompass its whole domain. It is argued that the definitions are ambiguous, and many studies have even be published without a clear definition (Maes, Rijsenbrij ym. 2000). Some vague definitions for alignment include "the extent to which the IS strategy supports, and is supported by, the business strategy" (Luftman, Lewis ym. 1993) and "the degree to which the IT mission, objectives, and plans support and are supported by the business mission, objectives and plans" (Reich & Benbasat 1996).

Later, slightly broader and more accurate definitions have been proposed by a few authors. For example, Luftman (2000) states that "business-IT alignment refers to applying Information Technology (IT) in an appropriate and timely way, in harmony with business strategies, goals and needs". Moody clarifies and extends the scope of the concept by stating that alignment results from consistent objectives and metrics shared by IT and business alike (Moody 2003). The most extensive definition, considering all the discussion in this section, is the one presented by Maes et al. who define alignment as "the continuous process, involving management and design subprocesses, of consciously and coherently interrelating all components of the business-IT relationship in order to contribute to the organization's performance over time" (Maes, Rijsenbrij ym. 2000).

Nevertheless, even the term "alignment" itself is not the only one used in literature. For example, alternative terms like *linkage*, *balance*, *fit*, *integration* and *coordination* are used as well (Reich & Benbasat 1996; Luftman 2000; Maes, Rijsenbrij ym. 2000; Avison, Jones ym. 2004; Silva, Plazaola ym. 2006). Moreover, even though some authors (for example Reich & Benbasat 1996; Luftman 2000) argue that the fundamental concepts behind the term remain similar, it seems that a common perception on the concept has not been found so far (Henderson & Venkatraman 1989; Maes, Rijsenbrij ym. 2000; Avison, Jones ym. 2004; Silva, Plazaola ym. 2006; Silvius 2007). In this study, we use the term "alignment" as an abbreviation of alignment between business and IT.

3 Characteristics of Alignment

The main question regarding the characteristics of alignment brought out in literature is whether alignment is a static state (outcome or effect) or a dynamic process (cause) (Maes, Rijsenbrij ym. 2000; Avison, Jones ym. 2004; Cumps, Viaene ym. 2006; Silva, Plazaola ym. 2006). The former view has dominated the literature (Maes, Rijsenbrij ym. 2000; Avison, Jones ym. 2004), but later some authors considered alignment as both a process (e.g. the activities to reach alignment) and a state (the amount of alignment) (Reich & Benbasat 1996; Silvius 2007). Recently, alignment has been regarded as a dynamic, evolutionary process instead of a static outcome by a few authors (Luftman 2000; Maes, Rijsenbrij ym. 2000; Chan 2002; Avison, Jones ym. 2004; Cumps, Viaene ym. 2006). In this respect, alignment needs to be maintained over time by a continuous process (Maes, Rijsenbrij ym. 2000; Avison, Jones ym. 2004; Hu & Huang 2005).

Timeframe of alignment is an interesting question: are business and IT only currently aligned or are their long-term visions or strategies also aligned, indicating potential alignment in the future as well? Literature for the most part addresses only the strategic side of alignment. However, several authors state that alignment should be assured on both strategic and tactical levels (Henderson & Venkatraman 1993; Reich & Benbasat 1996; Bruls 2003). For example, Reich and Benbasat address the issue by identifying two timeframes of alignment, short-term - common understanding of current plans by both business and IT, and long-term – shared IT and business long-term vision (Reich & Benbasat 1996).

3.1 Components

In addition to the characteristics of the alignment itself, the definitions indicate multiple components or “targets” for alignment. Even though authors seem to agree that both business and IT should be aligned with each other (Luftman 2000), the now commonly used term “business-IT alignment” or “business-ICT alignment” does not define which components of business and IT should be aligned. Even the probably most frequently used term “strategic alignment”, which emphasizes that organizations’ IT and business strategies should be aligned (Henderson & Venkatraman 1993; Reich & Benbasat 1996; Chan, Huff ym. 1997; Avison, Jones ym. 2004; Hu & Huang 2005), is still imprecise. Reich and Benbasat (1996) provide a more accurate definition by suggesting that both business and IT mission, objectives and plans should be aligned, and dividing alignment to intellectual (content of plans and objectives) and social (common understanding of plans and objectives) dimensions.

In general, alignment research seems to focus on the strategic component only (Maes, Rijsenbrij ym. 2000), although alignment is understood to encompass at least 1) structural, technology, process and skills (Henderson & Venkatraman 1993; Luftman 2000; Maes, Rijsenbrij ym. 2000; Chan 2002; Weiss & Anderson 2004), 2) knowledge, communication and learning (Reich & Benbasat 1996; Ciborra 1997; Luftman 2000; Maes, Rijsenbrij ym. 2000; Chan 2002; Weiss & Anderson 2004) and 3) metrics (Luftman 2000; Moody 2003; Weiss & Anderson 2004) components as well. Consequently, a number of authors specify the concept further by introducing various alignment models.

3.2 Models

The alignment models introduced aim to capture the complex nature of alignment, taking into account more than merely its strategic side. Particularly, the most cited is the Strategic Alignment Model (SAM), displayed in Figure 1. The model defines four alignment domains: 1) business strategy, 2) IT strategy, 3) organizational infrastructure and processes, and 4) IS infrastructure and processes (Henderson & Venkatraman 1993). The authors also describe four cross-domain alignment perspectives, which display different approaches to attaining alignment – either driven by business or IT strategy. Afterwards, the SAM has been further developed and extended in two distinct lines of research, specifically by Luftman et al. and Maes et al.

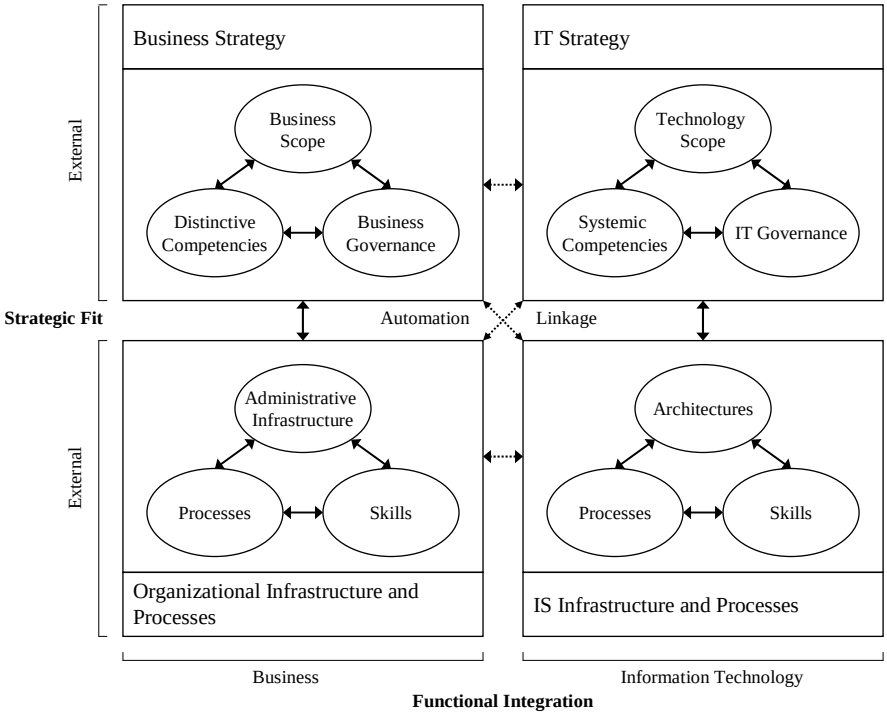

Figure 1. The Strategic Alignment Model (Henderson & Venkatraman 1993).

Building on the SAM, further research on alignment perspectives (Luftman, Lewis ym. 1993), and alignment enabler and inhibitor research (Luftman, Papp ym. 1999), Luftman constructs a strategic alignment maturity assessment method (see Figure 2), comprised of six components of alignment: 1) communications, 2) competency or value measurement, 3) governance, 4) partnership, 5) scope and architecture, and 6) skills (Luftman 2000). Moreover, Maes (1999) further extends the SAM by dividing the infrastructure and processes component into two distinct components (structure and operations) on the vertical dimension, and adding an information and communication component to the horizontal dimension to represent the information, knowledge and communication infrastructure crucial to any organization today.

Subsequently, attempting to provide a basis for further elaboration of the alignment concept, Maes and colleagues (2000) combine this extended version of SAM with Cap Gemini's Integrated Architecture Framework (IAF) (Goedvolk 1999) to develop an unified framework for alignment. The framework, depicted in Figure 3, consists of a 3-D model of three horizontal levels (strategy, structure and operations), four vertical architecture areas (business, information and

communication, systems and technological infrastructure), and a third dimension of five design phases (contextual, conceptual, logical, physical and transformational) (Maes, Rijsenbrij ym. 2000). Furthermore, van der Raadt et al. (2005) have also developed an architecture alignment evaluation model, built on previous research including the SAM and Luftman's work, consisting of six sub variables that explain both architecture alignment and maturity. However the model has not been validated this far.

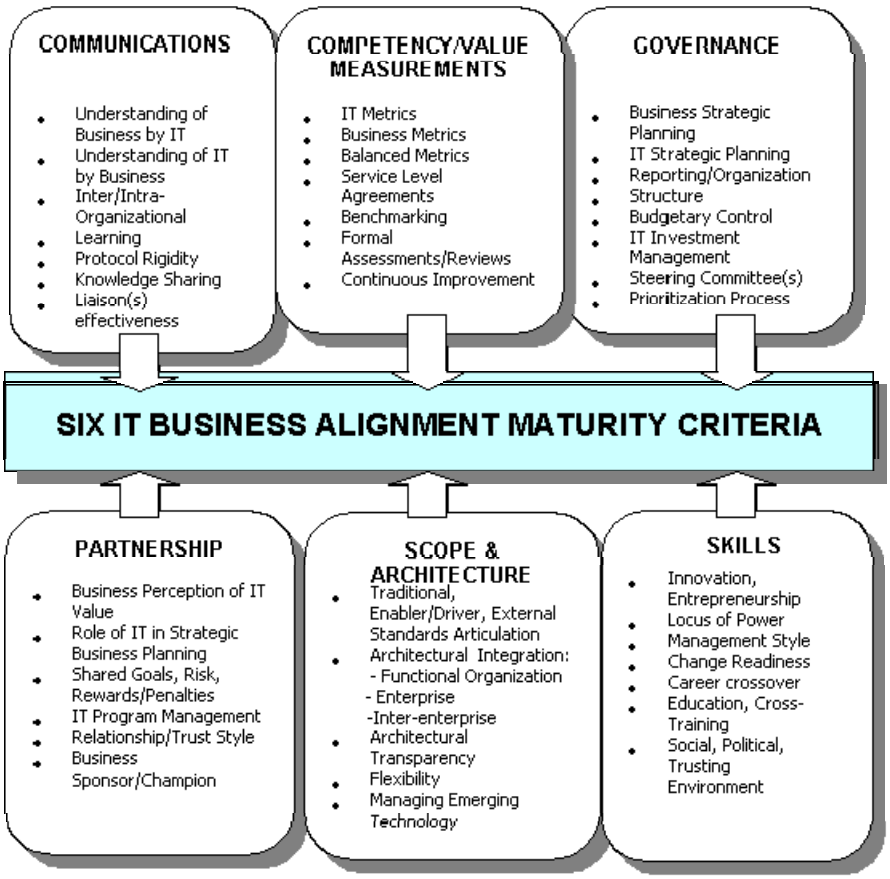

Figure 2. Business-IT alignment maturity criteria (from Luftman 2000).

In addition, alignment models not directly based on the SAM exist. Reich and Benbasat introduce a model of the social dimension of alignment, including four components divided into two antecedents, 1) shared domain knowledge between business and IT executives and 2) successful IT history, and two current practices, 1) communication between business and IT executives and 2) connections between business and IT planning, all found to influence alignment (Reich & Benbasat 2000). This model is further developed by Hu and Huang by adding relationship management as an antecedent and balanced scorecard as a mechanism for alignment (Hu & Huang 2005).

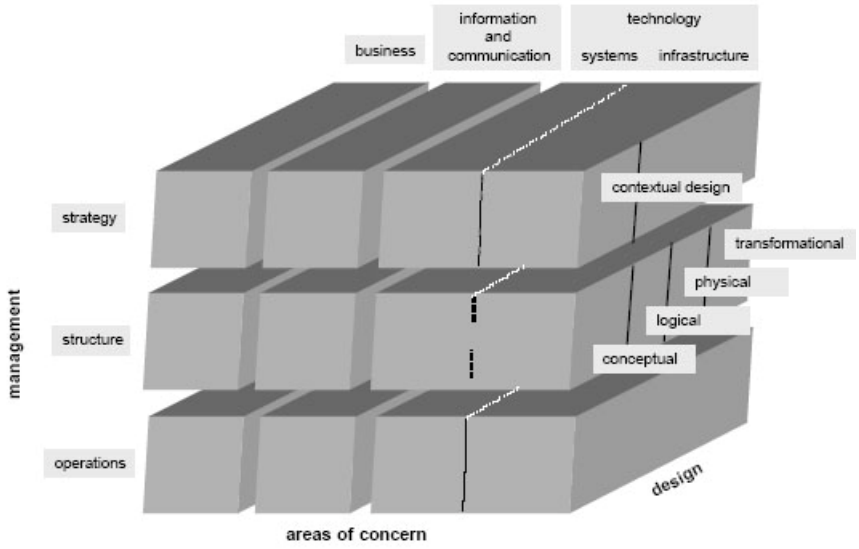

Figure 3. The unified framework for business-IT alignment (from Maes, Rijsenbrij ym. 2000).

Moreover, Chan et al. present a conceptual model which illustrates interrelations between realized business and IS strategy, strategic alignment and business and IS performance, and survey instruments related to these constructs (Chan, Huff ym. 1997). Cumps et al. take a different approach and base their model of alignment capability, competences and resources on the resource-based view of the firm (Cumps, Viaene ym. 2006). However, they draw the alignment competencies from Luftman's work (Luftman 2000).

Altogether, the SAM has remained the most referred model for alignment (Silva, Plazaola ym. 2006), with its extensions by Luftman (Maes, Rijsenbrij ym. 2000). Although it is often argued that the SAM is more a conceptual model, lacking practical implications (Hu & Huang 2005), it has been displayed to have both conceptual and practical value by empirical research (Avison, Jones ym. 2004). In addition, Luftman's alignment maturity assessment method has been validated at more than 50 Global 2000 companies (Luftman 2003) and used extensively in surveys by other authors (Cumps, Viaene ym. 2006; Silvius 2007). The unified framework for alignment (Maes, Rijsenbrij ym. 2000) has also been applied in a number of studies (Slot 2000; Avison, Jones ym. 2004). Although no model or assessment method can comprise the full picture of alignment, Luftman's alignment criteria seems to include most of the factors associated to alignment by research. In addition to the ones discussed above, it includes factors related to entrepreneurial and innovative organizations, stressed by some authors (see e.g. Chan 2002; Moody 2003).

3.3 Benefits

Although the majority of studies on alignment emphasize the importance of the subject, a considerably lower number mentions any benefits potentially attained by alignment. Some of these named benefits include maximization of return on IT investment, enablement of competitive advantage from IS, and increase of company flexibility in reacting to changes (Avison, Jones ym. 2004). However, many companies seem believe that alignment will automatically lead to the creation of new business opportunities through IT, which is a false assumption (Moody 2003). Moody's statement is supported by the fact that there are only a few studies which have been able

to support the claims of realized benefits by empirical evidence (see e.g. Chan, Huff ym. 1997; Papp 1999; Chan 2002).

The empirical studies display that alignment impacts positively a company's 1) business performance and 2) IT effectiveness. Papp investigated the impact of a company's alignment perspective (see e.g. Henderson & Venkatraman 1993; Luftman, Lewis ym. 1993) and industry classification to 18 traditional financial measures in 500 companies, displaying that the company's alignment perspective and industry affects the probability of realizing certain results with the measures (Papp 1999). A survey study by Chan et al. indicates that business strategic orientation, IS strategic alignment and IS effectiveness (as measured by end-user satisfaction and strategic impact) improve business performance (as measured by market growth, financial performance, innovation, and company reputation). Moreover, IS strategic alignment was found to be a better predictor of IS effectiveness than IS strategic orientation. (Chan, Huff ym. 1997) In a later case study, Chan (2002) found out that aligning business and IT strategies improved the overall IS function performance.

3.4 Striving for Business-IT Alignment in Practice

Many authors argue that alignment research, even with the models constructed, does not generally provide useful implications to practice (Ciborra 1997; Maes, Rijsenbrij ym. 2000; Avison, Jones ym. 2004; Cumps, Viaene ym. 2006). Still, several researchers have taken a more practical approach on the subject and investigated the factors affecting alignment, or even developed methods or practices for increasing alignment in organizations. The majority of them base their studies on published alignment models, particularly the SAM, which on its own gives an idea of what kind of factors might affect alignment.

Luftman et al. (1999) carried out an extensive survey study on alignment inhibitors and enablers, resulting in the factors displayed in Table 1. Also Leganza (2003) presents a fairly similar list of items as characteristics of unaligned IT organizations. Furthermore, in Luftman's (2000) strategic alignment maturity assessment method, a multitude of critical success factors of alignment are included. Luftman's work has also stimulated further research. Using mainly his alignment criteria, Cumps et al. found out in an extensive survey study that particularly the role of IT in an organization has a substantial effect on the organization's alignment maturity. Conservative, support role of IT was most often associated with low alignment maturity. The results also showed that organizations that build extensive and comprehensive business cases, including a diverse set of components, more probably have high alignment. (Cumps, Viaene ym. 2006)

Originally, Luftman's factors of alignment are not prioritized although research suggests that e.g. alignment on the strategic level may be more important than on the structural level. Moreover, informal interrelationships and structures between business and IT were found to be more important than formal ones. (Chan 2002) Furthermore, business and IT executives' shared domain knowledge was found to outperform the other factors (i.e. IT implementation success, communication, and connections between IT and business planning) in influencing alignment (Reich & Benbasat 2000).

Table 1. Inhibitors and enablers of Business-IT alignment (Luftman, Papp ym. 1999).

	Enablers	Inhibitors
1	Senior executive support for IT	IT/business lack close relationships
2	IT involved in strategy development	IT does not prioritize well
3	IT understands business	IT fails to meet commitments
4	Business-IT partnership	IT does not understand business
5	Well-prioritized IT projects	Senior executives do not support IT
6	IT demonstrates leadership	IT management lacks leadership

As discussed earlier in this section, alignment is suggested to be a continuous process. Consequently, such a process should be created and maintained in an organization. However, research provides few managerial implications to this area. A few authors suggest that assuring alignment should be the responsibility of the IT governance function (Symons 2005; Dahlberg & Kivijärvi 2006). In the Integrated IT Governance Framework, alignment is the starting point of the IT governance process, affecting on how IT is organized, resourced, managed and measured (Dahlberg & Kivijärvi 2006). For example, IT investments should be aligned with the organizational strategy (Symons 2005). Moreover, measurement systems, such as the Balanced Scorecard can be used in the process to promote alignment (Hu & Huang 2005). Nevertheless, IT governance should be closely connected to business, and hence constant communication and common understanding is required between top business and IT executives (Symons 2002). However, in many organizations, there may even be challenges in communicating the business strategy to the people responsible for executing it (Symons 2005). Finally, even if both business and IT strategies exist, are communicated and aligned, it may not be enough: to successfully leverage IT in business, IT and business strategy should be the same (Symons 2002).

According to the discussion above, factors affecting alignment encompass the entire organization. They include numerous intangible factors as well, making it difficult in practice to affect or even evaluate them. As a solution, taking into account the holistic nature of alignment, several authors suggest that EA could be an approach for enabling or improving alignment (Maes, Rijsenbrij ym. 2000; Slot 2000; Zijden, Goedvolk ym. 2000; Hirvonen & Pulkkinen 2003; Pereira & Sousa 2003; Weiss & Anderson 2004; van der Raadt, Hoorn ym. 2005; Zarvic & Wieringa 2006). Particularly, a few EA frameworks (Zijden, Goedvolk ym. 2000; Zarvic & Wieringa 2006), and maturity models (Slot 2000) for pursuing alignment have been proposed.

3.5 Summary

Above, we extensively discussed the various views of alignment from literature. According to literature, alignment between business and IT is an evolutionary process, which needs to be maintained over time by planning, design, management, and evaluation activities on both strategic and tactical levels. Moreover, alignment may refer to the extent or amount of alignment, measured by e.g. various maturity models. From the large number of models developed to depict this complex phenomenon, the SAM remains the most commonly referred. In general, several common factors affecting alignment can be derived:

- *strategic* factors, such as business and IT strategies, plans, objectives and vision,
- *structural* factors, such as processes, organizational structure, architectures, governance and competences,
- *social* and *cognitive* factors, such as communication, partnership, learning, and common knowledge and understanding, and
- *measurement* and *evaluation* factors, such as metrics and measurement systems for both business and IT.

Alignment, in turn, is argued to lead to a multitude of benefits, of which several have been empirically substantiated. Practically, alignment is suggested to be the responsibility of IT governance, which in turn needs to be in close relationship with business. However, since research offers little contributions to practice, alignment remains challenging to improve, sustain, or evaluate in practice. Moreover, factors affecting alignment encompass the entire organization, indicating that an extensive, holistic approach would be needed to address these issues. Hence, we continue with the notion, with support from literature (Maes, Rijsenbrij ym. 2000; Slot 2000; Zijden, Goedvolk ym. 2000; Hirvonen & Pulkkinen 2003; Pereira & Sousa 2003; Weiss & Anderson 2004; van der Raadt, Hoorn ym. 2005; Zarvic & Wieringa 2006), that EA could be this kind of an approach.

4 Business-IT Alignment in the EA Context

In this section, we will address alignment in the EA context – how could these two concepts relate to each other. We start by discussing the common characteristics of EA and alignment.

4.1 Common Characteristics of EA and Alignment

As described earlier, EA includes all the models needed in managing and developing an organization, including the viewpoints of business, systems, information and technology (see e.g. de Boer, Bosanque ym. 2005; Kaisler, Armour ym. 2005; Jonkers, Lankhorst ym. 2006). Although the concept in various forms has been discussed by academics for approximately 15 years, the area of research is still fragmented, lacking a consistent view. The studies on EA have attempted to define the concept itself (see e.g. Kaisler, Armour ym. 2005; Lankhorst 2005), and developed various frameworks (see e.g. Sowa & Zachman 1992; The Open Group 2006), and modeling and development methods (see e.g. Lankhorst 2005; Ylimäki, Halttunen ym. 2005; Lam-Son & Wegmann 2006). Recently, EA evaluation aspects, such as maturity evaluation (see e.g. OMB 2005; Niemi 2006) and critical success and failure factors (Rehkopf & Wybolt 2003; van der Raadt, Soetendal ym. 2004; Ylimäki 2006) have gained increasing attention.

The EA critical success factors (CFSs) depict the key areas where things have to be done exceedingly well in order to succeed and achieve the objectives and goals set for the EA (Ylimäki 2006). As can be seen from Figure 4, the factors relate to

- EA scoping and planning,
- EA development, management and measurement practices, organization and processes,
- EA's integration to organization's processes, and
- organizational and social practices, structures and behavior.

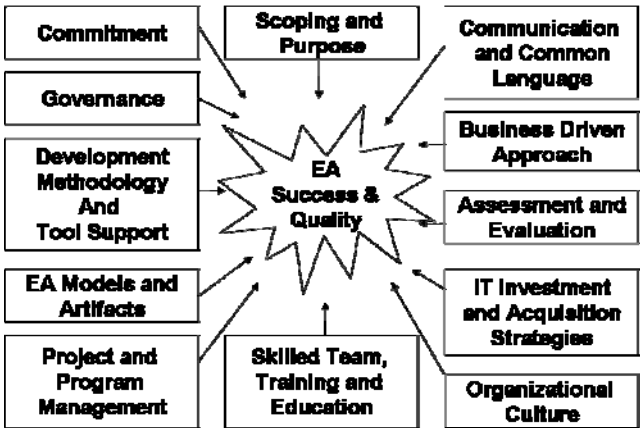

Figure 4. CFSs for EA (Ylimäki 2006).

From the point of view of EA as a holistic view of an organization, as well as its CFSs, EA and EA work seem to encompass the entire organization. Alignment-related factors (see Luftman 2000, for example), even though possibly different in scope and emphasis, seems to deal with organization-wide issues as well, thus requiring a holistic approach for their improvement, management or

evaluation. Van der Raadt et al. (2005) also suggest that a same set of factors affect both EA maturity and alignment. Moreover, alignment is regarded as one of the key benefits of EA (Morganwalp & Sage 2004; Ross & Weill 2005; Goethals, Snoeck ym. 2006; Kluge, Dietzsch ym. 2006; Niemi 2006), indicating that EA could be one potential vehicle towards better alignment.

4.2 Relationship between EA and Alignment

The viewpoint discussed in the previous section has been developed further by several authors. Hirvonen and Pulkkinen (2003) suggest that EA development can be seen as a bridge between business and IT development (Figure 5). Therefore, alignment can potentially be achieved through EA. EA as a business-driven approach guides and controls IT investments and projects implementing the investments by developing new ISs (or new IT) that support the business. This implies that in order to reach the desired state of alignment between business and IT via the EA approach, alignment is also required at least between business and EA, EA and investments, EA and projects, and investments and projects, as well as between EA and the actual impacts (benefits, new systems, cost-reduction etc.) of both investments and projects. In addition, alignment may be required between the organization's EA, and its partners' or customers' EA.

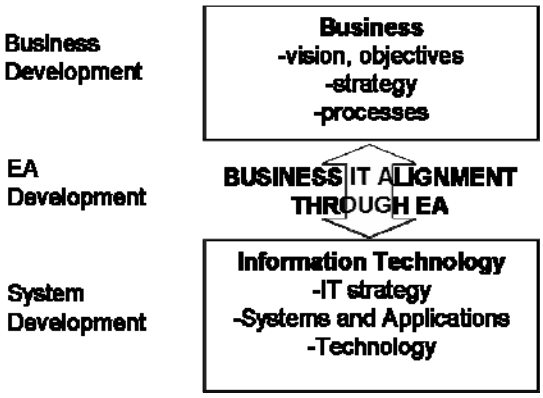

Figure 5: EA development as a bridge between business and IT (adapted from Hirvonen & Pulkkinen 2003).

Interestingly, the above mentioned objects (business, EA, investment, project and so forth) seem to be similar to the objects related to EA compliance and its evaluation (see Ylimäki, Niemi ym. 2007), which include the objects of business, external directions, EA, investment, project, impacts of investments and projects, partners, and customers. EA compliance, indicating conformance with specific specifications, is potentially required between the objects, as depicted in Figure 6. Therefore, we suggest that the same objects may also be the potential objects between which alignment is needed in the EA context to enable the organization to reach alignment between business and IT.

Moreover, other relationships may exist between the concepts of compliance and alignment. It seems that, even if business and EA are compliant (i.e. the business strategies and requirements have been taken into account in EA development, EA plans and models, and so forth), it does not automatically guarantee that business and EA have reached an ideal or desired state of alignment. For example, this could be the case in a situation where the business strategies and requirements themselves take alignment into account insufficiently, are too vague or abstract and interpreted into EA incorrectly. Moreover, a development project aiming at implementing a part of EA may end up

in a situation where it cannot follow the EA specifications and instructions, at least not with the existing resources. In both of these situations, it is crucial that workable feedback channel and practices exist to enable projects to provide valuable feedback to the EA development team, as well as, enable the EA team to provide help to projects to be able to proceed. In turn, the team can then analyze possible changes required in the EA plans, policies and models, or even identify development potential in the business strategies and requirements, to be communicated to organizational strategy planning. Because of the challenges mentioned, it seems that even the case of non-compliance or non-alignment, for instance between EA and a project, is not necessarily a disaster: it may reveal false assumptions made in EA development and planning, or even in the formation of the business strategy and requirements (see also The Open Group 2006).

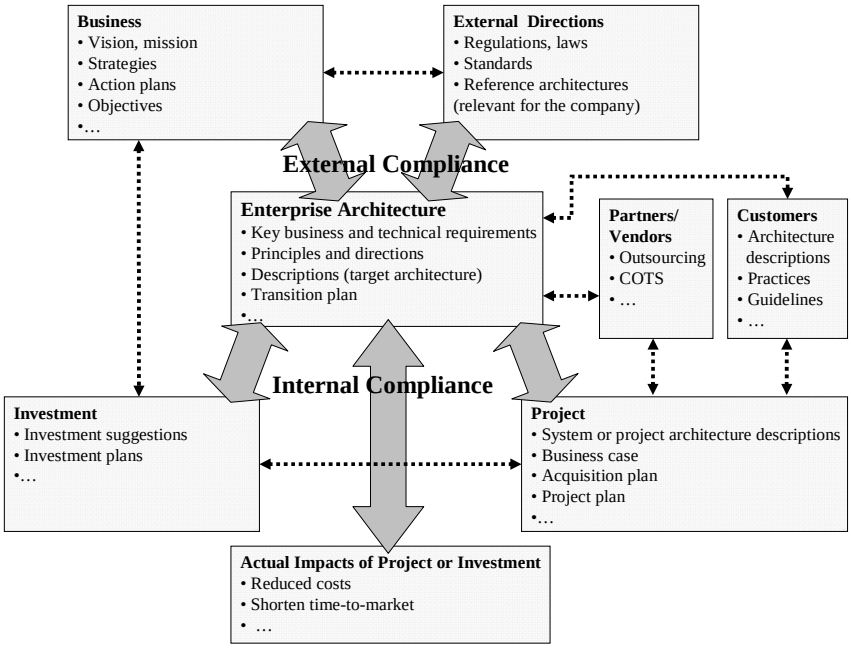

Figure 6. EA compliance objects and their possible relationships to be evaluated (Ylimäki, Niemi ym. 2007).

In addition, the alignment of various architectures, or architectural views, of an organization has been addressed by a few authors. Particularly, business architecture is proposed as a means for embedding business strategy to organization's other architectures, namely organization, process and IT (Versteeg & Bouwman 2006), providing a pragmatic framework for at least one-way alignment between business and IT. Further, Pereira and Sousa (2003) discuss alignment between organization's architectures, specifically business architecture, information architecture and application architecture, providing alignment criteria for the resulting three two-way interrelationships between the architectures. Chen et al. (2005) take a similar approach in developing a method for alignment, addressing alignment between business model, business architecture and IT architecture. Particularly, business architecture may allow the interpretation of business requirements to IT (Rosen, Ambler ym. 2007).

A different approach has been suggested by Slot (2000). He has developed an EA maturity model, building on the work by IAF (Goedvolk 1999), and Maes et al. (Maes, Rijsenbrij ym. 2000). He attempts to associate EA maturity levels with certain EA processes that should be developed or

refined in these levels. As a result, an approach suggested to improve alignment is provided. Deducing from this assumption, Slot seems to assume that alignment improves as EA maturity increases. As the maturity of EA refers to the organization's capability to manage the development, implementation and maintenance of its EA (van der Raadt, Soetendal ym. 2004), it could be assumed that having good EA processes leads to high alignment. Van der Raadt et al. (2005) support this notion by suggesting that EA alignment and maturity correlate, but do not explain one another.

4.3 Summary

Deducing from the discussion above, we draw the following conclusions:

1) Both EA and alignment are affected by a large number of factors in an organization
2) Factors affecting EA and alignment are similar to an extent
3) Alignment of architectures is one aspect of alignment
4) EA and EA work potentially improve alignment, but do not explain it on their own
5) EA compliance and alignment are related but compliance does not guarantee alignment.

Hence, two suggestions can be made about the relation between EA and alignment: 1) EA can be regarded as an enabler of achieving, improving and sustaining alignment in organizations, by providing tools for describing and communicating various aspects of an organization (e.g. the business strategy and objectives), as well as for achieving ISs that support the business, and 2) the factors affecting the success of EA and the extent of alignment are somewhat similar, even implying that alignment improvement efforts can be regarded as EA work having a slightly different scope and emphasis.

5 Evaluating Business-IT Alignment

In Section 2, several models for alignment were briefly introduced. In this section, we will focus on some of the models and present the evaluation aspects contained in these models, as well as some sample metrics suggested for these aspects. Furthermore, we will discuss how these models may enable evaluating alignment. The models addressed in this section are

- Luftman's (2000) strategic alignment maturity assessment method,
- Reich and Benbasat (2000): Social dimension of alignment,
- Chan et al. (1997): Four measurement instruments, and
- Symons's (2005) practical suggestions for alignment measures.

The three first models have been validated in practical cases, and hence they can be regarded as a feasible basis for alignment evaluation planning by introducing several evaluation targets and metrics. In addition, Symons (2005) provides some practical quantitative examples of alignment metrics. Other models, not included in this analysis, may also provide viable examples. However, some of the models are not validated or do not sufficiently suit practice these models. For example, the assessment model by van der Raadt et al. (2005) has not yet been validated.

First, Luftman's strategic alignment maturity assessment method (Luftman 2000) consists of five maturity levels: 1) initial/ad hoc process, 2) committed process, 3) established focused process, 4) improved/managed process, and 5) optimized process. Furthermore, as previously described, it contains six criteria (see also Figure 2): 1) communication maturity, 2) competence/value measurement maturity, 3) governance maturity, 4) partnership maturity, 5) scope & architecture maturity and 6) skills maturity. The sub-attributes or practices of the criteria, each with rationale for mapping it to a specific maturity level, are also presented (Luftman 2000; 2003). An excerpt of an evaluation score sheet is provided in Figure 7.

Practice Categories		Practices	Averaged Scores									Average Category Score
			1	1.5	2	2.5	3	3.5	4	4.5	5	
Communications	1	Understanding of business by IT										
	2	Understanding of IT by business										
	3	Organizational learning										
	4	Style and ease of access										
	5	Leveraging intellectual assets										
	6	IT–business liaison staff										
Competency/Value Measurements	7	IT metrics										
	8	Business metrics										
	9	Link between IT and business metrics										
	10	Service level agreements										
	11	Benchmarking										
	12	Formally assess IT investments										
	13	Continuous improvement practices										
Governance	14	Formal business strategy planning										
	15	Formal IT strategy planning										
	16	Organizational structure										
	17	Reporting relationships										

Figure 7. An excerpt of a business-IT alignment score sheet (from Luftman 2003).

Luftman suggests that the maturity evaluation should be carried out by a team of both business and IT managers, typically 10 to 30 participants. The team members should evaluate each of the alignment sub-attributes and determine which maturity level their organization matches. The evaluation can either be done by surveys, in a facilitated group setting, or by their combination. (Luftman 2000; 2003) A smaller set of sub-attributes can also be selected to result in a lighter survey (see e.g. Cumps, Viaene ym. 2006).

Second, Reich and Benbasat (2000) suggest four constructs that affect the social dimension of alignment: 1) communication between business and IT executives, 2) connection between business and IT planning, 3) shared domain knowledge between business and IT executives, and 4) IT implementation success. By social dimension of alignment they mean "the state in which business and IT executives within an organizational unit understand and are committed to the business and IT mission, objectives and plans" (Reich & Benbasat 2000). By measuring these constructs, both short-term and long-term alignment can be evaluated. Examples of measures and practices for each construct are presented in Table 2.

Table 2. Examples of measuring business-IT alignment (from Reich & Benbasat 2000)

Construct 1: Measuring communication between business and IT executives

- Six techniques are used to capture the interaction between business and IT executives:
  - Direct communication: regular or ad hoc meetings, email, or written memos
  - Liaison roles: a named person as liaison between IT and a line function
  - Temporary task forces: IT project team, new product development team
  - Permanent teams/committees: IT steering committee
  - Integrating roles: IT person leads the business quality team
  - Managerial linking roles: product management role
- Data is gathered from interviews validated by written documents (e.g. minutes of meetings).
- Low, moderate or high levels of communication are identified.

Construct 2: Measuring connections between business and IT planning

- Business unit representatives are asked to describe the steps in the most recent IT and business planning process.
- These descriptions are classified according to the types of IT planning describing different levels or degree of connections:
  - Level 1: Isolated – IT and business plans are developed separately
  - Level 2: Architected – IT plans are developed from data and application architectures
  - Level 3: Derived – IT plans are developed during a top-down analysis beginning with business objectives
  - Level 4: Integrated – IT plans are developed and ratified at the same time as other business objectives. Both business and IT executives participate in the planning.
  - Level 5: Proactive – IT objectives precede the formulation of business objectives and are used as input to their development.

Construct 3: Measuring shared domain knowledge

- Measured as work experience: the amount of IT experience among the business executives and amount of business experience among the IT executives.
- Business knowledge may be divided into divisions depending on the line of business of the organization. E.g. in an insurance company business knowledge can be regarded as an aggregate of 1) experience in the insurance industry and 2) experience as a line supervisor or manager
- Each interviewees' education and work history is elicited and rated; examples:
    - High level – more than 10 years in line roles or more than two years in IT management
    - Moderate level – between 3-5 years in line roles or management of a large IT project
    - Low level – under five years in line roles or user level involvement in IT only)

Construct 4: Measuring IT implementation success

- Each interviewee is asked several questions about IT activities during the last two years, including, for example:
    - Name the major projects started in the past two years.
    - How successful were each of the major projects?
    - Overall, how well were the IT plans implemented?
- In addition, open questions are asked about the general IT history within the business unit and major IT decisions are discussed to determine whether they are characterized as successes or failures.
- Based on this data, the overall level of success in IT implementation is rated (high, moderate or low).

Third, IS strategic alignment assessment presented by Chan et al. (1997) deals with four dimensions: 1) Current Realized Business Unit Strategy, 2) Business Performance, 3) IS Effectiveness, and 4) Realized IS Strategy. The authors develop instruments for each of the dimensions, and examples of these are presented in Table 3. The assessment is carried out as a survey, and each of the dimensions is assessed by a different informant in companies.

Table 3. Examples of IS strategic alignment assessment metrics (from Chan, Huff ym. 1997).

Current Realized Business Unit Strategy

- Aggressiveness: increasing market share even if it means reduced prices
- Proactiveness: first to introduce new products and services
- Innovativeness: creativity and experimentation are strengths

Business Performance

- Market share gains, sales growth, revenue growth
- ROI, cash flow, profitability
- Satisfaction with new product or service development

IS Effectiveness - Satisfaction with IS staff and services, e.g. satisfaction with the time required for new systems development - Satisfaction with users' participation in systems projects - IS increase the efficiency of business operations - IS improve decision-making
Realized IS Strategy - Systems used in the business unit help introducing products and services - Systems used in the business unit help monitoring changes in the market share

Finally, Symons (2005) presents some practical quantitative examples of alignment measures. These measures deal with 1) meetings, 2) projects, and 3) budget (see Table 4). For instance, metrics related to meetings indicate that the more frequent the meetings are, the more conceivable is the improved alignment. In addition, the metrics related to projects indicate that in order to achieve alignment, projects should be traceable to strategic business goals. However, without a more explicit framework to guide the evaluation, these metrics should be implemented with caution.

Table 4. Example metrics for alignment (from Symons 2005)

Meetings - Number of IT steering committee meetings - Number of joint IT and business planning meetings - Percentage of IT budget allocated to new initiatives versus sustaining the business
Projects - Number or percentage of current projects that are directly linked to a strategic business goal - Number or percentage of projects in which the business unit provided the ROI or the business case as opposed to IT - Number or percentage of projects with post-implementation audits to determine if the business case or ROI targets were met
Budget - Percentage of IT budget for new initiatives

To conclude, various different approaches exist for evaluating alignment. What seems to differentiate these approaches from each other is that they have a slightly different focus on the issues to be evaluated. They also seem to provide metrics of different granularity compared to each other. Both Luftman (2000; 2003) and Reich & Benbasat (2000) provide a wide selection of evaluation metrics, ranging from soft issues (e.g. communication) to hard issues (e.g. business metrics or skills related metrics). The soft aspects, especially the communication point of view, seems to be missing from the examples provided by Chan et al. (1997) and Symons (2005). However, communication and common understanding is required between business and IT executives (Symons 2002; van der Raadt, Hoorn ym. 2005). Similarly, in her later research, Chan discovered that soft aspects, especially the informal organization structure, may also affect the alignment success (Chan 2002).

We share the viewpoint of Luftman (2000; 2003) and Reich & Benbasat (2000) that both soft and hard issues need to be considered in enabling the success of both alignment and EA work. Therefore, by a combination of both qualitative (soft) metrics and quantitative (hard) metrics, a most pertinent set of metrics for evaluating the extent of alignment can be achieved. It seems that the communication aspect, as one of the major soft issues in enabling both alignment and EA success, should be measured in alignment evaluations.

If alignment is regarded as one of the goals of EA work, the sample metrics presented in this section may provide some ideas for selecting or formulating the organization specific metrics to evaluate the extent of alignment in the EA context. Furthermore, the sample metrics represent the type of metrics that may be incorporated into the set of EA metrics in organization.

6 Conclusion

In this report, the concept of alignment was extensively discussed according to literature. Particularly, the various definitions, components, models, benefits and practical aspect of the concept were discussed. In addition, the concept was addressed in the EA domain, and approaches for its evaluation were described. To summarize the results, we draw the following conclusions:

- Majority of the definitions for alignment are vague: none depicts the full picture of the concept. According to literature, alignment is an evolutionary process, which needs to be maintained over time by planning, design, management, and evaluation activities on both strategic and tactical levels. It is affected by a great number of strategic, structural, social, cognitive, and evaluation-related factors. Furthermore, alignment may refer to the extent or amount of alignment, measurable with e.g. various maturity models.
- EA can be seen as the enabler of alignment: EA approach can be regarded as a bridge between business and IT, and improved alignment is usually one of the goals of EA work.
- Alignment evaluation can be seen as a part of evaluating the EA and its benefits. Especially, if improved alignment between business and IT is defined to be one of the goals of EA work, evaluation is needed to demonstrate whether the goal has been reached, and to what extent has the goal of alignment been reached. Examples of measures to evaluate alignment were presented to provide some ideas to define the organization-specific metrics for alignment.

Moreover, there seems to be a relationship between EA compliance and alignment. Hence, we suggest that the evaluation targets of alignment evaluation in the EA context are the same as the evaluation targets of EA compliance evaluation as described in Figure 7. This raises the question of whether the evaluators of alignment might be the same than the evaluators of EA compliance. Stakeholders that conduct or assist in conducting EA compliance evaluation are suggested to be those stakeholders who deal with or are in charge of the evaluation objects of EA compliance, such as business representative, project manager, CFO, or CIO (Ylimäki, Niemi ym. 2007). However, Jayashetty et al. (2004) claim that an organization needs to have a functional Architecture Review Board (or architecture governance board), which is responsible for evaluating alignment periodically. Still, both the evaluation targets and evaluators of alignment in the EA context remain to be clarified in further studies.

Further research is also needed to study how to successfully apply the existing metrics in defining organization specific metrics for business-IT alignment, or for an EA program in the cases where alignment is one of the major goals of EA work. Further research could also clarify the relationship between EA and alignment in more detail.

References

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

Bruls, W. (2003). Representing Business/IT alignment in the enterprise planning cycle. Proceedings of the Landelijk Architectuur Congres 2003 (LAC 2003). Nieuwegein, the Netherlands, Nederlands Architectuur Forum.

Chan, Y. E. (2002). "Why Haven't We Mastered Alignment? The Importance of tthe Informal Organizational Structure." MIS Quarterly Executive **1**(2).

Chan, Y. E., S. L. Huff, D. W. Barclay & D. G. Copeland (1997). "Business Strategic Orientation, Information Systems Strategic Orientation, and Strategic Alignment." Information Systems Research **8**(2): 125-150.

Chen, H.-M., R. Kazman & A. Garg (2005). "BITAM: An engineering-principled method for managing misalignments between business and IT architectures." Science of Computer Programming **57**(1): 5-29.

Ciborra, C. U. (1997). "De profundis? Deconstructing the concept of strategic alignment." Scandinavian Journal of Information SYstems **9**(1): 67-82.

Cumps, B., S. Viaene, G. Dedene & J. Vandenbulcke (2006). An Empirical Study on Business/ICT Alignment in European Organizations. Proceedings of the 39th Hawaii International Conference on System Sciences. Kauai, Hawaii, USA, IEEE Computer Society.

Dahlberg, T. & H. Kivijärvi (2006). An Integrated Framework for IT Governance and the Development and Validation of an Assessment Instrument. Proceedings of the 39th Hawaii International Conference on System Sciences. Kauai, Hawaii, USA, IEEE Computer Society.

de Boer, F. S., M. M. Bosanque, L. P. J. Groenewegen, A. W. Stam, S. Stevens & L. van der Torre (2005). Change Impact Analysis of Enterprise Architectures. Proceedings of the IEEE International Conference on Information Reuse and Integration, IRI -2005, IEEE**:** 177-181.

Goedvolk, J. G. (1999). White Paper Integrated Architecture Framework. Cap Gemini White Paper, Cap Gemini.

Goethals, F., M. Snoeck, W. Lemahieu & J. Vandenbulcke (2006). "Managements and enterprise architecture click: The FAD(E)E framework." Information Systems Frontiers **8**(2): 67-79.

Henderson, J. & N. Venkatraman (1989). Strategic Alignment: A Model for Organizational Transformation. Transforming Organizations. T. Kochan & M. Unseem. New York, USA, Oxford University Press.

Henderson, J. C. & N. Venkatraman (1993). "Strategic alignment: Leveraging information technology for transforming organizations." IBM Systems Journal **32**(1): 4-16.

Hirvonen, A. & M. Pulkkinen (2003). Evaluation of IT Architecture Solutions - How Can an ICT Consultant Tell What Is Best for You? Proceeding of the 10th European Conference on Information Technology Evaluation, Management Centre International Limited.

Hu, Q. & C. D. Huang (2005). Aligning IT with Firm Business Strategies Using the Balance Scorecard System. Proceedings of the 38th Hawaii International Conference on System Sciences (HICSS'05). Big Island, Hawaii, USA, IEEE Computer Society.

Jayashetty, S., P. K. Manjunatha & H. Kashyap. (2004). "Over-Engineering Enterprise Architecture and Business Competitiveness." SETLabs Briefings, Vol. 2. No. 4, http://www.infosys.com/technology/sb_v2n4_enterprise_architecture_and_business_competitiveness.pdf.

Jonkers, H., M. Lankhorst, H. ter Doest, F. Arbab, H. Bosma & R. Wieringa (2006). "Enterprise architecture: Management tool and blueprint for the organization." Information Systems Frontiers **8**(2): 63-66.

Kaisler, S. H., F. Armour & M. Valivullah (2005). Enterprise Architecting: Critical Problems. Proceedings of the 38th Hawaii International Conference on System Sciences, HICSS'05. Hawaii, IEEE Computer Society.

Kluge, C., A. Dietzsch & M. Rosemann (2006). How to Realize Corporate Value from Enterprise Architecture. the Proceedings of the 14th European Conference on Information Systems (ECIS 2006). Göteborg, Sweden, Association for Information Systems.

Lam-Son, L. & A. Wegmann (2006). SeamCAD: Object-Oriented Modeling Tool for Hierarchical Systems in Enterprise Architecture. Proceedings of the 39th Annual Hawaii International Conference on System Sciences, HICSS '06.

Lankhorst, M. (2005). Enterprise Architecture at Work. Modelling, Communication, and Analysis, Springer-Verlag.

Leganza, G. (2003). Overcoming Obstacles to the Alignment of IT and the Business. Giga Research Planning Assumptions, Giga Information Group.

Levy, Y. & T. J. Ellis (2006). "A Systems Approach to Conduct an Effective Literature Review in Support of Information Systems Research." Informing Science Journal **9**(1): 181-212.

Luftman, J. (2000). "Assessing Business-IT Alignment Maturity." Communications of AIS **4**(Article 14).

Luftman, J. (2003). "Assessing IT/Business Alignment." Information Systems Management **20**(4): 9-15.

Luftman, J., R. Kempaiah & E. Nash (2006). "Key Issues for IT Executives 2005." MIS Quarterly Executive **5**(2).

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

Luftman, J. N., R. Papp & T. Brier (1999). "Enablers and Inhibitors of Business-IT Alignment." Communications of the Association for Information Systems **1**(11).

Maes, R. (1999). "A Generic Framework for Information Management." PrimaVera Working Paper 1999-03 Tarkistettu 31 January, 2007, http://imwww.fee.uva.nl/~maestro/PDF/99-03.pdf.

Maes, R., D. Rijsenbrij, O. Truijens & H. Goedvolk. (2000). "Redefining business-IT alignment through a unified framework." PrimaVera Working Paper 2000-19 Tarkistettu 29 January, 2007, http://primavera.fee.uva.nl/PDFdocs/2000-19.pdf.

Moody, K. W. (2003). "New Meaning to IT Alignment." Information Systems Management **20**(4): 30-35.

Morganwalp, J. M. & A. P. Sage (2004). "Enterprise Architecture Measures of Effectiveness." International Journal of Technology, Policy and Management **4**(1): 81-94.

Niemi, E. (2006). Enterprise Architecture Benefits: Perceptions from Literature and Practice. Proceedings of the 7th IBIMA Conference on Internet & Information Systems in the Digital Age. Brescia, Italy, International Business Information Management Association (IBIMA).

Niemi, E. (2006). "Enterprise Architecture Work Overview in Three Finnish Business Enterprises." WSEAS Transactions on Business and Economics **3**(9): 628-635.

OMB (2005). Federal Enterprise Architecture Program EA Assessment Framework 2.0, OMB FEA Program Management Office, The Executive Office of the President, USA.

Papp, R. (1999). "Business-IT alignment: productivity paradox payoff?" Industrial Management & Data Systems **99**(8): 367-373.

Pereira, C. M. & P. Sousa (2003). Getting into the misalignment between Business and Information Systems. Proceedings of the 10th European Conference on Information Technology Evaluation. Madrid, Spain, Academic Conferences International.

Rehkopf, T. W. & N. Wybolt (2003). "Top 10 Architecture Land Mines." IT Professional **5**(6): 36-43.

Reich, B. H. & I. Benbasat (1996). "Measuring the linkage between business and information technology objectives." MIS Quarterly **20**(1).

Reich, B. H. & I. Benbasat (2000). "Factors That Influence the Social Dimension of Alignment between Business and Information Technology Objectives." MIS Quarterly **24**(1): 81-113.

Rosen, M., S. W. Ambler, T. K. Hazra, W. Ulrich & J. Watson (2007). Enterprise Architecture Trends. Enterprise Architecture, Vol. 10, No. 1. Arlington, Massachusetts, USA, Cutter Consortium.

Ross, J. & P. Weill (2005). Understanding the Benefits of Enterprise Architecture. CISR Research Briefings 2005. Cambridge, USA, Massachusetts Institute of Technology.

Silva, E., L. Plazaola & M. Ekstedt (2006). Strategic Business and IT Alignment: A Prioritized Theory Diagram. Proceedings of the Portland International Conference on Management of Engineering and Technology (PICMET '06). Istanbul, Turkey, PICMET.

Silvius, A. J. G. (2007). Business & IT Alignment in theory and practice. Proceedings of the 40th Hawaii International Conference on System Sciences. Big Island, Hawaii, USA, IEEE Computer Society.

Slot, R. (2000). "Improving Business - IT Alignment Towards an Enterprise Architecture Maturity Model." Cap Gemini White Paper Tarkistettu 30 January, 2007, http://www.serc.nl/lac/LAC-2001/lac-2000/1-dynamiek/enterprise%20architecture%20maturity%20model.doc.

Sowa, J. F. & J. A. Zachman (1992). "Extending and Formalizing the Framework for Information Systems Architecture." IBM Systems Journal **31**(3): 590-616.

Strnadl, C. F. (2006). "Aligning Business and IT: the Process-Driven Architecture Model." Information Systems Management **23**(4): 67-77.

Symons, C. (2002). Aligning IT Strategy With Business Strategy Is Too Late. Ideabyte, Giga Information Group.

Symons, G. (2005). IT and Business Alignment: Are We There Yet? Forrester Research Trends. Cambridge, USA, Forrester Research.

Symons, G. (2005). IT Strategy Maps: A Tool For Strategic Alignment. Forrester Research Best Practices. Cambridge, USA, Forrester Research.

Tan, F. B. & R. B. Gallupe (2006). "Aligning Business and Information Systems Thinking: A Cognitive Approach." IEEE Transactions on Engineering Management **53**(2): 223-237.

The Open Group. (2006). "The Open Group Architecture Framework version 8.1.1, Enterprise Edition (TOGAF 8.1.1)." Tarkistettu 10 September, 2006, http://www.opengroup.org/architecture/togaf/.

van der Raadt, B., J. Hoorn, F. & H. van Vliet (2005). Alignment and Maturity are Siblings in Architecture Assessment. Proceedings of the 17th Conference on Advanced Information Systems Engineering, CAiSE 2005. Porto, Portugal, Springer.

van der Raadt, B., J. Soetendal, M. Perdeck & H. v. Vliet (2004). Polyphony in Architecture. Proceedings of the 26th International Conference on Software Engineering (ICSE 2004), IEEE Computer Society**:** 533-542.

Wegmann, A., P. Balabko, L.-S. Lê, G. Regev & I. Rychkova (2005). A Method and Tool for Business-IT Alignment in Enterprise Architecture. Proceedings of the 17th International

Conference on Advanced Information Systems Engineering (CAiSE'05). Porto, Portugal, Springer.

Weiss, J. W. & D. Anderson (2004). Aligning Technology and Business Strategy: Issues & Frameworks, A Field Study of 15 Companies. Proceedings of the 37th Hawaii International Conference on System Sciences.

Versteeg, G. & H. Bouwman (2006). "Business architecture: A new paradigm to relate business strategy to ICT." Information Systems Frontiers **8**(2): 91-102.

Ylimäki, T. (2006). "Potential Critical Success Factors for Enterprise Architecture." Manuscript, to be submitted to the Journal of Enterprise Architecture.

Ylimäki, T., V. Halttunen, M. Pulkkinen & T. Lindström (2005). Methods and Tools for Enterprise Architecture. Larkki Project October 2001 - April 2005, Publications of the Information Technology Research Institute 16, 2005, University of Jyväskylä.

Ylimäki, T., E. Niemi & N. Hämäläinen (2007). Enterprise Architecture Compliance. Unpublished Manuscript, Information Technology Research Institute, University of Jyväskylä. Finland.

Zarvic, N. & R. J. Wieringa (2006). An Integrated Enterprise Architecture Framework for Business-IT Alignment. Proceedings of Workshops and Doctoral Consortium of the 18th International Conference on Advanced Information Systems Engineering (CAiSE'06). Luxembourg, Namur University Press.

Zijden, S., H. Goedvolk & D. Rijsenbrij. (2000). "Architecture: Enabling Business and IT Alignment in Information System Development." Cap Gemini White Paper Tarkistettu 30 January, 2007, http://home.hetnet.nl/~daan.rijsenbrij/arch/publ/artarc05.doc.