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The relation between EA effectiveness and stakeholder satisfaction

Bas van der Raadt[a,*], Marc Bonnet[b], Sander Schouten[c], Hans van Vliet[d]

[a] Ernst & Young Advisory, Euclideslaan 1, 3584 BL Utrecht, The Netherlands
[b] Accenture, Gustav Mahlerplein 90, 1082 MA, Amsterdam, The Netherlands
[c] Capgemini, Papendorpseweg 100, 3528 BJ Utrecht, The Netherlands
[d] Vrije Universiteit, De Boelelaan 1081a, 1081 HV Amsterdam, The Netherlands

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ABSTRACT

Enterprise Architecture (EA) is increasingly being used by large organizations to get a grip on the complexity of their business processes, information systems and technical infrastructure. Although seen as an important instrument to help solve major organizational problems, effectively applying EA seems no easy task. Active participation of EA stakeholders is one of the main critical success factors for EA. This participation depends on the degree in which EA helps stakeholders achieve their individual goals. A highly related topic is effectiveness of EA, the degree in which EA helps to achieve the collective goals of the organization. In this article we present our work regarding EA stakeholder satisfaction and EA effectiveness, and compare these two topics. We found that, regarding EA, the individual goals of stakeholders map quite well onto the collective goals of the organization. In a case study we conducted, we found that the organization is primarily concerned with the final results of EA, while individual stakeholders also worry about the way the architects operate.

1. Introduction

Each organization tries to be unique in order to distinguish itself from its competitors. However, the complexity many large organizations face regarding their business and IT structures, processes, systems and procedures, is not unique. Organizations have different causes for this complexity, such as mergers and acquisitions (Pablo, 1994), low maturity of the IT function (Myers et al., 1998), or high diversity between operating models of various business divisions (Moore, 2005). As a result, however, they typically face similar problems. For example, due to the complexity of the operational environment, maintenance becomes a managerial problem, resulting in stability and continuity problems.

Large organizations use similar instruments to tackle these problems, one of which is *Enterprise Architecture* (EA). EA is concerned with planning the development of the enterprise, including its business processes, information systems and technical infrastructure. Although EA is an instrument for reducing organizational complexity, effectively applying EA is not easy (van der Raadt et al., 2007). This is often caused by the architects not being very well integrated in the organization; they try to solve problems in a manner that is not very effective. There are two typical patterns: architects are (1) too theoretical, or (2) too pragmatic. Enterprise architects are often too theoretical because they suffer from the ivory tower syndrome; they focus on delivering a long-term EA, but forget the link with practice. For example, the EA does not solve the urgent problems of the project manager, and thus ends up as shelf-ware. Technical architects, on the other hand, often help solve short-term, practical problems with their technical knowledge. They are, however, unable to provide senior management with the overview of the organization and advise them on which long-term decisions to make.

The literature mainly focuses on the efficiency of the EA process, methods and frameworks architects use to create their enterprise architectures. Several assessment models are available in the literature, e.g. NASCIO (2003) and US DoC (2007). We also created a basic EA efficiency assessment model (van der Raadt et al., 2005; van der Raadt and van Vliet, 2009). However, we think the answer as to why architects often do not solve the problems of organizational complexity is to be found in other areas than the efficiency of the process and the means they use. Interaction between architects and stakeholders – such as senior management, program and project managers, designers, and programmers – is often problematic. Also, architects are often insufficiently result or goal-oriented. To extend our EA efficiency assessment approach, we address two topics in this article, namely EA stakeholder satisfaction and EA effectiveness.

In Section 4 we discuss that collaboration between architects and EA stakeholders is often problematic because EA stakeholders are reluctant to take part in creating and implementing the EA.

* Corresponding author. Tel.: +31 6 21252084; fax: +31 30 259 2400.
E-mail addresses: bas.van.der.raadt@nl.ey.com, bas@vanderraadt.nl (B. van der Raadt), marc.bonnet@accenture.com (M. Bonnet), sander.schouten@capgemini.com (S. Schouten), hans@cs.vu.nl (H. van Vliet).

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This reluctance depends on the satisfaction of EA stakeholders. This satisfaction is determined by the degree in which stakeholders perceive EA to help them achieve their *individual goals*. Current EA literature provides little insight into how EA stakeholders expect the products and services of architects to help them achieve their goals. We provide this insight based on a case study at a business division of a large international company. The work in Section 4 is based on (van der Raadt et al., 2008).

In Section 5 we argue that many large organizations have doubts about the effectiveness of their architects. Managers responsible for EA want to determine the organizational effectiveness of their architects. This effectiveness is determined by degree in which the outputs of architects help the organization attain its *collective goals*. For this purpose we present an EA effectiveness measurement model, which we applied within the IT and operations division of the same international company.

In general, stakeholders value their individual goals for a system or process more than the collective goals of an organization (Hoorn, 2006). We see no reason to think this is different for EA. We expect that the positive influence of EA on the attainment of organizational goals also determines, to a large degree, stakeholder satisfaction. However, there may also be differences between collective goals of the organization and individual goals of stakeholders. For example, standardization of technologies may be beneficial to the organization, but may hinder a specific department manager, because his department uses non-standard technologies for its business critical applications. If the collective goals of the organization regarding EA coincide with the individual goals of stakeholders, then EA effectiveness determines, to a large degree, EA stakeholder satisfaction. If there are differences, however, other factors determine EA stakeholder satisfaction. In Section 6 we compare the individual goals of stakeholders with the collective goals of the organization to determine the relation between EA effectiveness and EA stakeholder satisfaction.

This article is structured as follows. In Section 2 we describe the theoretical framework we used as a starting point for our research. In Section 3 we discuss related work. In Section 4 we explore how stakeholders perceive EA should help them attain their individual goals. Section 5 describes our research on a measurement model to determine the degree in which EA positively influences the attainment of organizational goals. In Section 6 we compare the concepts of EA stakeholder satisfaction and EA effectiveness. In Section 7 we discuss the limitations of our research. In Section 8 we give our main conclusions.

2. Theoretical framework

The objective of our research is to better understand how to make the organizational function that creates and implements the EA more effective and efficient. To this end, we need a good understanding of what EA entails. However, since there is no one comprehensive definition of EA, we provide a characterization of the concept based on the literature in Section 2.1. Next, we provide a definition of the EA function in Section 2.2 and describe the highlights of our EA function reference model (van der Raadt and van Vliet, 2008) in Sections 2.2–2.4. This provides the starting point for the two studies presented in Sections 4 and 5.

2.1. Enterprise Architecture

An EA provides the overall design of a complex, multisystem solution (Perks and Beveridge, 2003). An EA acts as the target blueprint that provides a long-term view of the organization's processes, systems, and technologies (Ross et al., 2006).An EA provides a means for choosing, from a selection of solution alternatives, the optimal (most feasible) solution to a complex organizational problem (Johnson et al., 2007). This supports senior management decision making (Simonsson et al., 2005). The selected solution alternative is detailed into the target blueprint (Armour et al., 1999). A target blueprint structures the overall solution into business and information, information systems and technical infrastructure layers (Lankhorst, 2009). The target blueprint thus decomposes the complexity of the organization into comprehensible and manageable business and IT components. This allows for better communication between the various stakeholders of the organizational problem at hand (Smolander and Päivärinta, 2002). In contrast, Software Architecture (SA) aims at creating one system or component within the information systems aspect area (Bass et al., 1998).

To guide the implementation of the target blueprint, an EA also provides an implementation roadmap. An implementation roadmap describes the steps to reach the organization's target state as described in the target blueprint (Pulkkinen et al., 2007). During implementation, the target blueprint provides a means of governance to validate the conformance to the blueprint of sub-solutions delivered by project teams (Boster et al., 2000). This enables senior management to make decisions about which measures to take regarding projects that plan to deliver sub-solutions that deviate from the blueprint. EA thus provides a means for comprehensive and coordinated planning and management of business and ICT development projects (Pulkkinen et al., 2007).

2.2. The EA function

The EA function is the organizational capability responsible for EA. In our view, the EA function not only includes the architects who create and maintain the EA, but also the stakeholders involved in ratifying the architectural decisions and implementing organizational changes in conformance to the EA. Therefore, we define the EA function as: *The organizational functions, roles and bodies involved in creating, maintaining, ratifying, enforcing, and observing EA decision making – established in the enterprise architecture and EA policy – interacting through formal (governance) and informal (collaboration) processes at enterprise, domain, project, and operational levels*. The EA function performs all activities that are required to effectively and efficiently create and implement the EA. These activities are performed by the three sub-functions of the EA function: (1) EA decision making, (2) EA delivery, and (3) EA conformance.

EA decision making (e.g., senior management) is responsible for the formal and informal approval of new EA products or changes to existing EA products. A typical EA product is a target blueprint of the application landscape of the enterprise, including a road map for implementing the target blueprint. The accountability of this decision making is typically assigned to senior management, but may be delegated to a decision making body (e.g., EA council) with representatives from the key stakeholder groups within the organization (e.g., business unit managers, IT managers, program managers). EA decision making also includes resolving conflicts between the various bodies and roles within the EA function, and handling issues of non-conformance. EA products describe the EA decisions taken, and provide a means for communicating and enforcing these decisions throughout the organization. Furthermore, EA decision making defines the objectives of the EA function.

EA delivery (i.e. the architects) is responsible for creating and maintaining the EA products, and provides advice to guide EA decision making. EA delivery also validates solutions and operational changes to see whether they conform to the EA, and provides support in applying EA products.

EA conformance (i.e. projects and operational maintenance) is responsible for implementing organizational changes in compli-

ance with the EA, and provides feedback on the applicability of the EA products.

There are many forms in which the above three sub-functions can be implemented. For example, the EA delivery function can be organized as a temporary task force or a permanent department. EA decision making may be done in an existing management team meeting, or a special architectural board may be created. Regardless of the organizational forms chosen, all three sub-functions should be implemented and should properly perform their activities as described by our reference model in order for the EA function to be effective.

2.3. EA Stakeholders

EA stakeholders are individual or grouped representatives of the organization who are affected by EA products (Boh and Yellin, 2007), either by providing input to EA decision making or having to conform to the EA products. Typical EA stakeholders include senior management, program and project managers, software architects, and enterprise architects. Based on their role within the EA function, the organizational level at which they operate, and the aspect area they focus on, EA stakeholders pursue specific objectives. These objectives are potentially conflicting (van der Raadt and van Vliet, 2008), and may not help to meet organizational objectives (Peterson, 2004). However, regarding the attributes of the products and services of the EA function, each stakeholder expects these to help achieve their goals (Gutman, 1997).

We used the key SA stakeholder roles described by Smolander and Päivärinta (2002) to create the 4 by 4 matrix of EA stakeholders shown in Table 1. The columns represent the four EA aspect areas (Lankhorst, 2009) and the rows represent the four organizational levels (van der Raadt and van Vliet, 2008). We omitted the architect role in Table 1, since we focus on the other EA stakeholders in Section 3. Architect roles exist at different organizational levels, and have one or more aspect areas of responsibility.

At the *enterprise level*, management is responsible for EA decision making regarding the target enterprise architecture. This involves creating a strategy for the aspect area these stakeholders are responsible for. The Chief Information Officer (CIO) is responsible for business and IT alignment (Lindström et al., 2006), i.e. that IT supply meets business information demand. Therefore, the CIO is concerned with both information and IS aspect areas. The Chief Technology Officer (CTO) is responsible for decision making regarding technology components and platforms. The board of directors, responsible for overseeing the activities of an organization, should ensure the organization has an enterprise architecture and its management understands and uses it to determine the impact of their decisions. For example, does management understand the impact of an integration of business activities due to a merger with another organization on the operational continuity of the organization before they make a final decision.

Domain level EA stakeholders are typically domain owners and change managers who coordinate or manage change programs within that domain. Within the business aspect area, a domain owner is the head of a Business Division (BD) or Business Unit (BU), who is responsible for the operational performance of his/her domain. Like the CIO, the Division Information Officer (DIO) (Peterson, 2004) is responsible for the business and IT alignment for a specific business domain, and therefore focuses on both information and information systems aspect areas. Within the TI aspect area, the platform manager is responsible for the operational performance of a platform or infrastructure domain. The platform subject matter expert guides all changes on that platform or domain.

At the *project level*, EA stakeholders are responsible for running projects and implementing high impact changes into the operational environment (van der Raadt and van Vliet, 2008). For example, the business project manager is responsible for delivering, within time and budget, a solution that fits the business requirements. The business analyst is responsible for determining the business requirements and the design of the business processes of the solution.

EA stakeholders at the *operational level* are responsible for the stability and continuity of the operational environment. For example, the operational manager is responsible for day-to-day operation and reporting. Business process, data, application, and infrastructure administrators perform day-to-day maintenance and improvement activities to optimize continuity and stability.

2.4. Outputs of the EA function

The two key outputs of the EA function are: (1) EA decision making, and (2) the implementation of EA decision making. EA decision making is typically written down in *EA products,* which provide a means for communicating and enforcing these decisions throughout the organization (Ross et al., 1996). The key products of the EA function are architectures and EA policies (van der Raadt and van Vliet, 2008). An *architecture* document typically describes *what* the target blueprint for the enterprise looks like. *EA policies* are the principles, standards, guidelines and procedures that prescribe *how* projects should implement organizational changes. Setting EA policies allows organizations to control change activities of subunits without dictating precisely how they handle the details (Boh and Yellin, 2007).

EA implementation is the realization of the EA decisions by running change projects and implementing operational changes conforming to the EA products. This requires collaboration between the EA delivery and conformance sub-functions. EA delivery is responsible for validating solutions and operational changes. It also provides support to EA stakeholders in applying EA products. EA conformance is responsible for providing feedback on the applicability of EA products to the EA delivery function,

Table 1
Key EA Stakeholders, their aspect areas and organizational levels.

	Business	Information	Information systems (IS)	Technical infrastructure (TI)
Enterprise	CEO, CFO, COO Board of Directors	CIO	CIO	CTO
Domain	Head of BD/BU Business change manager	DIO IT change manager	DIO IT change manager	Platform manager Platform subject matter expert
Project	Business project manager Business analyst	Information analyst	Software development project manager Software designer/architect	Infrastructure project manager Infrastructure engineer
Operational	Operational business manager Business process administrator End-user	Database administrator End-user	Application management Application administrator End-user	Data center management Infrastructure administrator

which potentially leads to changes and improvements in the EA products.

3. Related work

3.1. EA Stakeholders

Related work on EA stakeholders by Lindström et al. describes how EA frameworks provide the CIO – as the primary EA stakeholder – a means for decision support, addressing his/her highest priority concerns (Lindström et al., 2006). Although important, the CIO is just one stakeholder of the many functions, roles and bodies that make up the EA function (van der Raadt and van Vliet, 2008). Clerc et al. (2007) describe the software architect's mindset, including some use cases that are stakeholder-centric and involve identifying stakeholders and communicating the architecture towards these stakeholders. Even though they describe elements of importance for the collaboration between architects and stakeholders, they focus primarily on the software architect's perspective. Smolander et al. describe stakeholder participation in software architecture design, including their problems in relation to architecture, and the rationale for architecture description they emphasize (Smolander and Päivärinta, 2002). However, they primarily focus on the role of stakeholders from the software architect's perspective. They do not provide insight in the specific objectives of EA stakeholders who are not architects themselves, and the way in which stakeholders expect architecture to help them achieve those objectives.

3.2. EA Effectiveness

Many existing EA function assessment approaches focus on determining the efficiency of the EA delivery function. They focus on the EA processes, the quality of the EA products, and the knowledge, skills and experience of the architects (e.g., NASCIO, 2003; US DoC, 2007). Although these approaches provide valuable information that might be used to improve the EA function, these approaches provide no insight in the degree in which the EA function achieves the objectives pursued with EA. Other existing approaches focus on determining the financial value of the EA function (e.g., Schekkerman, 2005). However, there are quite some disadvantages to using traditional financial methods to evaluate EA functions (Hoffman, 2007). We have reason to believe it is very hard to cost-justify having an EA function (Zachman, 2001). The focus of EA is mainly on improving the quality of decision making and implementation of organizational changes, to eventually improve the quality of service provided to customers. In general, service quality improvement is hard to translate into financial benefits (Zeithaml, 2000). Furthermore, based on our practical experience, we have learned that organizations are not so much interested in justifying the costs of the EA function – most managers we have spoken to do not question the EA function's reason for existence, but want to know whether they are achieving the objectives they have set with their EA function.

Morganwalp and Sage (2004) summarize the perspectives of several authors on how to measure the effectiveness of EA (in terms of objectives or metrics). Based on the three measurement dimensions and corresponding benefits of Buchanan (2001), Morganwalp et al. formulate 12 qualitative objectives, with 58 corresponding indicators. 11 of 12 objectives (47 of 58 indicators) appeared to be positively influenced by EA. A limitation of this research is that it focuses on the positive impact of an EA framework and architecture development process. However, this does not measure the positive impact of the quality and implementation of EA decision making on the goals of the organization as we do in our research.

4. EA stakeholder satisfaction

In order for the EA function to be effective, architects and EA stakeholders should work together through formal (governance) processes, but more importantly through informal (collaboration) processes (Peterson, 2004). The foundation for this collaboration between architects and EA stakeholders is the understanding of each other's perspectives in EA decision making (Peterson, 2004). EA stakeholders make decisions based on the objectives specific to their roles (Nutt, 1984). The willingness of EA stakeholders to participate in the EA function depends on their satisfaction with its performance, which is determined by the degree in which they perceive their expectations about the EA function to be met (Zeithaml et al., 1990). EA stakeholders expect the consequences of the EA function's products and services (outputs) to help them achieve their goals (Gutman, 1997). In order to effectively work together with EA stakeholders, architects should have a good understanding of the individual goals of EA stakeholders and how they can positively impact them.

In this section, we provide insight in the mindset of EA stakeholders, showing their expectations regarding the EA function's products and services, and goal achievement. Because there is not much available about the topic of EA stakeholder satisfaction in the literature, we had to perform an exploratory study in order to build the EA stakeholders mind map. We used techniques taken from consumer research (Gutman, 1997) to get an understanding of the way in which EA stakeholders perceive the EA function.

This section is structured as follows. Section 4.1 explains the two core elements of the theoretical framework of this study, stakeholder satisfaction (Section 4.1.1) and cognitive structure (Section 4.1.2), and introduces the interview and analysis techniques we used in creating the cognitive map of EA stakeholders (Section 4.1.3). Section 4.2 describes the context and characteristics of the company we conducted this study in. In Sections 4.3 and 4.4 we provide the approach and results of the data gathering and analysis.

4.1. Theoretical framework

4.1.1. Stakeholder satisfaction

Customer satisfaction is defined as the degree in which the customer perceives the expectations regarding a specific product or service to be met (Zeithaml et al., 1990). The customer service literature has extensively investigated the concept of customer satisfaction. For example, Voss et al. used theory and approaches from the customer service literature to measure the perceived service quality in higher education (Voss et al., 2007). The concept of customer satisfaction has, to our knowledge, not yet been applied in EA literature.

4.1.2. Cognitive structures

Cognitive structures reflect the sense-making structures of individuals (Weick, 1979). In customer service literature, cognitive maps are used to study stakeholder expectations and to evaluate their satisfaction (Voss et al., 2007). Personal cognitive structures typically show the sequence of conscious and unconscious acts directed toward goal achievement (Gutman, 1997). They contain hierarchically related sets of elements across levels of abstraction; high-visible, short-term goals and low-visible, long-term goals (Brewer, 1983). For example, the cognitive map of a student may reveal that the high-visible, short-term act of drinking coffee helps in achieving the low-visible, long-term goal of obtaining a master degree; drinking coffee allows the student to stay awake, study longer, and get better grades (Gutman, 1997). Stakeholder groups typically differ in the goals they pursue, and therefore have different dominant cognitive schemas (Bettis and Prahalad, 1995). Therefore, we expect that different

EA stakeholder groups evaluate the EA function service delivery differently.

4.1.3. Means-end chain analysis and laddering technique

A well-known type of cognitive structure is the means-end chain. A *means-end chain* shows how a stakeholder associates, in his mind, consuming or using a product or service (the means) with achieving a valued state (the ends) (Gutman, 1997). The elements in a means-end chain consist of *attributes* (characteristics of a product or service), *consequences* (results directly related to the delivery of a product or service), and *values* (higher level ends the stakeholder wants to achieve) (Voss et al., 2007). For example, "color" is an attribute of the product "car"; having a red car may help to get a car look sportier. The objective of our study in Section 4 is to determine how EA stakeholders associate their ability to attain their goals and values (ends) with the qualities and attributes of the EA function.

The *laddering technique* provides an approach for building means-end chains. There are two types of laddering techniques: (1) soft-laddering and (2) hard-laddering (Voss et al., 2007). Soft-laddering involves in-depth interviews with respondents following their natural flow of speech; the researcher seeks to understand the meaning of the answers given and to link them to the means-end model. Hard-laddering uses more standardized interview and questionnaire techniques. Because of the exploratory nature of our research we applied the soft-laddering technique. We wanted to leave room for the respondents to introduce their own attributes, and use further questioning to gain more understanding about those attributes, and how they connect these to consequences and values. The approach involves using semi-structured, qualitative, in-depth interviews during which the interviewer asks questions to reveal attribute-consequence-value chains by repeatedly asking questions why an attribute, consequence or value is important to the respondent. The interviewer takes the subject up a ladder of abstraction and follows a process of digging deeper by asking inquiring questions. The answer to a question is a starting point for further questions (Voss et al., 2007). Table 2 shows an example ladder based on an interview with a change manager.

4.2. Case study: stakeholder satisfaction at business division

We conducted this study within a business division of a large international company. We do not mention the name of the company and have changed some characteristics of the company to keep the case description anonymous.

Table 2
Attribute-consequence-value ladder of a change manager.

Respondent: "I want the architects to stop arguing with each other about what the enterprise architecture should look like. This is becoming a limiting factor."
Code: 'Collaboration between architects' (Attribute)
Respondent: "Until they reach consensus, the enterprise architecture is still changing and therefore rendered useless."
Code: 'EA product quality' (Consequence)
Respondent: "I need to have the enterprise architecture finished, otherwise I don't know which interfacing standards my project teams should use."
Code: 'EA conformance' (Consequence)
Respondent: "If we don't have these interfacing standards available soon, my projects need to build the interfaces without these standards. This makes it very likely that we will run into problems later, when connect our applications to those of other LoBs."
Code: 'Horizontal alignment' (Value)

Table 3
Organizational structure of the business division.

Business units (BU)	Generic domains	Change organization
Product Line 1	Finance & Control	BU Change Departments
Product Line 2	Marketing & Sales	Generic Change Department
Product Line 3	Customer Relationship Management	Application Management
Product Line 4	Delivery Channels	Staff (Architecture, etc.)
	Corporate & Performance Management	

4.2.1. Organizational context

The insurance division has four Business Units (BU), five generic domains, and one change organization (see Table 3). The BUs focus on different product lines or product-market combinations and make up the operational business units of the division. The five generic domains provide generic supporting services to the BUs.

The change organization guides and executes change activities in both BUs and generic domains. One generic change department is responsible for the changes within the generic supporting services domains. The four BU change departments each serve a specific BU. The Application Management (AM) department performs operational maintenance for all applications. The staff department of the change organization contains the architecture department, amongst others. The business division uses an external Technical Infrastructure (TI) service provider to host its information systems, responsible for operational maintenance and change activities regarding the technical infrastructure.

4.2.2. EA function

The EA function is primarily positioned within the change organization and consists of: (1) the EA council, (2) the architecture department, and (3) various roles within the change and application management departments.

The *EA council* consists of management representatives of the change departments and the application management department. The EA council prepares EA decision making, which are made final by the change organization management team. The members of the EA council are also responsible for communicating the enterprise level EA decisions to the rest of the organization.

The *architecture department* consists of three teams: (1) business and process architecture, (2) technical application and service architecture, and (3) technical infrastructure architecture. The department supports enterprise and domain level EA decision making and creates target architectures and EA policies. The architects should also provide support to stakeholders how to apply the EA products, and ensure that changes are implemented in conformance to the EA products.

Change managers are responsible for domain level EA decision making and coordination of all changes within a specific BU or generic domain. *Program managers* are responsible for running change programs (consisting of a set of projects sharing a common goal) within the constraints of the enterprise architecture. *Project leaders* are responsible for running a project within time and budget constraints. *Application managers* coordinate the operational changes in the information systems to ensure their stability and continuity.

4.3. Data gathering

We created a list of topics to be addressed in the interviews. We first carried out 12 interviews with EA practitioners to gain an understanding of the world of an enterprise architect, and to identify the types of stakeholders enterprise architects work with in practice. Next, we conducted preliminary interviews with 6 non-

architect practitioners (2 project managers, 2 program managers, a business and an information analyst) experienced in cooperating with enterprise architects at client organizations. This allowed us to gain an understanding of how those stakeholders perceived their participation in the EA function. We used the information thus gained to create a semi-structured interview form for EA stakeholders. The main objective of the interviews was to ask the respondents: What do you consider important regarding the service delivery of the EA function? And why is that important to you? For example, do you find the products and advice of the architects useful? And what is your experience with working together with the architects?

In total, we interviewed 21 stakeholders of the EA function at the business division: 4 change managers, 4 program managers, 3 project leaders, 5 application managers, 1 information analyst, 2 employees of the sourcing department, and 2 infrastructure architects of the external TI service provider. Interviewing these stakeholders was part of an integral assessment of the EA function. We also interviewed 8 architects and the EA delivery manager of the business division to determine the maturity of the EA delivery function. We used the data from these interviews as background information in our study regarding the stakeholder's perception of the performance of the EA function.

Two interviewers, trained in applying the soft-laddering technique, conducted the interviews and took notes. The same scribe was present at all interviews to transcribe and double check whether the essential topics of the interview form were addressed. Afterwards, the interviewer checked the interview transcript with his own notes and made adjustments if necessary. A summary of the transcript was sent to the interviewees so they could check whether the highlights came across correctly. After having received feedback from the respondents, we completed the interview transcripts by making final adjustments.

4.4. Analysis

4.4.1. Attributes, consequences and values

We omitted five stakeholders from our analysis. Two of them were external stakeholders with an architect role. We left them out because in this study we focus on non-architect roles. We omitted the information analyst role, since we had access to only one such person. This was insufficient to get a complete enough perspective for that role. We also left out the two employees of the sourcing department, because they both indicated to have no role in the EA function. We used the interview transcripts of the remaining 16 respondents in our analysis.

We analyzed the interview transcripts by labeling new categories and marking the quotes that indicated the recurrence of existing categories. This resulted in a set of labeled categories and accompanying quotes. We restructured and rephrased some categories to sharpen their definitions and to achieve one level of abstraction. We grouped the categories in *attributes* (desired characteristics of the EA function service delivery), *consequences* (pleasant results directly related to the EA function service delivery), and *values* (higher level ends the EA stakeholders want to achieve). Also, for each category we determined how many members mentioned that category in the interviews, which indicates how important an attribute is perceived by stakeholders.

Table 4 lists all attributes of the service provided by architects or the EA function as deemed important by respondents. For each attribute, it gives the label and a definition. Some attributes are closely related – e.g., 'governance structure' and 'governance processes', as well as 'thinking along' and 'proactive behavior'. The three themes 'technological knowledge', 'functional knowledge' and 'market trends' indicate the expectations regarding the knowledge of architects.

Table 4
Attributes of the EA function as mentioned by the respondents.

Attribute	Definition
Clear roles	The demarcation and awareness of all roles within the EA function at the different levels within the organization.
Governance structure	The responsibilities within the EA function assigned to formal roles and bodies regarding EA decision making, EA delivery and EA conformance.
Communication	The skills and behavior of architects that makes communication with stakeholders effective.
Proactive behavior	Architects who act decisively and help stakeholders in applying EA products.
Vision	The architect having a long-term overarching view and a realistic opinion about the organization and the realization of its business and IT strategy.
Tenaciousness	The architect being persistent and powerful regarding the architecture vision and principles, leading stakeholders in the planned direction.
Collaboration between architects	A good cooperation within the architecture team to define clear directions to stakeholders. This includes discussing and sharing important knowledge.
Functional knowledge	The architect's knowledge and insights in software packages/components and their functionality and the way these can be used within the organization to support its business.
Think along	The ability and willingness of the architect to think along with stakeholders and understand their goals and problems in order to provide the best solutions.
Market trends	The architects' knowledge and awareness of the current state of the art technology and innovations within the market regarding packages, tools and solutions.
Technological knowledge	Detailed knowledge of the technologies used within the organization and the planned technological solutions that will be used in the future.
Governance processes	The formal processes of decision making and the handling of architectural deviations and exceptions within the EA function.
Accountability	Architects being responsible for their advice and the outcome of their work.
Communication structure	The way in which communication within the EA function is formalized (e.g., reporting lines, intranet pages, etc.).

Table 7 shows how many respondents mentioned each attribute in the interviews. The four most important attributes show that stakeholders expect the EA function to have defined 'clear roles' and a clear 'governance structure'. Regarding the architects, stakeholders expect them to have proper 'communication' skills and content, as well as 'proactive behavior' in providing support in applying EA products.

Stakeholders perceive the attributes shown in Table 4 as important, because they result in positive consequences. Table 5 lists the consequences the respondents mentioned. Table 8 shows how many respondents mentioned each consequence. Every respondent mentioned 'EA conformance', either for architectures (designs) or for EA policies, as an important consequence. We found that the EA function is expected to deliver insight in three important aspects: current state ('as-is insight'), target state ('to-be insight'), and 'concrete change plans' (the translation of strategic plans to concrete solutions outlines). Architects are also expected to support 'decision making', and to formalize EA decisions in documents with a high 'EA product quality'. Stakeholders also find it important to have 'close cooperation' with architects in order to achieve the consequences mentioned above. Actively working towards the 'acceptance of changes' triggered by architecture is mentioned least.

Table 5
Consequences of the EA function attributes as mentioned by the respondents.

Consequence	Definition
EA conformance	Assure that everyone works according the EA decisions written down in EA products. Assure that change initiatives and plans are checked for compliance with the to-be architecture.
Decision making	A fast, effective and well supported decision making process to define a to-be situation or to tackle implementation issues.
To-be insight	Having insight and a holistic perspective of the long and mid-term future situation.
As-is insight	Knowledge of the current environment, its activities, the IT systems, infrastructure, business units and their mutual coherence.
Close cooperation	A frequent and close cooperation between architects and stakeholders based on a good business relation and aimed at constructively resolving problems.
Concrete change plans	The translation of strategic plans into specific implications and solution outlines to support definition and start-up of projects.
EA product quality	A high quality design (to-be or as-is) or policy regarding the organization's business and IT assets. Quality attributes are: consistency, coherence, readability, comprehensibility and relevance.
Acceptance of changes	A positive attitude towards the chosen to-be architecture among organizational members.

Table 6
Values as mentioned by the respondents.

Value	Definition
Realization of strategy	Achieving a situation which is as close as possible to the planned to-be architecture and the company's strategy.
Horizontal Alignment	Coherent and consistent (standardized) implementation of changes among the different generic domains and specific BUs.
Monitoring	An overview of the current activities (projects and programs) within an organization to supervise change/project status and how these activities can result in a particular future state.
Operational continuity	Assurance of the quality and effectiveness of the current core- and support operations, both business and IT.

Stakeholders expect the consequences (lower level goals) shown in Table 5 to help achieve four distinct values (highest level goals) shown in Table 6. The 'realization of strategy' is seen as an important goal of creating and implementing the to-be architecture. Also, achieving 'horizontal alignment' between generic domains and specific BUs through standardization of change implementation is a key value that stakeholders aim to achieve with EA. Furthermore, stakeholders expect to use EA as an instrument for 'monitoring' changes implemented by programs and projects, and to ensure 'operational continuity'.

4.4.2. Hierarchical Value Map

We analyzed how the interviewees related categories by building attribute-consequence-value ladders. We used a software tool

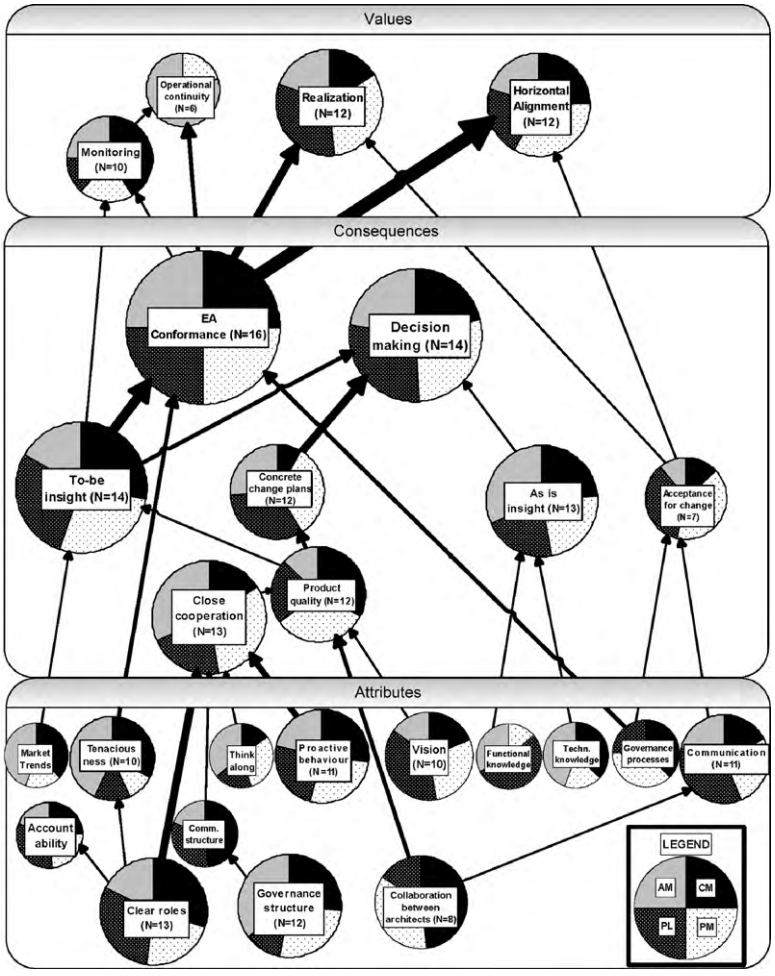

Fig. 1. The Hierarchical Value Map shows the attributes of the EA function as experienced by the EA stakeholders, and their relations with consequences and values as experienced by the EA stakeholders.

to analyze ladders and store the accompanying quotes. Fig. 1 shows the result of our analysis as a Hierarchical Value Map (HVM). A HVM is a graphical representation of means – end chains. The HVM provides the aggregated cognitive map of the 16 respondents. It shows how the four EA stakeholder groups – Change Manager (CM), Program Manager (PM), Application Manager (AM), and Project Leader (PL) – expect the EA function's service delivery attributes to result in consequences that contribute to achieving their personal objectives.

The HVM consists of nodes which represent the categories perceived as most important by the respondents. The size of the nodes depicts their relative importance. To keep the labels readable, categories mentioned by less than 8 respondents have the same size. The nodes are represented as pie charts indicating how many of each stakeholder group's respondents mentioned a specific category.

The lines between the nodes represent the positive linkages between concepts. The direction of the relations is from bottom to top. The thickness of the lines between categories indicates how often these categories have been related. To keep the HVM comprehensible, but at the same time ensure its level of detail, we applied a cut-off level of 4 to filter out less important categories and relations.

Fig. 1 shows that stakeholders perceive 'clear roles' within the EA function and 'proactive behavior' of architects to be the most important attributes that lead to 'close cooperation' between stakeholders and architects. Other attributes (e.g., 'communication structure') also contribute to 'close cooperation', but are perceived less important. A clear 'governance structure' indirectly results in 'close cooperation', because it enables a proper 'communication structure'. This shows that stakeholders expect low level attributes to help achieve higher level attributes.

Stakeholders perceive attributes of the services and products of the EA function result in consequences. There is also stratification in consequences, with 'EA conformance' and 'EA decision making' as high level consequences that are achieved through the fulfillment of lower level consequence, such as 'to-be insight' and 'as-is insight'.

Finally, consequences are perceived to result in achievement of values – e.g., 'to-be insight' results in improved 'monitoring' of organizational changes. 'Acceptance for changes' as described in the to-be architecture plays a minor role, but is the only consequence that directly links attributes of the EA function ('governance processes' and 'communication') to values of the stakeholders ('horizontal alignment' and 'realization of strategy').

4.4.3. Results

Tables 7–9 show for each attribute, consequence, and value the number and percentage of the 16 respondents that mentioned them in the interviews. For example, Table 8 shows that all stakeholders mentioned 'EA conformance' as a consequence that contributes to achieving their values. This is striking, because enforcing EA conformance comes with restrictions. We expected 'EA conformance' to be perceived as a negative consequence of the EA function, especially from the project leader stakeholder group. Apparently, stakeholders recognize that uniformity and coherence in implementing changes is critical.

Table 7
Number and percentage of respondents that mentioned the attributes.

Attribute	Number of respondents	Percentage of respondents
Clear roles	13	81%
Governance structure	12	75%
Communication	11	69%
Proactive behavior	11	69%
Vision	10	63%
Tenaciousness	10	63%
Collaboration between architects	8	50%
Functional knowledge	7	44%
Think along	7	44%
Market trends	6	38%
Technological knowledge	6	38%
Governance processes	5	31%
Accountability	4	25%

Table 8
Number and percentage of respondents that mentioned the consequences.

Consequence	Number of respondents	Percentage of respondents
EA conformance	16	100%
Decision making	14	88%
To-be insight	14	88%
As-is insight	13	81%
Close cooperation	13	81%
Concrete change plans	12	75%
EA product quality	12	75%
Acceptance of changes	7	44%

As a result of our analysis, we concluded that stakeholders have high expectations regarding the EA function. In this case study, it seemed infeasible for the EA function to fulfill all expectations. We found that stakeholder satisfaction with the EA function's performance differed per stakeholder group, but in general was quite low. Also, we observed a relation between the intensity and efficiency of the cooperation with architects and the level of satisfaction with the EA function's performance. For example, change managers were less satisfied with the performance of the EA function because EA did not help them in the 'monitoring' of changes and the architects did not have a 'close cooperation' with them. The members of the application management department were not satisfied with the EA function because architects did not provide 'as-is insight' in their operational application landscape, nor did they act as a gate keeper ensuring 'EA conformance' and thus 'operational continuity'. The project leader stakeholder group was relatively satisfied with the performance of the EA function because the 'functional' and 'technical knowledge' of the architects helped them in project level 'decision making'.

5. EA effectiveness

In the previous section we presented our work on the individual goals of EA stakeholders. In this section we shift our focus to the collective goals of organizations, by investigating how to determine whether an organization meets the goals it set with its EA function. Organizations want to know whether they are on the right track with the deployment of their EA function and, if not, in which areas they are underperforming. Current literature provides little guidance on determining the effectiveness of the EA function (Kaisler et al., 2005). The objective of this section is to develop an EA effectiveness measurement model and to better understand how the outputs (or attributes) of the EA function positively impact the goals set by the organization.

Our EA function measurement model describes the collective objectives realized by the outputs of the EA function. For example, the EA function may contribute to improvement of IT quality by prescribing standard interfaces and ensuring these are used

Table 9
Number and percentage of respondents that mentioned the values.

Value	Number of respondents	Percentage of respondents
Realization of strategy	12	75%
Horizontal Alignment	12	75%
Monitoring of changes	10	63%
Operational continuity	6	38%

when creating new IT solutions. Our measurement model provides a means for organizations to determine which non-financial objectives are supported by the EA function. We based our model on existing effectiveness measurement models, translated it into EA terms, and pre-tested our model using a case study approach.

This section is structured as follows. Section 5.1 defines our measurement model. Section 5.2 provides an overview of how we apply the measurement model when doing an EA effectiveness assessment. Section 5.3 discusses the fit of our measurement model to the specific context of a large financial services company.

5.1. Conceptualization and design of measurement model

To construct our EA effectiveness conceptual and measurement models we followed three steps: (1) literature review, (2) definition and structuring of a conceptual model and (3) construction of the measurement model. But before we describe these two models, we start with defining EA function effectiveness.

5.1.1. EA function effectiveness

EA function effectiveness concerns the evaluation of the outputs of the EA function and determining their contribution to the achievement of EA objectives (Cameron and Whetten, 1996; Hoorn, 2006). This is done by establishing the objectives and devising a method for determining whether or not those objectives have been attained (Morganwalp and Sage, 2004). We define EA function effectiveness as: "*The degree in which organizational objectives are attained through the outputs of the EA function*". Effectiveness may be objectively measured using organizational performance data related to the implementation of EA decision making. In case of unavailability or inaccessibility of such data, effectiveness may be subjectively determined from the joint perception of EA stakeholder groups.

5.1.2. Conceptual model

Based on a literature review, we identified *alignment* and *agility* as the two main organizational objectives the EA function contributes to (Hoogervorst, 2004). Alignment and agility are two separate concepts which we expect to correlate. There may be causal relationships between alignment and agility, but because of the abstract and multi-level characteristics of these concepts these are hard to hypothesize upfront. For example, the ability to react to environmental changes (agility increase), increases the need to re-align internal functions, processes, structures, and systems to facilitate that change (alignment increase). However, when an organization keeps reacting to external changes quickly (agility increase), such may negatively influence the organization's ability to internally re-align (alignment decrease).

The EA function helps achieve both alignment and agility through *EA decision making* and *EA implementation*. EA decision making influences EA implementation. For example, a central EA policy requires a different implementation process than a target architecture for a specific domain. EA implementation influences EA decision making. Projects providing feedback to architects regarding the feasibility of the EA decisions may result in changes to those decisions.

5.1.3. Measurement model

In order to operationalize the conceptual model, we constructed the EA effectiveness measurement model shown in Fig. 2. Based on a literature review, we identified a total of 131 low level objectives of the EA function that potentially contribute to achieving alignment and agility, which we clustered into 11 high level EA objectives. These 11 objectives form the *dimensions* in our measurement model (the rectangles linked to both alignment and agility in Fig. 2). Each dimension consist of a number of concrete measurable *indicators* (the numbers between brackets in Fig. 2).

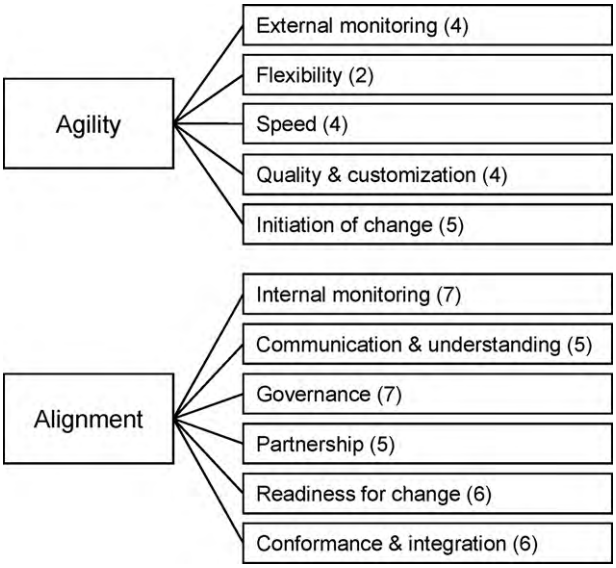

Fig. 2. EA effectiveness measurement model and scores.

Alignment encompasses horizontal alignment between business units, vertical alignment between strategy and operations, and business and IT alignment. The latter two are referred to by Henderson and Venkatraman (1993) as strategic fit and functional integration, respectively. Alignment is achieved when all components of an organization are interrelated coherently. These organizational components include all (business and IT) structures, processes, systems, and people internal to the organization, as well as the raw materials, (semi-finished) products, and services provided by external suppliers. The dimensions to be attained in order to achieve alignment have been derived from Luftman's Strategic Alignment Model (Luftman et al., 1993) and Business-IT Alignment (BITA) maturity assessment model (Luftman, 2000). These are: 'internal performance monitoring', 'communication & understanding', 'governance', 'partnership', 'conformance & integration', and 'readiness for change'. Table 10 provides a description of the alignment dimensions. Table 14 (see Appendix A) shows, for each of the alignment dimensions, the corresponding indicators.

Overby et al. (2005) define agility as: "*the ability to sense environmental change and respond appropriately*". Agility thus concerns aspects on the organizational interface between the external environment and internal organization, e.g., the products and services it provides. *External changes* include competition, customers, substitute and complementary products or services, government regulations, technological innovations, and the public opinion about social and environmental issues. The dimensions of agility have been derived from an analysis of enterprise agility concepts summarizing the main indicators of agility (Sherehiy et al., 2007). The dimensions of agility are: 'external monitoring', 'flexibility', 'speed', 'quality & customization', and 'initiation of change'. Table 11 describes the dimensions of agility. Table 15 (see Appendix A) shows for each of the agility dimensions the corresponding indicators.

5.1.4. Link between output of the EA function and EA objectives

The outputs of the EA function (see Section 2.4) contribute to meeting the organizational objectives of alignment and agility. The EA function helps to increase alignment by taking a holistic perspective on the organization to identify alignment opportunities. For example, a business-oriented architect within a company creates a Business and Information architecture, describing the

Table 10
Alignment dimensions and contribution of EA in attaining these objectives.

Dimension	Description	Contributing output of EA function
Internal monitoring	Routine reviews, assessments and benchmarks of operational performance of and changes implemented to business and IT organizational components.	EA products describe the quality indicators of all organizational components, and thus provide input for the specification of performance indicators and service level agreements. Architects perform reviews of solutions and changes implemented.
Communication & understanding	Common understanding of business and IT through knowledge sharing, and insight in consequences of decision making.	EA products contain explicit knowledge (descriptions) of business and IT components, which allows knowledge sharing. Architects provide management with insight in, and advice about, the consequences of decision making on existing organizational components.
Governance	Formal decision making, monitoring, and control of priorities and budget for both business and IT.	Architects translate strategic objectives to an architectural blueprint and transformation roadmap. Architects ensure that solutions and operational changes conform to these EA products.
Partnership	Business and IT are trusted partners where the business sponsors IT, sharing risks and rewards.	EA products link strategic plans and organizational components of the business (optimized for value creation) and IT (optimized for business support). By embracing and ratifying these EA products, business and IT management create a sense of partnership.
Readiness for change	Ability and willingness of the enterprise workforce to change attitudes, opinions, and behavior.	EA products provide insight in the consequences of, and the rationale for, organizational changes. By explaining the consequences and rationale, architects help changing the attitude, opinions, and behavior of the employees impacted.
Conformance & integration	Consolidation, standardization and integration of organizational components to a coherent, transparent and flexible business and IT landscape.	EA products provide transparent and enterprise-wide coherent architecture and standards. They describe and prescribe the consolidation and integration of organizational components. Architects ensure that all changes and new solutions conform to these EA products.

business processes, functions, and information needed to provide the products and services to the customer. An IT-oriented architect within that company uses this Business and Information architecture to describe the supporting Information Systems and Technical Infrastructure that deliver the required IT services in order to achieve business and IT alignment. In order to achieve alignment of all organizational components, including those provided by external suppliers, the EA function also supports external supplier management. The EA function, for example, provides external suppliers with EA products that prescribe: (1) what they should deliver, and (2) the required quality standards. Table 10 describes, for each of the dimensions of alignment, how the EA Function contributes in the attainment of these objectives.

The EA function contributes to agility by providing insight in the impact of the changes in the products and services an organization provides. For example, an architect may use his knowledge of processes, interfaces and systems to help determine the best solution to swiftly deliver a new web-enabled product or service. Table 11 indicates how the EA Function contributes to achieving agility.

5.2. Assessment approach

In order to conduct assessments using our measurement model we follow a three phase assessment approach inspired by the Standard CMMI Appraisal Method for Process Improvement (SCAMPI) (SEI, 2006): (1) plan and prepare appraisal, (2) conduct appraisal, and (3) report results. Please note that we do not use the CMMI model as the reference model for our assessments, but our EA function reference model (Section 2.2) and our EA effectiveness measurement model (Section 5.1). In this paper we summarize the essential activities of phase 2. For the detailed activities of all phases we refer to (Bonnet, 2009).

First, the organization's set of objectives for its EA function is identified by interviewing EA owners and analyzing formal documents. By comparing the specific set of objectives to the dimensions and indicators in the generic measurement model, a gap-analysis report of the EA objectives is created. Based on this report, and in collaboration with the EA owners, a final set of objectives of the EA function is determined. Next, the relevant indicators for each dimension are translated into (objective) metrics or (subjective) survey questions. For example, the indicator 'vertical integration (from strategy to operations) of the EA' is translated into the metric 'percentage of change projects and operational changes that conform to the EA products'. Next, the objective and subjective data are collected using unobtrusive measurement tools and surveys. The resulting data are analyzed to determine goal-attainment.

Table 11
Agility dimensions and contribution of EA in attaining these objectives.

Dimension	Description	Contributing output of EA function
External monitoring	Identification of changes and opportunities, and the ability to translate these to new business and IT ideas.	Architects keep up with the social, market, technological and regulatory developments, and help management in identifying opportunities and required changes.
Flexibility	Ability to change organizational components without major changes and investments.	Standardized organizational components (through EA products and EA governance) enable easy re-orchestration of components to implement changes.
Speed	Shortest time-to-market, time to act upon change, educate employees, and run end-to-end operations.	Architects use their domain knowledge to help projects shorten their lead time by identifying reuse of existing organizational components, and helping to integrate the new solutions with the existing organizational components.
Quality & customization	High quality and customizable products and services of the business and IT	Architects use their domain knowledge to guide projects in making high quality designs, ensuring the quality requirements of the products and services are realized.
Initiation of change	Ability and willingness of management (and the workforce) to initiate changes to implement new business ideas or introduce new technologies.	Architects helps management in decision making about new business and IT ideas, by creating solution alternatives and analyzing their profitability and feasibility.

5.3. Case study: EA effectiveness at IT & operations division

We performed a case study to determine the fit of our measurement model with the specific context of the IT & Operations (ITO) division of a large international company, the same company the business division (see Section 4.2) is part of. At the time of the assessment, the ITO division was in the process of implementing a new EA function. The ITO division consists of 8 Lines of Business (LoB) that deliver operational services and IT solutions to the company's European front-office divisions. ITO has one central technology unit responsible for providing infrastructural services to the 8 LoBs. The new EA function being implemented within ITO is responsible for: (1) setting the long-term strategic direction for ITO by means of creating and maintaining enterprise and domain architectures and EA policies, and (2) reviewing all solutions developed and changes implemented by ITO as to their quality and conformance to the architectures and EA policies.

5.3.1. Approach

We started by interviewing five owners of ITO's EA function, who are held responsible for its effectiveness. These *EA owners* are each members of the management team of a specific LoB, assigned with the responsibility of running that LoB's EA function. We interviewed them to identify the relevant objectives of the EA function and possible metrics for meeting those objectives. We sent the transcripts of the interviews to the interviewees for confirmation. We analyzed documents related to the purpose of the EA function, and the reports of two workshops concerning the value of the EA function with the EA owners and several stakeholders of two LoBs. We then interviewed four *third-party EA experts*, all members of the program team charged with the design and implementation of ITO's EA function. The interviews with third-party experts allowed us to determine whether additional dimensions would be relevant in this specific context. Also, it allowed us to cross-check the relevance of objectives mentioned by the EA owners and documents not explicitly incorporated in the model. We performed an analysis of the gap between the objectives mentioned by both respondent groups.

5.3.2. Findings

The scores in Table 12 show the result of our analysis. It shows for each dimension in the measurement model the number and percentage of indicators mentioned by the respondents, both for the EA owners alone and including the third-party EA experts.

First we only looked at the indicators mentioned by the EA owners. Table 12 shows that they mentioned 18 out of a total of 55 indicators (33%) of the dimensions in our measurement model. Regarding the dimensions of alignment, 'conformance & integration' is mentioned most by the EA owners. All 6 indicators (100%) of this dimension were mentioned in the interviews, and most EA owners stressed this as the most important objective of ITO's EA function. For example, according to the EA owners, IT should enable the business (but not drive the business). And ITO's LoBs should be both horizontally and vertically integrated, and the various technologies used within ITO should be consolidated. On the other hand, 'readiness for change' was not mentioned in the interviews; the EA owners apparently did not deem this important.

The EA owners clearly mentioned the agility dimensions less in the interviews. For the agility dimension 'quality & customization', 2 out of 4 indicators (50%) were mentioned – i.e., quality of the IT systems, and quality of the products and services delivered to the customers. No indicator of both the 'initiation of change' and 'flexibility' dimensions was mentioned.

Next, we included the indicators mentioned by the third-party experts. They mention 12 additional indicators, resulting in a total of 30 out of 55 indicators (55%) mentioned. 'Conformance & integration' already had all indicators mentioned in the interviews with the EA owners and therefore was not discussed in the interviews with the third-party experts. For 'communication & understanding', 'external monitoring' and 'speed', the third-party experts did not mention any additional indicators. For the 'readiness for change' and 'flexibility' dimensions, they identified 1 additional indicator. For 'internal monitoring', 'governance', 'partnership', 'quality & customization', and 'initiation of change', the third-party experts mentioned 2 additional indicators. For internal monitoring the experts mention that IT metrics (e.g., technical and financial performance) should be available, and benchmarking be routinely performed. For 'governance', the experts mentioned that there should be a federated reporting structure, and that IT program management should be based on continuously improved standards. For 'partnership', they deem it important that the business is sponsor of the IT, and that IT portfolio management is based on standards approved by and continuously improved with the business. For 'quality & customization', they mentioned the ability to customize the IT systems, as well as the products and services delivered to the customers as being relevant. Regarding 'initiation of change', the third-party experts mentioned that it is important that management is properly trained to understand the impact of changes, and that they have the appropriate decision power to initiate change.

5.3.3. Results

The findings show that the EA owners of ITO's EA function mentioned more alignment indicators (39%) than agility indicators (21%). A possible cause may be that the EA owners are inclined to focus on the objectives to be achieved with the EA function that have a direct relation to their own scope of responsibilities. The third-party experts expect ITO to also strive for agility with its

Table 12
Number and percentages of indicators mentioned by the respondents (for both the EA owners alone and including the third-party EA experts).

Dimension	EA owners		EA owners + third-party experts	
Alignment	14 of 36	39%	21 of 36	58%
Internal monitoring	1 of 7	14%	3 of 7	43%
Communication & understanding	3 of 5	60%	3 of 5	60%
Governance	3 of 7	43%	5 of 7	71%
Partnership	1 of 5	20%	3 of 5	60%
Readiness for change	0 of 6	0%	1 of 6	17%
Conformance & integration	6 of 6	100%	6 of 6	100%
Agility	4 of 19	21%	9 of 19	47%
External monitoring	1 of 4	25%	1 of 4	25%
Flexibility	0 of 2	0%	1 of 2	50%
Speed	1 of 4	25%	1 of 4	25%
Quality & customization	2 of 4	50%	4 of 4	100%
Initiation of change	0 of 5	0%	2 of 5	40%
Total	18 of 55	33%	30 of 55	55%

EA function. Adding the indicators mentioned by the third-party experts, results in a better balance between alignment indicators (58%) and agility indicators (47%) mentioned.

Based on the mapping of the objectives in our measurement model to outputs of the EA function (Tables 10 and 11), and the findings from the case study (Table 12), we conjecture that our model fairly describes the EA function's objectives: on average, 55% of the indicators is mentioned. Other models either do not specifically focus on EA (e.g., Luftman et al., 1993), or do not explicitly link the output of the EA function with organizational objectives (e.g., Morganwalp and Sage, 2004; Kamogawa and Okada, 2005). Our model helps organizations identify the objectives of the EA function. This allows organizations to determine whether these objectives are met, and use this information to prioritize their efficiency measures (e.g., based on an EA efficiency assessment; van der Raadt and van Vliet, 2009) required to optimize the effectiveness of their EA function.

The results from the case study at the ITO division illustrate that our measurement model can be used to analyze the EA function's effectiveness. No new dimensions were identified, keeping the structure of the model intact. Based on the interviews with the EA owners we found 8 new topics, which can all be included as indicators of existing dimensions. However, before we do so, we need to conduct more case studies.

In general, we received positive feedback on our model and approach from the third-party experts we interviewed. They indicated that objectives should be specified according to the time-period in which they are attainable (short-term, mid-term, long-term objectives). The set of objectives and the corresponding target values to be met could be related to the EA function's stage in its life cycle. Also, the terminology used in the model is quite generic. Mapping and specifying the terminology to that used in a specific context could make it easier for respondents to determine the relevance of these objectives to their context.

6. Stakeholder satisfaction and EA effectiveness

In this section we relate the two topics of EA stakeholder satisfaction and EA effectiveness. We theorize that goal-attainment influences stakeholder satisfaction with the EA function, or may even be a precondition. As described in Section 4, stakeholder satisfaction is determined by the degree in which stakeholders perceive the EA function helps them achieve their individual goals (values). We further theorize that if, regarding the EA function, the individual goals of the stakeholders are the same as the collective goals of the organization, and moreover these collective goals are met, the individual stakeholders are satisfied. Therefore, it is interesting to compare the organizational goals of the EA function with the stakeholder expectations regarding the EA function, and determine whether these individual goals of the stakeholders and the collective goals of the organization are the same. If so, it suffices to measure either stakeholder satisfaction or goal-attainment.

In Section 6.1 we map the individual goals of the stakeholders and the collective goals and sub-goals of the organization. Based on this mapping, we analyze the differences and similarities between the individual goals of stakeholders and the organizational goals regarding the EA function in Section 6.2.

6.1. Mapping of stakeholder and organizational goals

We compared the individual goals of stakeholders with the collective organizational goals and sub-goals regarding the EA function. For this we first mapped the (sub) goals of our EA effectiveness measurement model as presented in Section 5.1.3 to the values and consequences of EA stakeholders as presented in Section 4.4.1. Table 13 shows this mapping.

We were not able to map any sub-goal onto the consequence 'EA product quality'. Apparently, the organization is not interested in the quality of the EA products, but stakeholders are, because they have to work with them. From practice, we have learned that stakeholders experience a lot of dissatisfaction when the quality of the EA products is low – e.g. when the readability is low.

We also were not able to map the two sub-goals 'flexibility' and 'speed' onto a value, consequence or attribute. These two concepts have much to do with a timely realization of the organization's strategic objectives, and therefore may be mapped to the value 'realization of strategy'.

The attribute 'market trends' is mapped onto the sub-goal 'external monitoring'. Apparently the organization thinks it is an important goal of the EA function to monitor external changes, but stakeholders rather see it as one of the regular activities of the EA function.

Table 13
Difference between stakeholder and organizational objectives regarding the EA function.

Stakeholders Unmapped	Percentage mentioned	Organization Unmapped	Percentage mentioned	Difference
EA product quality	75%	[No equivalent]	–	–
[No equivalent]	–	Flexibility	50%	–
[No equivalent]	–	Speed	25%	–
Stakeholders Consequences	**Percentage mentioned**	**Organization Sub-goals**	**Percentage mentioned**	**Difference**
Concrete change plans	75%	Initiation of change	40%	35%
To-be insight	88%	Communication & understanding	60%	28%
Acceptance of changes	44%	Readiness for change	17%	27%
As-is insight	81%	Communication & understanding	60%	21%
Close cooperation	81%	Partnership	60%	21%
Decision making	88%	Governance	71%	16%
Market trends	38%	External monitoring	25%	13%
EA conformance	100%	Conformance & integration	100%	0%
Stakeholders Values	**Percentage mentioned**	**Organization (Sub) goals**	**Percentage mentioned**	**Difference**
Monitoring of changes	75%	Internal monitoring	43%	32%
Realization of strategy	75%	Agility	47%	28%
Horizontal Alignment	38%	Alignment	58%	−21%
Operational continuity	63%	Quality & customization	100%	−38%

6.2. Difference in percentages

The left two columns of Table 13 show the percentages of the 16 stakeholders who mentioned their values and the consequences they expect regarding the EA function. Table 13 also shows the organizational goals with the EA function and the percentages of the indicators as mentioned by the EA owners and third-party experts. The rightmost column of Table 13 shows the difference between the percentages.

What is striking is that at the individual stakeholders' level the consequences of the EA function are structurally mentioned more than at the collective organizational level. This may be explained by the fact that, in general, stakeholders value their individual goals more than the collective goals of the organization (Hoorn, 2006); the EA function seems no exception. One exception, though, is that 'EA conformance' and 'conformance & integration' are mentioned very much at both the individual and collective level. Apparently, conforming to the EA products is widely considered an important objective.

When comparing the difference between the two main goals in our EA effectiveness measurement model (agility and alignment), it is striking that individual stakeholders mention 'realization of strategy' more than the organization mentions its equivalent 'agility'. On the other hand, the organization mentions 'alignment' more than individual stakeholders mentions its equivalent 'horizontal alignment'. Apparently, individual stakeholders are much more externally oriented than the organization is. This also explains why individual stakeholders mention 'market trends' more than the organization does its equivalent 'external monitoring'.

What is also striking is that the organization mentions internal alignment more than individual stakeholders do, in combination with the fact that individual stakeholders mention internal monitoring of changes more than the organization does. Apparently, individual stakeholders are concerned with the process of change rather than the result of the change. This may be because the stakeholders want to gain the credits and prestige for successfully managing the change process. The organization may be more concerned with alignment because misalignment may lead to operational problems, potentially harming the 'quality & customization' of its operational service or product delivery.

7. Discussion

7.1. Stakeholder satisfaction

The study we present in Section 4 is a first exploratory study of the stakeholders of the EA function, because, up till now, there was little know-how of stakeholder perception of the EA function. Our exploratory study is based on a limited number of respondents. Our sample of 16 interviews – with an average of 4 interviews for each stakeholder group – turned out to be too small to draw detailed conclusions for each stakeholder group. We have not been able to include all stakeholder groups as described in Table 1, because they were not all available. For example, we omitted the 'designer' and 'Chief Information Officer' roles. However, the literature already provided insight in the relation of these roles with EA (e.g., Smolander and Päivärinta, 2002; Lindström et al., 2006). Also, the case study lacked stakeholders external to the insurance division, because the EA function was quite internally oriented.

Another limitation is that we conducted this study at one organization, which is insufficient to test the external validity. Future work is to conduct research to get a more in-depth understanding of the expectations of the various stakeholder groups regarding the EA function, across different organizations. For example, by constructing a standard customer satisfaction questionnaire and assessment approach.

7.2. EA effectiveness

The research described in Section 5 was aimed at developing and validating an EA effectiveness measurement model. A limitation to our work in Section 5 is that we have not yet tested the construct and discriminant validity of the measurement model. Future work is to perform additional case studies to collect data both from direct observations as well as from questionnaires and use the gathered data to determine the construct and discriminant validity, before testing the conceptual model as proposed. In order to validate the conceptual and measurement models, we have to take into account the multi-level and longitudinal characteristics of effectiveness measurements.

Another limitation is that we were not able to test the external validity, because we only performed one case study. Different types of organizations are expected to pursue different objectives with EA. The (partial) applicability of the measurement model may differ per organization, or type of organization. The findings in our case study may thus be explained by the specific context of the ITO division and its focus on EA. Future work is directed to conducting multiple case studies by analyzing several organizations (active within different sectors and countries) to test the external validity of the model.

During the interviews, the EA owners proposed potential metrics to measure the attainment of the objectives of ITO's EA function (see Bonnet, 2009). However, due to time limitations and timing issues, we were unable to come to a final list of metrics approved by all EA owners. The EA function was still being implemented in the ITO organization at the time of the assessment. This meant that the precise objectives, scope and responsibilities of the EA function were still shifting, making it hard to get the indicators formally approved. Future work is to test the applicability of our model to specify concrete metrics and determine goal-attainment by conducting additional case studies.

7.3. Stakeholder satisfaction and EA effectiveness

A limitation to our analysis in Section 6 is that we compare data collected from two case studies conducted at two different divisions of the same company. However, the situations we encountered at the two divisions were very comparable regarding culture, governance, way of working (processes, methods and techniques), etc. Also, the approach we taken to conduct both case studies differed, since our research in Section 4 is exploratory (building a stakeholder mind map from scratch by building attribute-consequence-value ladders) and in Section 5 is a qualitative validation (designing a conceptual and measurement model from the literature and validating its applicability in practice). However, both studies had the same EA function reference model as starting point.

In Section 6 we compare percentages we calculated in different ways. For the stakeholders we counted how many of the in total 16 interviewed stakeholders mentioned a topic during their interview. For the organizational goals we counted the number of indicators of one sub-goal mentioned in all the interviews with 5 EA decision makers and 4 third-party experts together.

8. Conclusions

In order to build an effective EA function, the organization needs to do more than assess and improve the efficiency of the architects. Improving the satisfaction of the EA stakeholders by helping them achieve their individual goals is vital in order to ensure their participation in the EA function. Clearly setting goals with the EA function, measuring their attainment and making adjustment to increase the

effectiveness is also key. In this article we present our research in which we elaborate on both topics, and combine them to show their relation. With this research we build on earlier work regarding EA function efficiency (i.e. van der Raadt et al., 2007; van der Raadt and van Vliet, 2009).

In Section 4 of this article we present the cognitive map of various stakeholder groups that take part in the EA function of a business division of a large international company. We used soft-laddering to build means-end chains that reveal how stakeholders expect the observable attributes of the EA function to help them achieve their objectives. The extent to which they perceive the attributes of the EA function to contribute to their goal achievement determines their satisfaction with the performance of the EA function. For architects and EA stakeholders to better collaborate and make the EA function effective, there should be proper mutual understanding. *The cognitive map of EA stakeholders allows architects to better understand what their stakeholders expect from them*. The attributes in the EA function we found form a basis for architects to improve their EA service delivery – e.g., define clear roles, and behave pro-actively in providing support. *Improving the service delivery of the EA function will increase the willingness for EA stakeholders to actively participate*. Ultimately, this will improve EA function effectiveness, including the quality of the EA products. The cognitive map shows that different EA stakeholder groups pursue different objectives, related to their specific role within the organization. An important conclusion is that *it is difficult to satisfy all stakeholders*. Their objectives may be conflicting – e.g., the need of change managers for innovation and change versus the pursuit for operational continuity and stability of the operational manager. Based on this study we argue that *the architect should prioritize which stakeholder groups to serve, and determine a strategy accordingly*. Completely ignoring a specific stakeholder group is not advisable however. The EA function will only achieve maximum effectiveness when all stakeholders collaborate efficiently towards a shared goal.

In Section 5 of this article we present a measurement model for EA effectiveness, which describes the generic potential objectives of an EA function. We performed a pre-test of our measurement model using a case study. The case study shows that the EA measurement model provides guidance in identifying and structuring the objectives of the EA function. We argue that to be able *to measure EA effectiveness, the objectives of the EA function should be directly related to its concrete outputs*. The typical error many organizations make is to identify too abstract objectives which the EA function cannot help attain. Our measurement model prevents this, which makes it easier to *define concrete metrics and performance indicators in order to measure the effectiveness of the EA function* in terms of (non-financial) goal-attainment. The case study provides an early indication of the fit of the measurement model in a specific organizational context. Although, several indicators may have to be added to and/or omitted from the model, the measurement model provides an early foundation of how to measure attainment of the objectives the EA function contributes to. Additional research has to be performed in order to come to a reliable and valid measurement tool.

In Section 6 we compare the concepts of Section 4 (attributes of the EA function, positive consequences, and relevant stakeholder values) with the concepts of Section 5 (goals and sub-goals of the EA function), to determine the degree in which they are the same. We found that *regarding the EA function, the individual goals of stakeholders and the collective goals of the organization map quite well*. However, they are not exactly the same. We found that individual stakeholders mention the direct consequences of the EA function more than the collective organization. This means that *the organization is more concerned with the final results of the EA function* in terms of organizational goal attainment, and less with the way in which the EA function operates. In general, stakeholders are as much concerned with the final results of the EA function, but *stakeholders also appreciate how efficiently the EA function operates*. Therefore, we need to *measure both EA effectiveness and stakeholder satisfaction to get a complete picture of the performance of the EA function*, because when all goals (individual and collective) are attained, stakeholders may still be unsatisfied with the EA function for the way it operates.

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Appendix A. Indicators

See Tables 14 and 15.

Table 14
Indicators for alignment dimensions.

Internal monitoring
(1) IT metrics are available concerning technical performance, cost efficiency, ROI, cost effectiveness and external partners.
(2) Business metrics are available based on functional organization, traditional financial indicators, clients and cooperation with external partners.
(3) Business and IT performance is assessed by using mutually dependent indicators, with respect to external partners.
(4) Service Level Agreements are used throughout the enterprise, extended to external partners.
(5) Benchmarking is routinely performed, with feedback from external partners.
(6) Formal assessments and reviews are performed routinely.
(7) Continuous improvement takes place based on the assessments using routine practices.

Governance
(1) Business strategic planning is integrated across and outside the enterprise.
(2) IT strategic planning is integrated across and outside the enterprise.
(3) There is a federated reporting/organization structure where the CIO reports to the CEO.
(4) IT is seen as a cost and profit center.
(5) Decision making is steered by partnerships.
(6) Prioritization is based on added value, extended to the added value of external partners.
(7) IT program management is based on continuously improved standards.

Partnership
(1) Business perceives IT as a partner in creating value.
(2) Business and IT develop the strategic plan together.
(3) Risks and rewards, concerning objective achievement, are shared among business and IT.
(4) Business and IT are trusted partners.
(5) CEO is IT sponsor/champion.

Conformance & integration
(1) IT has an external scope and is a driver and enabler for the business strategy.
(2) Enterprise and inter-enterprise standards are specified and maintained.
(3) The EA is integrated vertically (from strategy to operations).
(4) The EA is integrated horizontally (between business units).
(5) The EA is transparent and flexible across the organization (change projects shape EA).
(6) Synthesis of diverse technologies (system integration).

Readiness for change
(1) Innovation and entrepreneurship by the employees is the norm.
(2) There is high and focused change readiness throughout the organization.
(3) Education and cross-training is possible across the organization.
(4) Employees can switch careers across the organization.
(5) Management style is relationship based.
(6) A trusted environment is created by valued partnerships.

Communication & understanding
(1) Improved understanding of business by IT.
(2) Improved understanding of IT by business.
(3) Less communication protocols and more informal communication.
(4) Knowledge is shared within and between business IT and extra-enterprise.
(5) Broader and more effective internal and extra-enterprise liaison(s).

Table 15
Indicators for agility dimensions.

External change monitoring
(1) Responsiveness to change in customer's preferences, demands.
(2) Responsiveness to market and technological changes and trends.
(3) Responsiveness to social, regulatory and environmental issues.
(4) Adjustability of business objectives to the changes.
Flexibility
(1) Flexible product model.
(2) Flexible IT systems.
Quality & customization
(1) High product quality.
(2) High IT quality.
(3) Customization of products/services.
(4) Customization of IT systems.
Speed
(1) Shortest Time-To-Market.
(2) Shortest time between identifying necessary changes and acting upon that identification.
(3) Shortest time of educating employees.
(4) Shortest time of operations (time needed for end-to-end chain).
Initiation of change
(1) Innovation and entrepreneurship by management is the norm.
(2) There is high en focused change readiness among management.
(3) Education and cross-training is possible between management roles.
(4) Managers can switch roles.
(5) Executives, including CIO and partners, have decision-power.

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Bas van der Raadt started working as an Enterprise Architecture (EA) practitioner at Capgemini Financial Services, after he finished his study Business Information Science at VU University in Amsterdam, the Netherlands. He conducted various EA function assessments at client organizations and helped them build an effective EA function. Bas is currently employed at Ernst & Young Program Advisory Services and is about to finish his PhD-research on the performance of the EA function. Bas

has presented his work regarding the performance of the EA function at various international academic and practitioner conferences.

Marc Bonnet has an MSc degree in Systems Engineering, Policy Analysis and Management – Information Architecture, which he obtained at the Delft University of Technology. Currently, Marc is part of Accenture's Enterprise Architecture (EA) practice, guiding organizations in large transformation programs. Specific areas of interest include EA design and implementation, EA governance structures and EA performance (efficiency, effectiveness, satisfaction) assessments.

Sander Schouten works as a consultant at Capgemini Netherlands advising organizations on the subject of business rules management and business process management in order to effectively align business and IT. In 2005 he finished his bachelor degree in Business and Technology at the University of Amsterdam with a study to product rationalization in the insurance market. In 2008 he obtained his master degree in change management at the Rotterdam School of Management investigating the Enterprise Architecture function in large organizations.

Hans van Vliet is Professor in Software Engineering at the VU University Amsterdam, the Netherlands, since 1986. He got his PhD from the University of Amsterdam. His research interests include software architecture and empirical software engineering. Before joining the VU University, he worked as a researcher at the Centrum voor Wiskunde en Informatica (CWI, Amsterdam). He spent a year as a visiting researcher at the IBM Almaden Research Center in San Jose, California. He co-authored over 120 refereed articles. He is the author of "Software Engineering: Principles and Practice", Wiley, 3rd Edition, 2008. He is a member of IFIP Working Group 2.10 on software architecture, and the Editor in Chief of the Journal of Systems and Software.