IBM Research Report

A Comparative Review of Business Architecture

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Abstract

Business Architecture provides foundational and practical concepts for enterprises and their transformation. Business Architecture is an approach to represent the way an organization operates, instrument alignment between business performance targets and operational priorities, and capture resources needed (including IT solutions). These Business Architecture goals have received a great deal of attention from different disciplines in the last two decades. Recently, companies and industries in regimes of fast technological change and innovation have made Business Architecture gain new emphasis. As it is also seen from the literature, Business Architecture is being revisited intensively by companies, government, analysts, standards organizations, and researchers.

As Business Architecture involves different concepts and it has a strong multidisciplinary nature, it is common to find a number of approaches to Business Architectures in the literature. Furthermore, the variety of Business Architecture perspectives is wide and their applications depend on purpose of adoption, scope of usage, and overall maturity of specific concepts. Thus, in order to unravel commonalities and differences among these approaches, it is important to establish a unified perspective for presenting and comparing them.

Business Architecture comprises three core components or dimensions, namely, conceptual model, methodology and tooling. This report reviews ten approaches to Business Architecture from the literature and evaluates them according to proposed measures. Strengths and shortfalls may be identified across the above dimensions. A particular focus of the evaluation is laid on the service concept, which is often presented as the connection point between business and IT.

1. Introduction

Growing global competition with constantly changing marketplaces and increasing customer demands has altered the way enterprises sell their offerings to their customers and collaborate with their partners (Friedman 2007). Consequently, in order compete, enterprises must have a comprehensive knowledge about their business, must be able to quickly evaluate the business effect of external factors, and must be in a position to recognize new business innovations. Based on this knowledge, decisions can be made to adjust the enterprise accordingly, including the required modifications to the company's information systems. In this context Business Architecture (BA) has regained interest, providing an approach to analyze business concerns, align solutions to business priorities and communicate resulting actions and portfolios (Burton & Robertson 2008)[1].

According to a recent study by Forrester, 50% of the analyzed companies claimed to have an active BA initiative, whereas 20% were planning to engage in BA work in the near future (Scott 2008). However, despite the high interest in BA, there is not yet a common understanding of the main concepts (Burton 2008). Furthermore, no holistic business architecture is available, and instead, various BAs have emerged, differing significantly in purpose, scope, level of detail, and maturity (BAWG 2009a). For instance, some BAs are business-centric, focusing on business transformation and business capabilities necessary to realize change. Other cases of BA are IT centric, guiding the enterprise in IT strategy and IT investment decisions. Consequently, the strengths and weaknesses of current business architectures are often not clear, thus making it difficult for enterprises to determine the most suitable BA approach for their needs.

Thus, aiming at providing improved insights for the selection of Business Architectures, this report proposes a review and a comparison of available approaches to BA. The paper is structured as follows. The next section provides essential background information on Business Architecture. We then introduce ten business architecture approaches that represent important trends in the literature. A comparative analysis identifies status quo, as well as BA's strengths and weaknesses regarding conceptual models, methodologies and tools. The last section draws some conclusions and proposes future research opportunities.

2. Business Architecture Foundations

"Architecture" is used in various disciplines, such as construction and information technology. Architecture helps manage the complexity of the work done in these disciplines by supporting design, change, communication, and realization of the objects of concern. According to ANSI/IEEE Std 1471-2000, architecture is "the fundamental organization of a system, embodied in its components, their relationships to each other and the environment, and the principles governing its design and evolution (IEEE Standards Association 2000).

Building on this generic architecture definition, various business-specific definitions have been proposed in recent years. Table 1 shows a summary of some of the definitions available from the literature. Business Architecture (abbreviated BA) is used to guide businesses-IT integration concerns, by pivoting on Business Strategy, IT Strategy, Business Process Management (BPM), and Service Oriented Architecture (SOA).

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[1] Enterprise Architecture was likely the first context in which a Business Architecture was required (Minoli 2007, 9). However, the architectural breadth of EA is broader than BA as the former also includes technology and application architectures (The Open Group 2009b). Much in the same way non-profits and government organizations may have found EA useful, the application of BA will also bring a number of unique advantages to these industries. While the word "business" suggests that the scope of BA be for-profit enterprises, the BA conceptual model definitions clearly show wider applicability. Whether an entire EA or Business Architecture is to be used depends on the problem and context at hand. This subject is complex and goes outside the scope of this paper.

By using the context of house construction, Lankhorst presented an analogy of Architecture, which is also valid for the more specific notion of Business Architecture. "Suppose you contract an architect to design your house. You discuss how rooms, staircases, windows, bathrooms, balconies, doors, a roof, etc., will be put together. You agree on a master plan, on the basis of which the architect will produce detailed specifications, to be used by the engineers and builders. How is it that you can communicate so efficiently about that master plan? We think it is because you share a common frame of reference: you both know what a 'room' is, a 'balcony', a 'staircase', etc. You know their function and their relation. A 'room', for example, serves as a shelter and is connected to another 'room' via a 'door'. You both use, mentally, an architectural model of a house" (Lankhorst 2005).

Similar to the housing case, a Business Architecture specifies the core functions of an enterprise, how they are operated and how they relate to each other. BA offers an abstract design, which ignores many details, such as the colors and detailed materials used in a house. These details will be filled in later design stages of the business. There are a number of definitions of BA, all similar but not identical. Table 1 shows some examples that illustrate commonalities and differences.

Business Architecture Definitions
"A **Business Architecture** is a formal blueprint of governance structures, business semantics and value streams across the extended enterprise. It articulates the structure of an enterprise in terms of its capabilities, governance structure, business processes, and business information. The business capability is "what" the organization does, the business processes, are "how" the organization executes its capabilities. In articulating the governance and information." … "In defining the structure of the enterprise, business architecture considers customers, finances, and the ever-changing market to align strategic goals and objectives with decisions regarding products and services; partners and suppliers; organization; capabilities; and key initiatives." (BAWG 2009a)
Business Architecture …"describes the fundamental relationships between a business entity's business environment and its intent, value, capabilities, processes, and resources (human, IT, knowledge, capital, facility, and material)." (IBM/ BizADS)
Enterprise Business Architecture (EBA) represents the requirements, principles and models for the enterprise's people, financials, processes and organizational structure. As such, the EBA process should result in the creation of EBA artifacts, including requirements, principles and models, that business and IT people can use to evolve their business in the context of existing interrelationships. EBA is distinct from information and technology viewpoints but is deeply integrated with them in a holistic solution architecture. (Burton 2008)
Business Architecture …"describes the fundamental relationships between a business entity's business environment and its intent, value, capabilities, processes, and resources (human, IT, knowledge, capital, facility, and material)." (Strosnider et al. 2002)
"The concepts in the *Business Architecture* description provide a semantic framework for speaking about common business concerns. … For our purposes, this semantic structure provides a common set of concept patterns to be able to understand the types of content that need to be supported in technology-based information systems. …a set of generic concepts and their interrelationships organize business information content in terms of requirements on the business, the boundary of the business, and the business as a system for delivery of value." (McDavid 1999)
"*BA* is the business strategy, governance, organization, and key business processes information, as well as the interaction between these concepts. … A Target Business Architecture describes the product and/or service strategy, and the organizational, functional, process, information, and geographic aspects of the business environment, based on the business principles, business goals, and strategic drivers." (The Open Group 2009b)
"We use the concept of *Business Architecture* to structure the responsibility over business activities prior to any further effort to structure individual aspects (processes, data, functions, organization, etc.). … Business Architecture "…" is an architecture that is specifically meant to structure responsibility over economic activities by multiple organizations (supply chain level), by one organization (enterprise level) or by part of an organization (business unit level)." (Gerrit , Versteeg & Bouwman 2006)

Table 1. Definitions of BA Approaches

In the context of this report, Business Architecture framework is defined as depicted in Figure 1. It is based on current BA definitions and foundational enterprise architecture work, such as the Generalized Enterprise Reference Architecture and Methodology (GERAM) developed by (IFIP-IFAC Task Force 1999). The framework consists basically of four dimensions, three of which will be the basis for the comparisons addressed later in this report. Specifically, these three dimensions are as follows:

1. The **BA Conceptual Model**, also referred to as metamodel or modeling language, offers modeling constructs that cover, fully or partially, the business domains of an enterprise. Thereby, the core of the conceptual model can be represented in a business capability map and high-level business process models, using business goals and strategy as input and IT strategy and application portfolio contents as output (Scott 2008). The constructs are applied in BA models (i.e., instances of the conceptual model) in the context of a real-world company or organization. The BA conceptual model should not be confused with "Business Model" as used in the business literature. Following (Osterwalder 2004), a Business Model is a conceptual tool that contains a set of elements and their relationships and allows expressing a company's logic of earning money.

2. The **BA Methodology** describes the development process of BA models and more importantly, the techniques that are used in the specific context in which BA is applied. In a process model or a structured procedure, the methodology explains the responsibilities to be defined, the activities to be executed and the principles to be considered. In the context of this report, design principles, best practices, reference models, or use case scenarios are part of the BA methodology.

3. The **BA Tools** support the engineering of the BA models and the BA methods used in the enterprise. They should provide the functionality to develop, to visualize, analyze, and eventually simulate aspects of the BA.
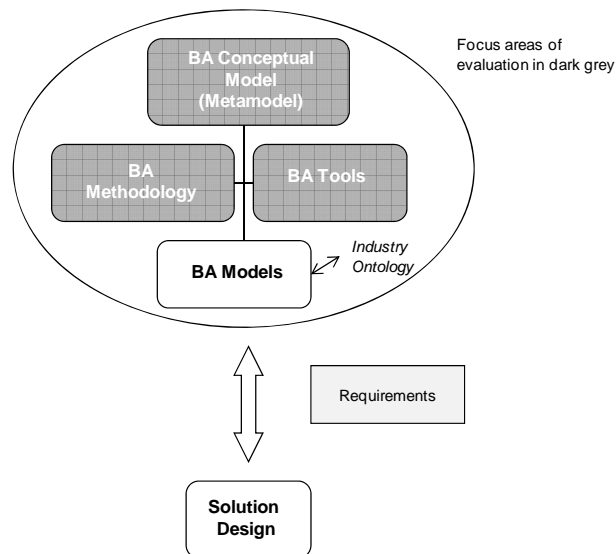

Figure 1. Business Architecture Framework consists of four dimensions

Using Business Architecture concepts, an enterprise creates BA models of the company's current and future states. These models illustrate the company-specific business concerns. The gap between the business and target states reveals the areas that need further improvement, and thus will guide the design of the final solution under considerations of the company's requirements designed for execution (Ross et al. 2006). Thus, business transformation activities in an organization are highly assisted by using BA frameworks.

Business Architecture is used to model various domains of a business. In this report, we differentiate between the following business domains defined by Tikkanen et al. (2005):

1. ***Strategy & Structure*** defines the meaning and direction of an enterprise, governing its actions and structure. The domain is decomposed into three sub-domains. First, Business Strategy which refer to the development of the enterprise's business models. Second, Organizational Structure, which describes the decomposition of the enterprise into organizational units. Third, Governance, which specifies internal and external commitments of the enterprise.

2. The ***Business Network*** describes the enterprise's interaction with its partners, as well as the partners' impact on the enterprise. It comprises four sub-domains, in which the enterprise has varying roles. In the Customer Relationship Portfolio the enterprise is the provider, offering services and products to the final customers; in the Supplier Relationship Portfolio the enterprise itself is the customer, receiving services, products and resources from its suppliers; In the Product Development Portfolio the enterprise collaborates with other partners, designing and testing new products and services; finally in the Extra-Business Relationships the enterprise is impacted by its relationships to competitors, debtors, and equity holders.

3. ***Operations*** refer to the ongoing recurring activities, which consume resources and capabilities in order to produce the output of the enterprise. The domain is decomposed into three sub-domains. First, the enterprise's Offerings (i.e., products, services, or the combination of both), which create a value to the customer. Second, Process Architecture, which represents back stage and front stage business processes, aiming at generating the best overall service performance. Third, Resources and Capabilities, which are used as input for the processes in order to create the enterprise's offerings.

4. The ***Performance and Revenue Model*** is concerned with the financial and performance aspects of enterprises. It covers aspects, such as the financial position of an enterprise, financial resources, value configuration, financial strengths, limitations, and goals, as well as financial metrics.

3. Introduction to Current BA Approaches

In recent years, various techniques that cover different Business Architecture Frameworks have been developed. To establish a better understanding of the current status quo of these BAs, an extensive literature review on Business Architecture was conducted. A wide range of publications on BA (i.e., specifications of current standards, contributions in scientific journals and conferences, as well as websites or whitepaper publications from practitioners) were identified, analyzed, and compared with each other. BA propositions differ significantly in terms of the degree of detail or their completeness. A sub-set of ten BAs was selected to be included in this report as they stood out due to their awareness levels, contributions to the BA community, application, maturity of the conceptual models, methodologies or supporting tools, as well as promising planned enhancements. The results of this evaluation were discussed with scholars and practitioners. The feedback was incorporated into the final evaluation results.

The overview of each BA is structured as followed:

- ***General Information***. This criterion contains BA information about the publisher, the purpose, its application and degree of standardization.
- ***Conceptual model***. This criterion is used to provide a short description of the elements defined by the conceptual model. Furthermore, it determines the maturity of the conceptual model considering syntax, semantics, and pragmatics.

- ***Methodology.*** This criterion describes the information available to guide the architect in BA initiatives (e.g., guidelines, responsibilities, activities, or structured procedures). Based on this information the maturity of the methodology can be identified.
- ***Tools.*** This criterion lists which tools support the usage of the particular BA.
- ***Business IT Alignment.*** The service focus describes in how far the service concept is incorporated in the conceptual model, the methodology, or the supporting tools (Sanz et al. 2007). A particular focus is laid on the business service's connection to IT architectures.

ArchiMate

Originally maintained by the ArchiMate Foundation, in February 2009 ArchiMate(R) Version 1.0 was formally approved as technical standard by the Board of The Open Group. Today, consulting firms and tool vendors are engaged in its support, as well as the development of version 2.0. ArchiMate is an EA language that can be applied to formally describe business and IT concerns of enterprise operations (i.e., resources, process architecture, and offerings). It is used to identify requirements and to reason about the current and future structure and behavior of business and IT systems. ArchiMate is not however particularly designed to model the strategic, business network, financial, or performance aspects of an enterprise. The application of ArchiMate is published in various sources (e.g., ArchiMate Forum 2009a; ArchiMate Forum 2009b; Lankhorst 2004; Lankhorst 2005;The Open Group 2009a).
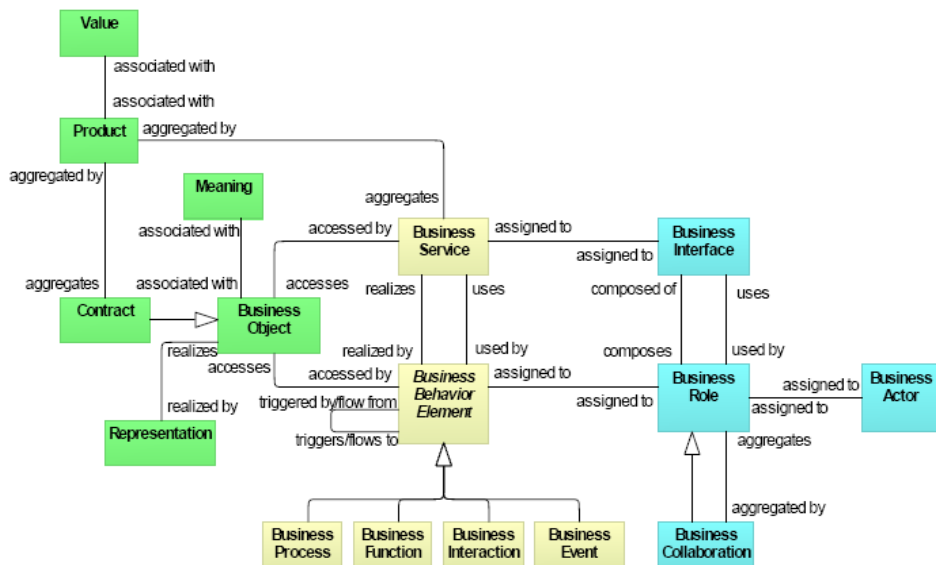

Figure 2. Business Layer of ArchiMate (The Open Group 2009a, 13)

Conceptual Model. The ArchiMate modeling language is decomposed into three tightly connected EA layers, i.e., the business layer, the application layer, and the technology layer. Thereby, the elements of each EA layer are bundled into three groups, i.e., elements representing an active structure, passive structure or the behavior. As illustrated in Figure 2, the Active Structure of the business layer consists of the business actor, which is assigned to a business role, working in internal or external collaboration with other business actors. The Behavior part includes the business service realized by business behavior elements. Finally, the Passive Structure connects the elements product, value, contract, and business object. The business object is an abstract element, which provides information about real objects of concern for the enterprise, such as a customer, an invoice, or a product. The business object is further described regarding its meaning and representation. Its linkage to the data element of the application layer is one example of how tightly the business layer is integrated with the

other two EA layers. The modeling language can be described as mature. The elements and their relationships are clearly defined and extensively explained. Furthermore, to simplify the readability, ArchiMate provides a unique symbol for each EA element, as well various views, filtering the BA information for different stakeholders.

Methodology. To guide the architect in creating EA models for a particular enterprise, ArchiMate describes a comprehensive sample case of an insurance company. It explains for each element which information needs to be defined. However, no management information is offered that describe how the EA models are used in a business transformation process.

Tools. The visualization of the ArchiMate-specific symbols is supported by various modeling tools, including BiZZdesign Architect by BiZZdesign, ARIS ArchiMate Modeler by IDS Scheer, Metis by Troux, Corporate Modeler by Casewise, and System Architect by IBM. Additionally, ArchiMate stencils to be used in MS Visio are available.

Service Focus. ArchiMate incorporates thoroughly the concepts of service orientation. On each layer a service element exists, namely the business service, the application service, and the technology service. The notation and the relationships of these service elements to other EA elements are formally explained. For instance, in the business layer, the business service is created by business behavior. The business service is externally visible to the environment and can be bundled to service groups that form together with a contract the product. Products and services create a value to a defined party, which accesses this outcome through a business interface. Finally, the business service uses the application service from the application layer as input.

Business Architecture Working Group

In 2007, the Business Architecture Working Group (BAWG) was founded as part of the Object Management Group (OMG). The BAWG aims at establishing industry standards, supporting the creation, and alignment of business blueprints. In this context, it is planned to develop a Business Architecture, connecting OMG's existing and proposed business standards (see Figure 3). The current status of the work is published in whitepapers and on the group's wiki (see e.g., BAWG 2009b, BAWG 2009a, or TSG, Inc. 2008). BAWG's BA ecosystem is planned to cover all business domains on an abstract and detailed level (i.e., strategy & structure, business networks, operations, and revenue & performance model). As the BAWG's BA is still in its infancy, it has not yet become a standard in BA.
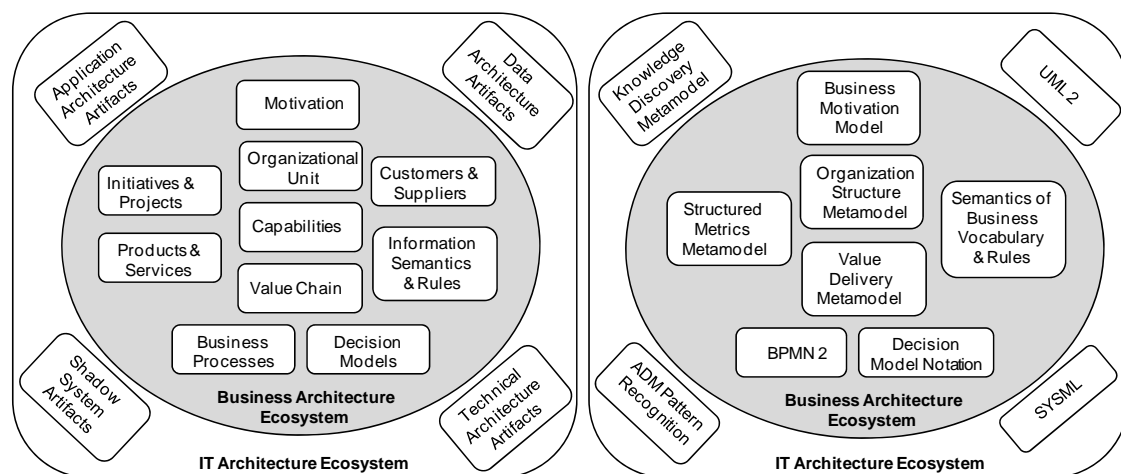

Figure 3. BA and IT Architecture Ecosystem: components and OMG standards (BAWG 2009b)

Conceptual Model. Currently, the BAWG provides partially varying concepts about the key components of a BA ecosystem. The current status of the proposal of an integrated IT and BA ecosystem, published in BAWG's BA requirements for a standard, is illustrated in the following (BAWG 2009b). In the proposal, the BA ecosystem covers aspects regarding the motivation, the organizational unit, capabilities, value chain, initiatives & projects, products & services, customer & suppliers, information semantics & rules, business processes, and decision models. As depicted in the figure above, these areas are addressed by existing and planned BA standards. As the standards represent silos, which are not connected, the planned BA work shall integrate these standards. As the work by the BAWG is still in an initial state, the maturity of the conceptual model can be described as low.

Methodology. In addition to the integration of standards in the BA and IT ecosystem, the Business Architecture Working Group has published business scenarios to illustrate the application areas and value of BA. Furthermore, a roadmap for the integrated BA ecosystem was defined and an overview of existing business models is given.

Tools. The current unfinished state of the BA cannot be supported by any tool.

Service Focus. In the Business Architecture by the BAWG, the service is defined as one element in the BA ecosystem. However, no further information is currently provided on the service in general, or its specific role as connecting element between BA and other IT architectures. The numerous conceptual areas in the BA ecosystem and the IT architecture ecosystem (see Figure 3) indicate that the service element will most likely not be the only element that will link these two ecosystems.

Business Motivation Model

In 2005, the Business Motivation Model (BMM) became a standard of the OMG (Object Management Group). The BMM is used for establishing, communicating, and managing business plans. As such, it defines the factors that motivate a business plan, the elements and the relationships of a business plan. The BMM is designed to model the strategy, governance and the business network of a company. The business operations are not addressed by this model, (Anderson Healy & Ross 2007; OMG 2006).

Conceptual Model. The elements of the BMM are divided into two groups. First, the Ends & Means define what an organization tries to achieve. Thereby, the ends (i.e., vision, goal, objectives) describe the planned accomplishments of an organization, whereas the means define the actions to achieve these goals. This includes the mission of a company, the course of action (i.e., strategy, tactic), and the directives (i.e., business policy, business rule). Second, in order to understand the context of the ends and means, the internal and external Influencers are an essential part of the BMM. Examples of internal influencers are infrastructure, assumption, issue, corporate value, resource, habit, and management prerogative. Examples of external influencers are environment, technology, regulation, supplier, customer, competitor, and partner. Influencers are neutral until their impact (i.e., the strength, weakness, opportunity for or threat against a company. The BMM model is described formally regarding the core elements and their relationships. Furthermore, BMM covers thoroughly the business domains to be modeled. Each element is explained with an extensive example, simplifying the understanding of the model. However, the BMM, does not provide recommendations on how to filter the modeled information in order to focus on specific stakeholder concerns.

Methodology. BMM's conceptual model provides for each element detailed examples, which serve as guidelines on how to develop the BA model for a specific company. It does not provide any methodology on how to develop company-specific BMM models.

Tools. Being a well-defined conceptual model, BMM can be modeled with any entity relationship modeling software. IBM Rational RequisitePro in combination with IBM Rational® Software Modeler also provide a BMM template which assigns to every definition a unique symbol.

Service Focus. The concept of a service is not represented as core element of the BMM model. However, it is used in combination with an action, as well as market and customer information to form the mission statement. For instance, "Provide (action) + car rental service (service) + across Europe for business and personal customers (market & customer)". No connection between the service element or any other BMM element to IT architectures is defined in BMM.

Business Process Modeling Notation

In 2004, OMG released the Business Modeling Notation BPMN 1.0 Specification. BPMN is based on prior efforts by the BPMI Notation Working Group. BPMN aims at linking business process model design and process implementation. As such, it shall be understandable from business analysts, to the technical developers, as well as the people involved in the management and control of the processes. BPMN can be used to describe business operations on a detail, as well as on a high-level. Thereby, it addresses in particular aspects of the process architecture, and only marginally resource and capability aspects. BPMN is a well accepted standard for process modeling. While in January 2009 the specification 1.2 was released, the BPMN specification 2.0 is in progress as of July 2009. The BPMN introduction given in this report is based on Lankhorst (2005) White (2004) and OMG (2008, 2009).
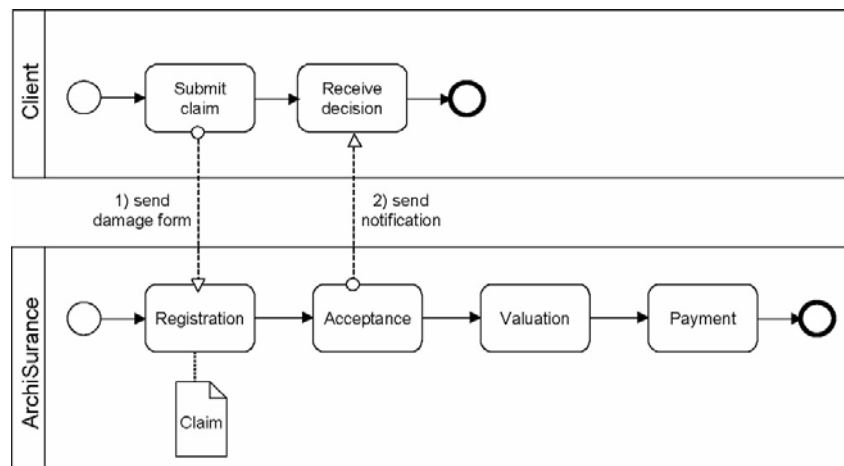

Figure 4. Example model in BPMN (Lankhorst 2005, 34)

Conceptual Model. The BPMN is based on four core element types. Flow Objects, the main element group, consists of events, activities, gateways and connections. These elements are linked to each other with different types of Connecting Objects, namely sequence flows, message flows, and associations. In order to provide the ability to cluster elements, two levels of groupings are available: Pool and Lane. Finally, Artifacts (i.e., data objects, group, and annotation) can be used to provide further information about the process. The BPMN elements are specified in further detail regarding their attributes, types, or sub elements. The BPMN is based on a clear syntax. Furthermore, it meets the defined purpose of building the bridge between business analysts and technical developers. As such, BPMN will furthermore be provided with an internal model that enables the generation of executable BPEL4WS. Due the simple set consisting of the four core elements, BPMN is easy to understand. However, it becomes more complex to manage if the numerous specifications of the elements are applied.

Methodology. The BPMN specification explains the notion of the elements in detail. Reference models, best practices, and guidelines on how to create the BPMN models however are provided in various books on BPMN, which are published independently from the OMG.

Tools. BPMN is supported by various SW vendor, as well as open source tools. Examples are System Architect from IBM, Lombardi Teamworks from Lombardi Software, or the BPMN modeler for Eclipse. The usage of these tools assures that the company-specific models are compliant with the BPMN syntax.

Service Focus. The concept of a service is addressed in the BPMN element 'task', a sub element of the element activity. Representing a single unit of work, the task can be of the type 'service task'. Service tasks are used to model automated services or web services.

Business Concepts

In 1996, McDavid introduced the business concepts as a business language that provides a technique to model common business concerns relevant for the development of information system (McDavid 1996, 1999). The business concepts are based on practical experiences gathered within IBM's initiative Enterprise Solution Structure (ESS), (Plachy & Hausler 1999). They describe a generic Business Architecture, addressing on a high-level aspects of enterprise modeling, such as strategy, structure, business network, and operations. Against this, no particular focus is laid on the revenue and performance models of an enterprise. The BA concepts by McDavid represent a seminal introductory work in BA. As such, it has been laid the foundation for various BA concepts and practices. However, McDavid's business concepts needs to be further specified if they are used in practice.
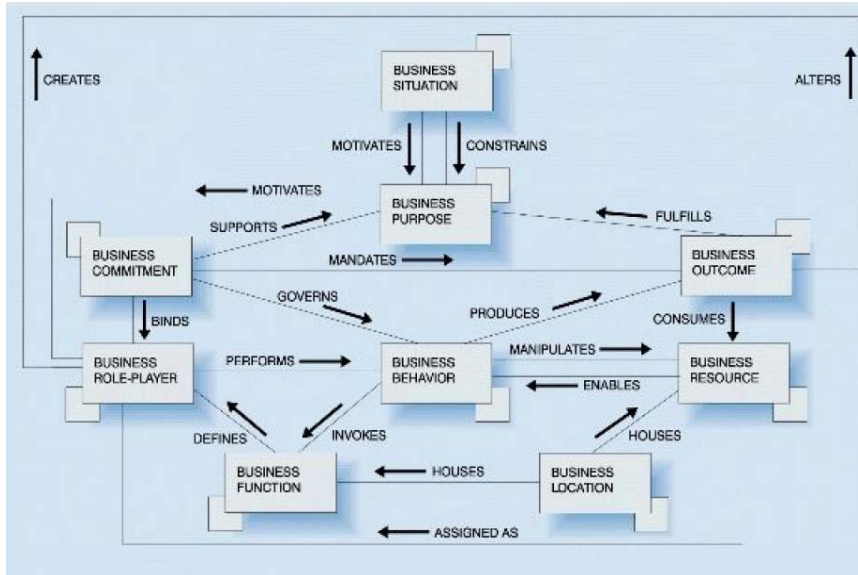

Figure 5. Business Concepts by McDavid (1999)

Conceptual Model. McDavid defines a small set of nine business elements which are grouped into three interrelated parts. The Drivers of a Business describe the first part of the model, representing which requirements must be fulfilled by the enterprise as a system. Elements include the business situation, the business purpose, and the business outcome. The second part is the Business Boundaries. This part of the enterprise defines the business commitment, connecting the different role players in an ecosystem. The third part is the Business Delivery System. The business delivery system creates the value that was defined in the busi-

ness commitments. It contains the elements business function, business resource, and business location. Between the before described elements various connection exists. Furthermore, the elements can be decomposed into sub-elements which can be connected on different levels of detail. The elements and their relationships of the conceptual model are well-defined elements. With the small set of nine elements describing different business domains, it serves the purpose of a high-level BA. Furthermore, it explains the general abstract relationships between business and IT systems. The business concepts do not provide further insights on how the different elements can be visualized in a final BA model.

Methodology. McDavid does not provide a comprehensive methodology on how to develop Business Architectures. However, he describes in which documents, i.e., so-called work products, the business model can be captured: Classified business terms define the industry- and company-specific business terminology captured in interviews and available documents; context diagrams are used to model the relationships between the different role players; business process models explain the behavior of a company; business rule catalogs define the business commitments, and finally business object models capture the business concerns described in a more IT-related approach.

Tools. In order to support McDavid's business concepts with an entity relationship modeling tool the syntax of the model needs further specification.

Service Focus. McDavid defines outcome as one key element in a Business Architecture. The service is mentioned as a specific type of outcome. It is not explained in which way the service is connected to the outcome in general, or the other outcome types, i.e., interim outcomes, products and byproducts. Similarly, the relationship of the service to the other eight key elements is not specified, but can be derived from the element outcome. Thus, according to McDavid, a service fulfills a purpose, it is mandated by a commitment, produced by behavior, and it consumes resources. As part of the outcome the service is used to connect McDavid's business concepts to the IT, more specifically the service is connected to the component defined in the IT Systems Architecture Concepts. As illustrated in Figure 6, the service / outcome is not the only element which serves as connection point to the IT. McDavid defined for almost all business elements a connection to elements of the IT Systems Architecture.
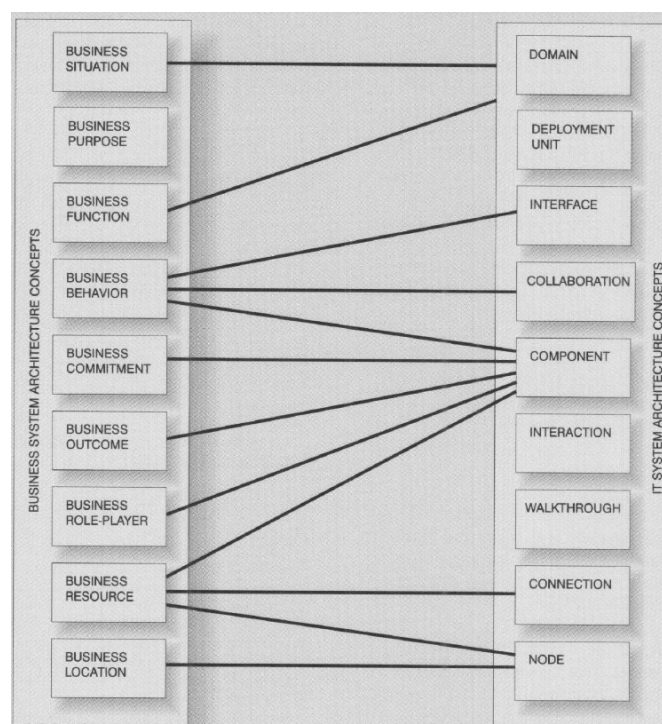

Figure 6. Business-to-IT concept mapping

Component Business Model

The component-based Business Architecture (CBM) has been developed by IBM and is actively applied in the consulting activities by IBM Global Business Services (GBS). CBM is used for business transformation, by prioritizing strategic targets and their linkage to solutions through traditional packaged applications or SOA solutions (Cherbakov et al. 2005). CBM covers aspects of the operations and organizations such as a company's strategy, governance, operations, as well as revenue and performance models. Business network aspects are currently less prominent in CBM (Nayak et al. 2007).
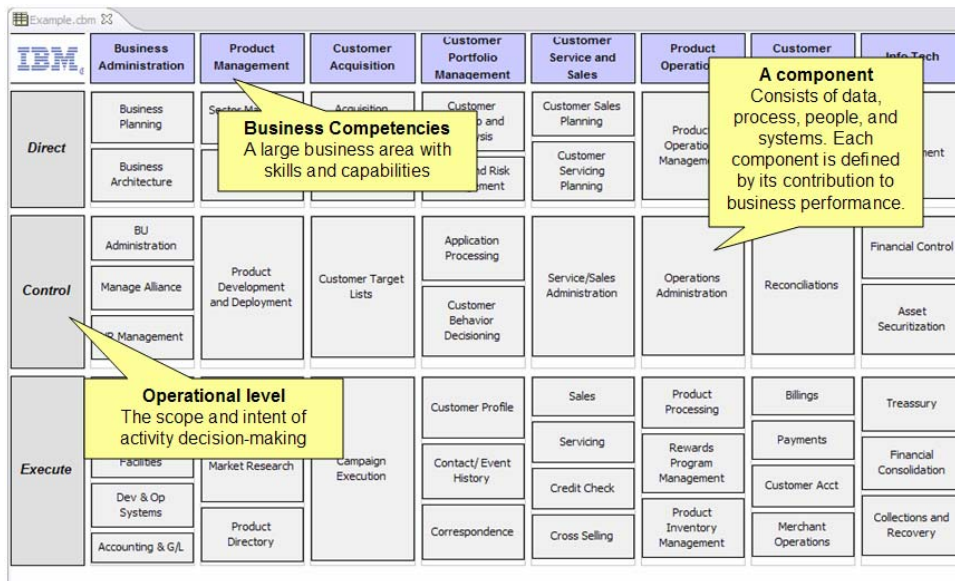

Figure 7. CBM map

Conceptual Model. The focal element of CBM is the business component. The business concepts serves as structuring element and has five dimensions: business purpose, activities, resources, governance model and business services (IBM 2005). Business component dependences establish the loosely-coupled model of operations for the enterprise, thus enhancing the manageability of the conceptual model and the decision-making. (Sanz et al. 2006). Components are assigned to business competencies, which represent a large business area with skills and capabilities, as well as accountabilities levels, which are a simple framework for separating strategic decisions, control mechanisms, and business actions. All CBM elements and the relationships amongst them are well defined. Each element has a rich notation.

Methodology. In addition to the conceptual model IBM uses methods that guide GBS consultants in the use of BA for different type of client engagements. A CBM-related method is used for business transformation, a strategy and change method for strategy engagements, and an EA method for Enterprise Architecture initiatives.

Tools. Core tools support the above conceptual model, including IBM's publicly available WebSphere Business Modeler, as well as a CBM-specific tool.

Service Focus. CBM uses a business service concept. Business services are described in a business specification and assigned to operational goals. Composed of service functions, the business service is provided by the business component, i.e., it is part of an offering associated to the business value model. Finally, CBM is also linked to other critical models, which include operations and IT. These in conjunction with industry specific content, methods, metrics and tooling make the heart of a practical approach to BA from IBM. A complete Business Architecture Framework from IBM is shown in (IBM 2009b).

Enterprise Business Architecture

Developed by Gartner, the Enterprise Business Architecture (EBA) is an integral part of an enterprise architecture. As such, its objective is to optimize business components along with information and technology in order to support the business strategy. EBA is a descriptive BA, which can be used as introduction to the BA topic. It covers in particular the structure and the operations of a company. Aspects, such as the business network and the performance models are less emphasized in the EBA. Publications on the EBA are available from 2008, e.g., (Burton & Robertson 2008, 2008b; Burton 2009).

Conceptual Model. The EBA consists of five key dimensions. The Business Capabilities (also referred to as business functions or high-level business services) form the architecture foundation. Capabilities are realized by four key business elements: People who directly impact the scope of the EBA; Financials, which describe the financial situation of a company; Organization, which refer to the formal reporting structure, as well as the informal structure, including cultural hierarchy, virtual teams, and social networks; and finally Processes, which are composed of business activities. According to Gartner, these dimensions are impacted by several internal and external Influencing Factors. Although, Gartner intents to provide a BA that can be used to align business and IT concerns, the EBA lacks a formal descriptions of the linkages to other parts of the enterprise architecture (e.g., information or technology architecture). Regarding the maturity of the architecture, the syntax of EBA is rather ambiguous the relationships between the elements are not well-defined.

Methodology. In addition to the before described conceptual model, Gartner provides best practices, as well as requirements for an enterprise business architect. Moreover, Gartner defines a seven phase iterative procedure model for the development of enterprise Business Architectures (see **Error! Reference source not found.**). In the first phase, i.e., Define & Scope, the scope of the EBA must be defined, and a common agreement and understanding of what EBA is must be reached. In the second phase, i.e., Organize, the EBA team must be determined. Afterwards, in phase 3, i.e., Future State, the vision of the future EBA is described, by creating the requirements, principles and models of the Business Architecture. Phase 4, Current State, aims at establishing a good understanding of the current state of the business, which is in the defined scope of the EBA. Based on the results of phase 3 and 4, in phase 5, a Gap Analysis is conducted. In phase 6, i.e., migration plan, initiatives, which aim at closing the gaps, are identified and selected according to priorities. Finally, phase 7, i.e., Iterate & Refine, describes the ongoing process of supporting and evolving the EBA.
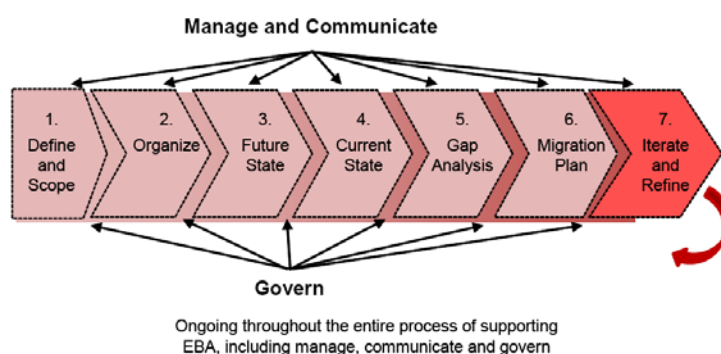

Figure 8. EA development process (Burton & Robertson 2008)

Tools. In order to support Gartner's EBA model with an entity relationship modeling tool the syntax of the model needs further specification.

Service. In the EBA, service concept is not specifically addressed. EBA furthermore does not provide any detailed information how IT architectures can be connected to the business architecture.

Event-Driven Process Chain

As part of ARIS ('Architecture of Information Systems'), the Event Driven Process Chain (EPC) was originally developed within a research initiative lead by Prof. A. W. Scheer. EPC is a mature conceptual model, which is widely used for the documentation, and analysis of enterprise operations. The outcomes of these activities serve as foundation for the design of information systems. In particular, in the configuration and customization projects of the enterprise solution SAP, ARIS provides the standard modeling environment. The EPC was first introduced in 1992 in an article by Scheer (Scheer & Hars 1992). Since then various scientific and practitioner contributions followed (e.g., Davis & Brabänder 2007, Davis 2008, Scheer 2000a, 2000b).

Conceptual Model. The EPC provides the subsequent four core elements for the modeling business processes. The first core element is the Event. This element, being of either internal or external nature, represents the changing state of an enterprise system. The second element is the Function. Triggered by events, functions are activities or tasks, which are carried out as part of a business process, create value for to the company. The third core element is the Rule. Rules connect events and functions, governing the process flow. Finally, Resources, also referred to as non-structurally relevant objects, form the fourth group of elements. Resources comprise sub-elements, such as organization, systems, data, knowledge, information carriers, products and services, objectives and measures, or general resources. In EPC, all elements are further defined by a set of attributes (e.g., the attributes costs and time for the element function). To model these resource elements about 150 symbols are provided by the EPC. The elements can be connected amongst each other, using five different relationship types. The EPC is of a high maturity, as its syntax is clearly defined, and the semantics of the elements are well explained. Furthermore, increasing the understandability of the EPC, to each element a unique symbol is assigned. Represented in the ARIS house, the following five views of the conceptual model are provided, focusing on different enterprise aspects, including the organization view, data view, control view, function view, and product service view.
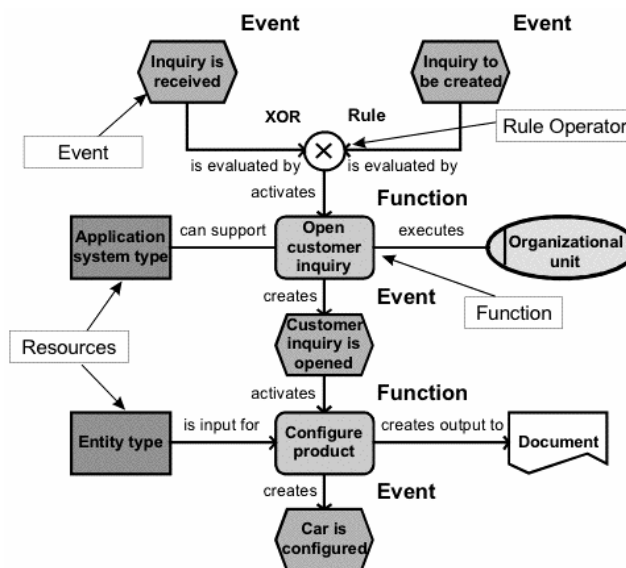

Figure 9. Typical EPC Process Model (Davis & Brabänder 2007)

Methodology. Providing guidance for the development of company-specific ARIS models, the ARIS concept is supported by the ARIS build time phases that are incorporated into the ARIS house. Thereby, each view of the ARIS house is decomposed into a requirements definition phase, a design specification phase, and an implementation phase. Above all views lies the strategic phase. ARIS defines thereby for each phase and view a set of ARIS models to be developed (in total 150 models are available in ARIS). Due to its industry-wide application and its tight connection to SAP, in ARIS for numerous industry sectors reference models and best practices are available.

Tools. ARIS is supported by the ARIS Software platform, which is composed of the numerous tools of the strategy platform, design platform, implementation platform, and control platform. Thereby, the tools of the ARIS design platform provide the capabilities to model and manage the EPC business models. All tools of the ARIS platform are based on one data model repository, thus allowing the re-use of information from any tool. For instance, key performance indicators created in the balanced scorecard tool can be accessed in the ARIS Tool and connected to business process models.

Service. The service concept is represented in the resource element product/service, which can be connected to a function as an output. Furthermore, ARIS proposes a product/service tree model, which aims at representing product hierarchies. In this model, the 'has' relationship describes the sub-components of a product/service, the 'substitution' relationship illustrates by which other products/services it can be replaced. In the EPC, no direct connection between the business service and IT architecture elements is defined. Instead, the business architecture is linked to IT elements (e.g., software or hardware resources) through the element function.

Enterprise Business Motivation Model

The Enterprise Business Motivation was developed by Microsoft's enterprise architect Nick Malik. It was first published in his blog, later also in Microsoft's The Architect Journal (Malik 2009a, 2009b). The BA model aims at illustrating how the actions of a company are aligned with its objectives. It covers numerous aspects of enterprise modeling. A particular focus is thereby laid on the modeling of business models. As the EBMM was first published in 2009, little is known about the EBMM's actual application in companies, nor can it be today defined as a standard for BA.
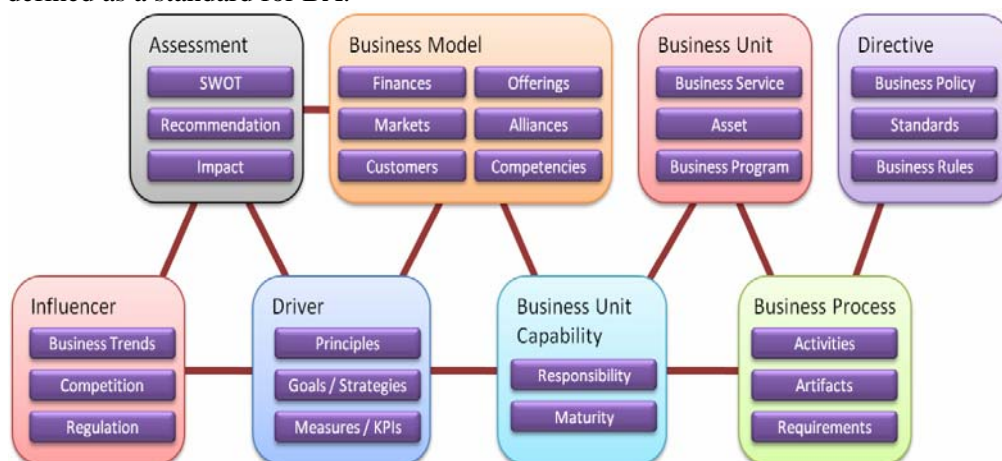

Figure 10. Enterprise Business Motivation Model (Malik 2009b)

Conceptual Model. The EBMM is composed of the eight interrelated business areas illustrated in Figure 10.Thereby, the business area Assessment evaluates the Business Model and

describes the impact of a company's Influencers. The assessment is furthermore defined as the impetus for the business Drivers. The drivers respond to the influencers, and motivate changes towards the business model. The business model defines the requirements for the Capabilities of the Business Units. Finally, implemented through the business unit capability the Business Process is performed by the business units and governed by the Directives. Each business area is decomposed into more detailed elements which are tightly connected to each other within one individual business area, or amongst different business areas. The conceptual model is comprehensive and well-defined. On a high-level it meets its purpose to explain comprehensively how the actions of a company are aligned to its goals. Against this, the notions of the business elements are explained in less detail. Thus, if more detailed information about the company has to be captured, the model needs further extensions. Regarding the understandability of the model, the detailed UML models provided by the author are essential.

Methodology. The EBMM explains the notations and relationships of the elements, it provides however little guidance on how the conceptual model is created.

Tools. The EBMM can be supported by any tool that provides ER modeling features.

Service. The concept of a service is incorporated in the EBMM as a core element of the business model. It is a bundling of business capabilities that are offered to a customer or partner through a distribution channel. As such it is targeted in the value configuration. The business service is provided, as well as consumed by business units. The business service, nor any other element of the EBMM is directly connected to elements of the IT architecture.

TOGAF Business Architecture

TOGAF (The Open Group Architecture Framework) is developed and maintained by the members of The Open Group working in the Architecture Forum (The Open Group 2009b). TOGAF Version 1 was originally published in 1995 with a strong focus on IT architecture. In recent years, Business Architecture has become an essential part of TOGAF. In particular version 9.0, published in February 2009, shows various enhancements regarding conceptual model and guidelines for the creation of Business Architectures. Thereby, the Business Architecture in TOGAF addresses on a high level the organizational aspects strategy, structure, and operations. The business network, performance and revenue models are less covered in TOGAF. However, the maturity between the Business Architecture and other enterprise architectures still differs significantly. Nevertheless, TOGAF is a worldwide accepted standard for EA frameworks, which has been implemented for various industries.

Conceptual Model. TOGAF provides a so-called content metamodel which defines clearly the elements and relationships of the three enterprise architectures, i.e., Business Architecture, information system architectures, and technology architectures. The elements of the Business Architectures are decomposed into motivational, organizational, and functional groups (seeFigure 11) Furthermore, TOGAF defines which diagrams can be used to model particular business aspects of the company. The metamodel does not define specific symbols for the elements of the metamodel. In order to support business IT alignment TOGAF defines the connection between the Business Architecture and the information and technology architecture. For instance, the business service is realized through an application component, and implemented on a technology platform.
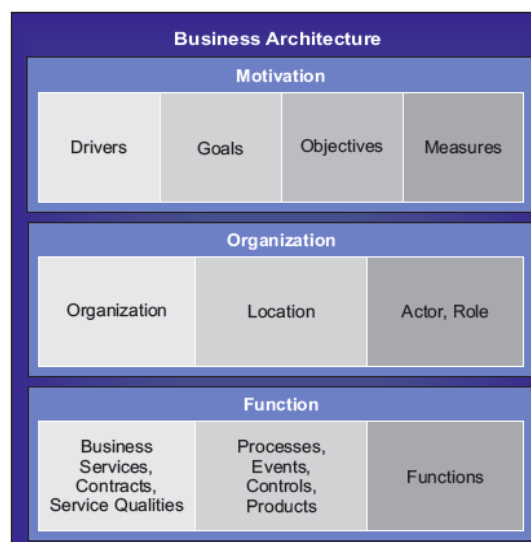
Figure 11. TOGAF Content Metamodel (The Open Group 2009b, 375)

Methodology. Supporting a company in transitioning from a current to a target state, TOGAF provides the Architecture Development Method (ADM), which consists of eight iterative phases. Thereby, the Business Architecture is the second phase, which follows the phase architecture vision. The BA phase sets the foundation for the subsequent phases information systems architecture and technology architecture. It is composed into four sections, i.e., objective, approach, inputs, and steps. The steps section thereby describes the activities necessary to develop a Business Architecture. It first proposes the selection of reference models, viewpoints, and tools. Afterwards, the baseline and target BA description is developed, which are then analyzed in the gap analysis. Based on the results on the previous steps, the roadmap components are defined. In the subsequent phase, the target Business Architecture is evaluated regarding its impacts on the remaining architecture landscape. In the following two phases, stakeholders review the target BA to be then finalized by the architecture team. The BA phase concludes with the creation of an architecture definition document.

Tools. The ADM is supported by various tools, such as IBM System Architect, MDG Technology by Sparx Systems, or Metastorm Provision. Thereby, most tools support the modeling of conceptual EA models referenced by TOGAF. Furthermore, they provide a structure to organize the created company-specific models, according to the phases of TOGAF's ADM method.

Service. Besides the before described business-IT relationships, TOGAF defines the following relationships between business elements. The business service is realized by a process and it is owned and governed by the organization unit, and accessed by an actor. Furthermore, TOGAF, describes the relationship between a business service, an application service and a technology service. According to TOGAF, the business service consumes and provides data entities, which are accessed by the application service. Furthermore, the business service is directly implemented on a technology service, which again is realized through a platform service.

4. Findings

As illustrated in the previous section, various kinds of Business Architectures can be applied for the design, change, communication and realization of enterprises. The main goal of BAs is thereby to support enterprises in creating business solutions that increase its overall performance. The requirements which Business Architectures must fulfill to meet this goal depend significantly on the specific characteristics of an enterprise, as well as the particular

objectives set for the transformation initiative. Thus, prior to every initiative, which requires the development of BA models, a careful comparison of the initiative's BA needs and the existing BA approaches is necessary in order to make a sound BA selection. To support enterprises in this selection process, the following BA comparison emphasizes on the differences between the before introduced Business Architectures. It provides general guidelines to choose the most suitable BA for a specific problem area of an enterprise, considering general information, conceptual model, methodology, and tool support of the BA (status as of July 2009). Finally, a particular focus is laid on the service element, which is often used as connection between business and IT elements,

Table 2 provides an overview this comparison.

General Information

Business Architectures are used to guide enterprises in business IT integration concerns. Depending on the specific problem area enterprises focus differently on Business Strategy, IT Strategy, Business Process Management, and Service Oriented Architecture. For instance, for one enterprise the information on the business strategy may be relevant for long-term IT investments decisions, determining which business areas need to be optimized. Other enterprises model in detail selected business processes in order to visualize cost reduction and value creation potentials of their business services. Additionally, often a transformation initiative must fulfill more than one modeling purpose, thus requiring the combination of different BAs.

Selected Business Architecture (July 2009)	ArchiMate	BAWG	BMM	BPMN	Business Concepts	CBM	EBA	EPC	EBMM	TOGAF BA
1. General Information										
• publisher	ArchiMate Foundation / The Open Group	OMG	OMG	OMG	McDavid	IBM	Gartner	IDS Scheer	Microsoft	The Open Group
• purpose	EA	Integration of OMG standards	Business Strategy	BPM	IT-Business Alignment	IT Strategy, IT-Business Alignment, SOA	EA	BPM, IT-Business Alignment, SOA	Business model, IT-Business Alignment, EA	EA
• available information	●	◑	●	●	◕	●	◑	●	◑	◔
• standardization / application	◑	◕	◑	●	◕	◑	◕	◔	◕	◑
2. Metamodel										
• scope										
– strategy & structure	◑	◑	◔	○	◕	◑	◑	◑	◔	◑
– business network	◕	◑	◔	○	◕	◕	◕	◕	◕	○
– operations	◔	◑	◕	◔	◑	◔	◑	◔	◑	◑
– revenue model & performance	○	◑	◑	○	○	◑	◕	◑	◕	◑
• integration with other architectures	●	●	◕	●	◑	◑	○	●	○	◑
• maturity	◔	◕	●	●	◑	◔	◕	●	◑	◕
3. Methodology										
• scope										
– development of BA model	◑	○	◑	●	○	◑	○	◔	◕	◕
– management BA initiatives	○	○	○	○	◕	●	●	◑	◕	●
• structured procedure model	○	○	◑	◑	◕	●	●	○	○	●
• use case scenarios	○	◔	○	◕	○	●	◕	◑	◕	○
• best practices / reference models	◑	○	◑	◔	○	●	◑	●	◕	◕
• maturity	◕	○	◑	◕	◕	◑	◕	◕	◕	◔
4. Tool Support										
• available tools	e.g., BiZZdesign Architect by BiZZdesign, ARIS ArchiMate Modeler by IDS Scheer, Metis by Troux, Corporate Modeler by Casewise, IBM System Architect, Visio by Microsoft	none, metamodel not yet defined	IBM System Architect	any entity relationship tool	none, metamodel extension would be necessary	WBM, CBM & SOMA	none, metamodel extension would be necessary	ARIS toolset	any entity relationship tool	any entity relationship tool that support the creation of the BA models referenced by TOGAF, & methodology supporting tools, such as IBM System Architect, Technology by Sparx Systems, or Metastorm Provision
5. Service Focus										
• service	●	◕	◑	◑	◕	●	◕	◕	●	◑

Table 2. Overview of Current Business Architectures

Current Business Architectures are developed and maintained by various parties, including vendor independent initiatives, companies, as well as individuals. Each party addresses one or

several purposes in its BAs. However, while the combined view of all models reveals a broad coverage of BA purposes, this view is not coherent. For instance, ArchiMate, EBA, EBMM, and TOGAF, are integral parts of an enterprise architecture, which guide in a top-down approach the design of the remaining architectures. Other BAs may have a more generic intent to align business and IT (e.g., business concepts by McDavid). Another purpose may be the support of business process management initiatives, which is for instance one goal of BPMN and ARIS. Another group of BAs is designed to illustrate the strategy and the motivations of a company, such as the business motivation model from OMG, or the enterprise motivation model from Microsoft. Additionally, ARIS and CBM amongst other purposes provide a modeling environment for SOA. Finally, the BA by BAWG aims at connecting different BA standards.

Furthermore, the amount and quality of available information explaining the particular Business Architecture varies. Whereas, more mature or standard BAs (i.e., ArchiMate, BMM, BPMN, CBM, EPC, TOGAF) have been explained extensively in various contributions, other not yet well-established BAs only provide introductory information (e.g., EBA, BAWG, business concepts). As a consequence, the models differ in how well they guide enterprises in the creation and application of BA models.

BA Conceptual Models

The purpose of a BA is tightly connected with the business domains and sub-domains addressed in the BA conceptual models. For instance, to model the business strategy, it is necessary to specify aspects of the strategy, business network, as well as the performance and revenue model. Furthermore, the directions and value of the product and service offerings must be determined. Against this, SOA projects have a strong focus on the back stage and front stage operations of an enterprise, including the process architecture, resources, and service offerings. When selecting a BA conceptual model for an enterprise, the scope and level of the business domains must therefore be clear and aligned with the purpose of the BA model to be created.

Evaluating BA conceptual models regarding their applicability for a defined purpose, it must be taken into account that BA conceptual models have different scopes and levels of detail. As in the case of the ten introduced BAs, some conceptual models (e.g., BPMN, BMM) focus explicitly on one or two business concerns, whereas others (e.g., BAWG, TOGAF, or McDavid's business concepts) cover on a more abstract level a broader spectrum of business areas. In the following, it is described in how far the four business domains of an enterprise are addressed by the conceptual BA models.

1. *Strategy & Structure*. The sub-domains *Strategy* and *Governance* are addressed in very detail by the BMM from OMG. Thus, these models can be used to determine the value and focus of the enterprise's offerings, as well as to plan future directions. Similarly, the EBMM from Microsoft has also a strong focus on the strategy and motivation of a company, but does not differentiate as extensively between directives, mission, vision, strategy, course of actions, policies and rules as the BMM does. The remaining BAs (e.g., ArchiMate, ARIS, business concepts) mostly cover the organizational aspects, and less the strategy aspects of a company.
2. *Business Network*. This business domain is only described on an abstract level by most of the evaluated BAs. BA elements used to define the specifics of certain networks or the enterprise's differing roles as a service system (e.g., supplier, customer, or partner) are not provided by these BAs. For instance, ArchiMate has the generic elements role and process that can be instantiated to define the supply chain process between the company and the supplier. The symbol of the role supplier and company however is the same as ArchiMate currently only offers one symbol for the superior element role. Against this, in the BMM by OMG and EBMM by Microsoft the customers, partners and suppliers are specifically

mentioned as BA elements and can be used to describe their impact on an enterprise. However, these BA elements are not used to define the business networks.

3. *Operations.* Business *Operations* are addressed by all Business Architectures. The level of detail of the elements for the process architecture, resources, and outcome differs however significantly between the conceptual models. For instance, the BMM, EBA and the business concepts define processes as a high-level element without information on how they are composed. Against this TOGAF, CBM, ARIS and ArchiMate define core components of a business process, such as events, functions, and connectors. Additionally, ARIS offers an extensive set of elements and element attributes to further specify the resources to be consumed and provided by a function. In contrast to the before described BAs, which also address other business domains, BPMN is exclusively designed to describe business processes. It provides a conceptual model which allows describing a business process in such level of detail that it can be transferred into executable business process language. The scope of the BPMN is limited as it does not extensively describe the resources and capacities, or the outcome of a business process. Consequently, to select a Business Architecture for the modeling of the enterprise's business processes, it must be considered in which level of detail they must be described for the specific purpose of the BA project.

4. *Revenue* and *Performance Model.* This business domain is not a particular focus of the analyzed Business Architectures. Some conceptual models, such as CBM or EBMM define financial metrics for the modeling of Business Architectures. However, financial position, value configuration, or financial resources are less addressed by most conceptual models of the ten evaluated BAs. In order to increase the transparency of an enterprise's revenue and performance model most BA models must be extended.

Today's enterprises depend heavily on information technology (IT). In order to identify potentials for a better business-IT-alignment, it is therefore crucial to integrate Business Architectures with other enterprise architectures, such as technology, application, or data architectures. Although, most BAs claim to address these business and IT alignment issues, their integration abilities differ significantly between them. For instance, the Business Architectures BMM, EBMM, and EBA are not well connected to other architectures. Contrarily, the BAs BAWG, ArchiMate, BPMN, and EPC specify more extensively the connections to IT. BPMN connects, for example, web services to tasks, whereas EPC links applications to functions. The differences in the BA's integration to other EAs must be considered when choosing a conceptual model.

The maturity of BA conceptual models varies also in syntax, semantics, and pragmatics. Some conceptual models, being still in their infancy (e.g., BAWG) or serving as simple introduction to BA (e.g., EBA) describe the core elements of a BA but lack in describing the formal relationships between the elements. Against this, more mature BA conceptual models formulate clearly the elements, as well as their relationships. Thereby, the explanations about the elements differ. BPMN for instance describes each element on the level of attributes. Against this, the element description from McDavid is more abstract, providing small examples for each element. Improving the readability of the final BA models, conceptual models, such as ArchiMate, ARIS, and BPMN, assign to each element a unique symbol.

BA Methodologies

The modeling of enterprises can be complex and error prone. Thus, in order to guide the business architects in the development of company-specific BA models it is essential to provide BA methodologies. Furthermore, in order for BA to deliver value in applications to real enterprise transformation problems and related practices, methodologies need to make BA representations practical. This is also the role of BA methodologies, i.e., provide the process or techniques to use BA in different transformation scenarios or business contexts. Also, a good methodology explains ideally, in the form of process models or structured procedures,

the activities to be executed, the responsibilities to be defined, business models to be reused, and general principles to be considered for deploying the practice. These characteristics allow for BA methods to be more easily adopted in large global enterprises, where common practices and integrated deployment of solutions are commonplace. Furthermore, methodologies may also contain design principles, best practices, reference models, business models (in the sense defined in this report) and use-case scenarios.

The evaluation of the ten BA approaches shown in this report reveals large variations in their methodologies. None of the analyzed BA methodologies guide business architects in similar ways through general BA project activities and concrete activities on how to develop BA models, even less so how to use BA to address transformation and change of operations. The methodologies have either a focus on the first or the second aspect. Furthermore, instead of well-defined procedures, most methodologies provide some kind of unstructured guidance. The information is mostly general and too generic to be used in any context of BA development (e.g., business strategy, IT strategy, BPMN, EA, and SOA). As consequence, enterprises may be uncertain about which BA elements they should focus on and in which level of detail they should develop the BA models and consumables needed for a particular purpose. For instance, to analyze the value of business services in a business strategy project, it is essential to provide an abstract view of the final business services, the external customers consuming these services, as well as their importance for the enterprise. Against this, in a BPM initiative, it is helpful to decompose the final business service into a hierarchy consisting of detailed services that can be connected to business process tasks.

Frameworks that stand out in their guidance regarding BA usage, with different degree of rigor and depth, are the EBA from Gartner, the BA phase published in TOGAF, and the CBM / Business Architecture method from IBM. TOGAF, for instance, defines several activities in its BA phase, ranging from activities to select reference models, viewpoints and tools, to develop the target and baseline architecture, to analyze the gaps, and to request the stakeholder agreement and finalize the BA. Similar activities are defined by Gartner's BA method. Gartner's and TOGAF's BA methods are strongly integrated into an EA development method, and thus the application or business context needing a BA is determined beforehand. Thus, the BA phase requires input from previous phases (e.g., in TOGAF from the Vision phase) and produces output for the remaining architecture (e.g., information systems and technology architecture phases), as well as design phases (e.g., opportunities and solution, and migration planning phases).

Additionally, a few BA approaches also provide best practices, fictitious examples or reference models. For instance, the BMM illustrates with various sample mission statements of a car rental company, how the element 'mission' is described in BMM. ArchiMate also visualizes the relationships between its elements using a fictitious example of an insurance company. EPC is covered in various books providing reference models for different industries. Finally, the OMG BAWG provides business scenarios to guide companies in the evaluation of BA values.

BA Tools

BA Tools support enterprises in their development of BA models. Ideally, the tools provide functionality to develop, to visualize, analyze, and simulate the BA models. As such, they have a significant impact on the quality of the BA models.

Similar, to the conceptual model and the methodology, the tool support varies among the BAs. Business Architectures, such as the EBA from Gartner, the current version of the BAWG from OMG and the business concepts from McDavid, do not provide the required syntax to be completely supported by a modeling tool. For other BA conceptual models, however, a broad variety of common entity-relationship (ER) modeling tools is applicable.

Additionally, some Business Architectures benefit from modeling tools that were enhanced, providing unique symbols for the BA elements. Examples are the ARIS software platform for EPC, or IBM's tool in support of CBM. In particular, the visualization of ArchiMate model is currently supported by several tools, such as BiZZdesign Architect by BiZZdesign, ARIS ArchiMate Modeler by IDS Scheer, Metis by Troux, Corporate Modeler by Casewise, System Architect by IBM, and Visio by Microsoft.

While the conceptual model is already broadly supported by tools, only a few tools support the execution of BA methods. IBM System Architect is for instance a positive example that supports different Enterprise Architecture Frameworks, such as TOGAF, DoDAF, and MODAF. MDG Technology by Sparx Systems or Provision by Metastorm are further tool examples that support TOGAF. However, a closer look at these tools reveals that the support of BA methodologies still leaves room for improvement. For instance, most tools do not provide a workflow capability that guides the architect automatically through the development of a business or enterprise architecture.

Service Focus

For the alignment of business and IT often the service represents the key element that connects business and IT architectures. For this reason, this section analyzes in particular the incorporation of the service concept in the introduced BAs. A particular focus is thereby laid on the conceptual models. Methodologies or tools are less discussed in this report as in the BAs no particular service orientation was recognizable.
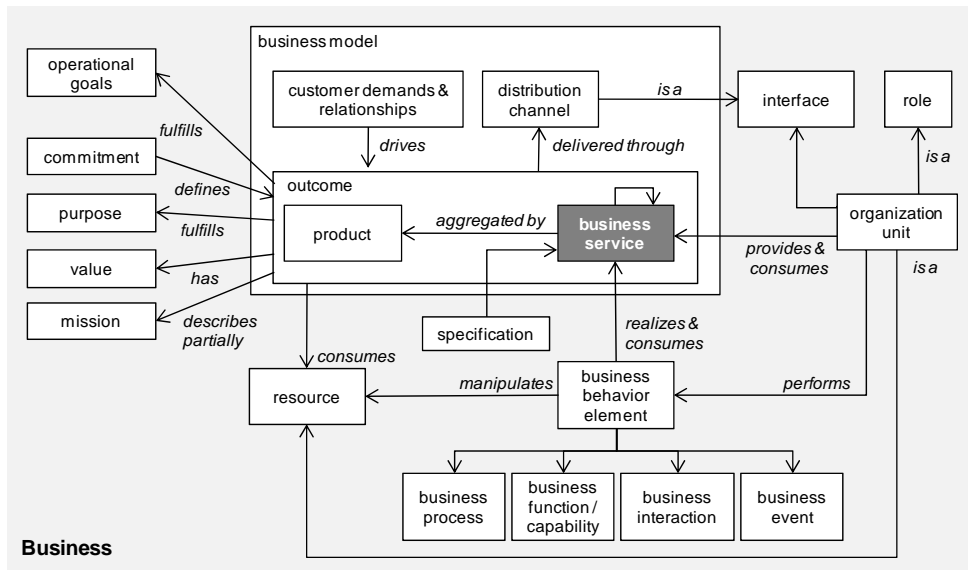

Figure 12. Integrated Service Model – Business View

To illustrate in which way the service element was represented in the conceptual models an integrated service model was developed, consisting of a business and an IT view. Figure 12 shows most service aspects of the business view, which were defined in the BAs. However, some relationships between service and other business elements were not integrated in the model as they were contradictory to parts of the conceptual model.

Following Business Architectures contribute to the business view of the integrated service model. ArchiMate provides the detailed relationship between the business service, the product, and their value. Most BAs emphasized services and product offerings being an outcome

of a business behavior. These behaviors are further specified by ArchiMate, ARIS, and BPMN. According to MS EBMM, the service is provided and consumed by the organization unit. McDavid defines more generically that the service consumes resources, e.g., capabilities of the organization unit. According to ArchiMate, the business unit is an interface and a role. Additionally, EBMM furthermore specifies that the organization unit, inheriting the characteristics from the interface, may be a distribution channel. EBMM also states that products and services are part of the business model and that they are driven by customer demands and relationships. Finally, according to BMM the business service is part of a mission statement. Inheriting from ARIS the business service can be decomposed into a service tree, whereby the 'has' relationships describes the sub-components of a service, the 'substitution' relationship defines by which other services the service can be replaced.
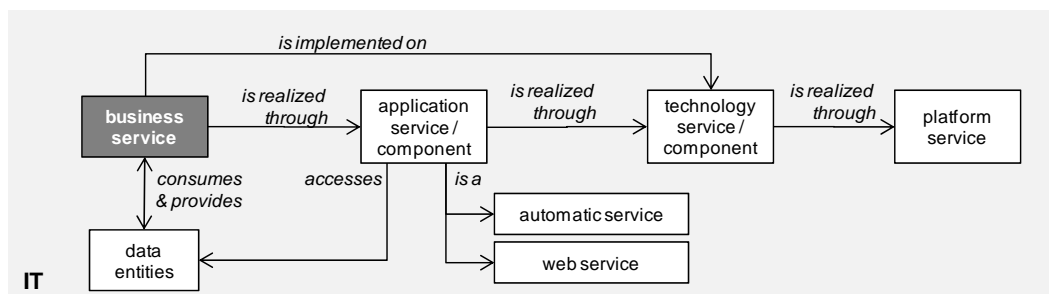

Figure 13. Integrated Service Model – IT View

As illustrated in Figure 13, the business service is often seen as a connection point to IT architectures. Both, ArchiMate and TOGAF, describe the relationship between a business service, an application service and a technology service. According to TOGAF, the business service consumes and provides data entities, which are accessed by the application service. Furthermore, the business service is directly implemented on a technology service, which again is realized through a platform service. Finally, BPMN further specifies the application service, also called service task in BPMN, as automatic or web service.

The proposed integrated service model provides a holistic view of all four business domains, as well as the integration points to the IT. Thus, it can serve as an integration model to the before introduced BA conceptual models. For instance, in a comprehensive transformation program an enterprise may choose the BMM by OMG to model the mission (which includes services) and other motivational aspects of the company. Using ARIS, the relevant business services can then be decomposed into more granular services, which then can be used with ArchiMate in order to specify the connection to the IT architecture. Similarly, other BA conceptual models can be integrated to better meet the BA purposes of a company.

Model integrations, such as the proposed integrated service model, should be used with cautious, as the simple connection of elements with the same name can lead to conflicts. For instance, unlike other Business Architectures, TOGAF differentiates specifically between a 'business function' and a 'business capability'. Thus, for the new service model the notation of this particular element needs to be newly defined. Furthermore, the combination of abstract and more concrete elements requires further specification. For instance, in the model the 'interface' is an abstract element, which can be instantiated by the more concrete element 'organization unit'. For these reasons, it is planned to evaluate the integrated service model in more depth, gaining further understanding on how it can be used for the development of real-life BA models, and how company benefit from it when applied for different BA purposes.

5. Conclusions

Current Business Architecture Frameworks differ in scope, maturity of their conceptual models and level of practical methodology to deliver value to enterprise transformation (IBM 2009a). As determined before, the more mature BA approaches address only selected sub-areas of the four business domains 'Strategy & Structure', 'Business Network', 'Operations' and 'Performance and Revenue Model'. In general, these BAs represent silos which provide only limited guidance for the integration with other BAs. On the other hand, BA approaches addressing a broader spectrum of business concerns currently lack the depth required for BA modeling in a practical context. For these reasons, when starting a business transformation initiative, which requires enterprise-wide BA models, it is essential to analyze carefully the different conceptual models with regard to how well they describe and address the specific business concerns. Additional development effort will be needed in both BA types. BAs with a broader spectrum most likely need to be defined in further detail. As the example of the integrated service model shows that the connection of several conceptual models also involves a risk of linking business elements with similar names but different notations.

Whereas, conceptual models represent the dictionary for business concerns, the methodology aims at explaining how the business sentences, i.e., the BA models, are created. Today, most BAs provide only generic guidelines and only a few explain in more detail how a BA model should be created. Consequently, more sophisticated guidelines must be established in order to improve the support provided to business architects and to reduce the ambiguity of business modeling. In particular, well-defined procedures which respect the varying requirements for BA developments in different contexts (e.g., Business Strategy and IT Strategy, BPM, or SOA) would contribute considerably to the development of BA models.

Current tools support in particular the development of BA models and less the execution of BA methodologies. However, current tools still reveal room for improvement in the support of both BA conceptual models and methodologies. For instance, guiding the business architects through a BA workflow supported by a BA modeling tool would allow to assign clearly tasks with defined goals, thus reducing potential mistakes in BA modeling and decreasing BA development times.

As identified in the previous section, the analyzed BAs incorporate the service concept to different extent. Thereby the service concept is not consistently used as the connection point between business and IT elements. This bridge will need substantial additional work if it will play a practical role in linking business and IT concerns.

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