Relationship modeling for Business Information Technology Alignment

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Abstract. The Business - Information Technology Alignment (BITA) problem is widely discussed since the beginning of Information Technology (IT) implementation and deployment for business. Mostly, the problem is discussed on top management level in an enterprise, however, lower level business units also are able to develop some reasonable solutions for their specific situations related to BITA issues. The main thesis of the paper is that the development of enterprise architecture (EA) supports the business IT alignment as well as the sustainable governance of IT in the business organization. The paper consists of three parts. At first, the paper covers discussion on the interpretation of BITA, its models and approaches, as well as its place in IT management methodologies, i.e., ITIL, and in EA frameworks, i.e., TOGAF, Zachman Framework, MODAF, and FEAF. Next, author presents the value of EA modeling for BITA. Finally, there is an application of ArchiMate language and tools for Relationship Modeling, to emphasize the alignment problems and to visualize the gaps in EA models, business strategy management, and in business units structuring. The main findings of the paper cover the proposed approach of the EA Relationship Modeling for business - IT alignment analysis.

Keywords: Business IT Alignment (BITA), Enterprise Modeling, Corporate Architecture, e-Healthcare, ArchiMate.

1 INTRODUCTION

According to Chandler [1] a business strategy is the determination of long term business objectives, the adoption of course of actions and associated allocation of resources required to achieve strategic goals. He argues that strategy management must be followed by enterprise engineering and utilization of feedback for the strategy formulation and its continuous management. The business strategy is identified with a selected way of creating an alignment between external and internal organizational resources and capabilities.

Therefore, IT strategy is a certain plan or a general direction of IT applications' development in the enterprise to achieve strategic business goals. Business strategy management life cycle covers strategy formulation, realization and evaluation. Taking into account the strategy process, practitioners should accept that thinking (i.e., strategy formulation) and action (i.e., strategy implementation) are two inseparable entities that must be well fitted, so implementation is to be a derivation of the fully formulated strategy.

Generally, the term "strategy" is derived from the Greek meaning "the art of the general". A strategy is considered as something business organization needs or uses in order to win or establish its position in a world of competition [2]. For Mintzberg and Quinn, strategy refers to a plan (i.e., rules leading to a goal), a ploy (i.e., a trick to beat competitors), a pattern (i.e., a way of behavior), a perspective (i.e., a vision to set the assumptions) and a position (i.e., a

safe place) in the business environment [3]. Strategy formulation is a version of analysis for alignment of an organization to its competitors and to other stakeholders such as customers, suppliers, investors, and the governments of the countries, within which the business organization operates. The term "collective strategy" is used by Astkey and Fombrun [4] to describe the situation in which strategy formation is the result of a process of collaboration and negotiation between separate organizations acting in partnership. Collaboration, cooperation and collective strategies include the fundamentals of alignment of the individual organizations who share among themselves their resources and competences needed to cope with a complex environment.

The approach is also applied for cooperative networks. A major strategic alignment is visible for businesses involved in the mergers and acquisitions processes [5]. Hitt et al. [6] argue that strategic alignment refers to the effective matching of strategic organizational capabilities, the opportunity to create synergy, and integration of value-enhancing activities between two or more businesses, e.g., joint R&D programs, brand names, distribution channels, advertising, and promotion campaigns. In the strategic alignment, business partners focus on the alignment of:

- objectives that are tangible and measurable to provide the base for monitoring the synergy effects and success as well as to evaluate the progress in the alignment strategy,
- activities through which the strategic alignment is achieved and presented,
- key success factors and performance indicators to monitor the strategy alignment process and its efficiency,
- organization policies, which cover rules, principles, guidelines and decisions for resolving conflicts among specific objectives.

The paper aims to emphasize that business IT alignment is present in the whole organization, at different business levels and occurs when two or more business units have similar and well fitted business processes, systems, structures, and principles.

Business and IT alignment can be evaluated in the aspect of their consistency, cohesion, and ability to be suitable and adoptable to their internal changes as well as to the changing business environment, and abilities to ensure their feasibilities. In this paper, alignment is defined as bringing into agreement, as well as close cooperation and well fitted arrangement. The next parts of the paper cover discussion on theoretical frameworks of business and IT alignment (BITA), enterprise architecture (EA) modeling for BITA, and finally the presentation of relationship modeling in EA for BITA.

2 THEORETICAL FRAMEWORKS OF BITA

According to Mekawy et al. [7] business and IT are aligned if IT applications are developed to achieve business objectives and each strategic change in business requires the appropriate re-assessment of the business-IT alignment. Models of BITA are available in literature, but they are not limited to the presented below:

- Strategic Alignment Model (SAM) based on strategic fit and functional integration. It emphasizes a distinction between the internal IT processes and infrastructures, and the external perspective of IT. There are different perspectives of alignment, i.e., strategy execution, technology transformation, competitive potential and service level,
- Integrated Architecture Framework (IAF) corresponding to support the integrated architectural design of business and IT. The IAF model enhances the SAM model by introducing the architecture of information, communication, and knowledge infrastructure. The alignment is divided into structural (i.e., architecture and capabilities alignment) and operational (i.e., processes and skills alignment).
- Luftman's Alignment Model (LAM) presenting strategic alignment as a complete holistic process, which covers not only establishing alignment but also its maturity by maximizing alignment stimulants and minimizing deterrents. LAM assumes a bottom-up approach by

setting goals, understanding the linkage between business and IT, analyzing and prioritizing gaps, specification of projects, and formulation of success criteria.

- Reich and Benbasat Model (RBM) specifying the factors related to the social dimension that can determine the alignment between business and IT objectives. The key factors included in the model are as follows: shared domain knowledge, IT implementation success, communication between business and IT executives, and connections between business and IT planning.
- Sabherwal and Chan Alignment Model (SCAM) emphasizing the business strategy contents, realized strategies, information systems and information management strategies.
- Hu Huang Alignment Model (HHAM), in which the relationship management is added as well as Balanced Scorecard approach and the RBM model for sustaining alignment. The authors prefer a top-down approach to create an effective alignment model.
- HP Information Technology Service Management (ITSM) Reference Model including the process of assessing the market for IT services, the business requirements that drive IT contribution to the corporate value chain, the customer management process enabling IT to function as a business partner with its customers, the IT strategy development that aligns customer business planning with IT business planning and supports IT to articulate a plan for achieving its goals [7], [8].

According to Frey [9] alignment is the business and IT working together to reach a common goal. The definition and the above models are too general, so they do not prescribe how alignment has to be achieved. In particular, the definitions of BITA should not be limited to the strategic level. They should also cover the alignment occurring at the tactical and operational levels. Furthermore, the social and cultural dimensions of alignment are not be omitted by the definition. It should be compatible with the requirements for alignment for effective IT project portfolio management. In that context, not only the IT strategy and the strategies of different business units involved have to be taken into account, but also communication and collaboration between business and IT leaders.

In general, the strategic alignment models provide a high-level perspective on structuring and strategy making. However, they also suggest that IT governance and BITA are interconnected. An organization with mature IT governance arrangements tends to score high on BITA and vice versa [9]. Van Grembergen and de Haes discussed the impact of enterprise governance of IT on BITA [10]. They perceive as necessary to align user orientation in IT domain with corporate mission to obtain a reasonable business contribution of IT investments as well as the mission to be the preferred supplier on the IT market with the mission to develop opportunities for future technology challenges.

Beyond that, BITA models and methods are a means of reducing complexity of a business organization. In the process of mutual alignment, the EA structures are emerging, the opportunities are revealed and the possibilities that are not relevant for the survival of the organization are sorted out.

2.1 Enterprise integration as a way of BITA

According to Lam and Shankararaman [11], enterprise integration is an activity that is business driven rather than technology driven and it coordinates business processes across different divisions of the enterprise, involves multiple stakeholders, focuses on enterprise information aggregation and supply chain optimization. The enterprise integration projects are to integrate the IT applications that reside within the organization, e.g., the integration of the warehouse computerized system with the order-management IT system. A Web integration project is concerned with integrating an organization's IT applications with Web applications to provide a Web channel. A B2B integration projects are developed for integrating an organization's IT system with those of its business stakeholders in the supply chain. The enterprise integration is supporting the connectivity of business partners, as well as the

connectivity of transformed data and metadata, and overall security and quality management. Enterprise integration is included in a systematic redesign of the information architecture within enterprises and across them, to ensure the flexibility and extensibility of the interorganizational applications [12]. Enterprise integration requires to integrate various platforms, tools and applications in different departments and areas dispersed beyond organizational borders, so to reach a certain consensus in the interorganizational value chain the business units' alignment as well as their technologies' seem to be obvious. Four stages of enterprise integration, i.e., interconnectivity, functional interoperability, semantic interoperability, optimization and innovation are subjects of value chain stakeholders' negotiations, co-designing, and implementation. In that approach BITA is extended into the interorganizational scale. Interconnectivity relies on a telecommunication infrastructure to connect the disparate equipment and applications together so that they could cooperate and exchange information through gateways. Functional interoperability implies similar functions' performance and applications' interfaces compatibility. Semantic interoperability requires sharing the same model of data among business partners [12].

2.2 BITA in IT Governance and IT Management

The IT governance objective is to align IT investments and priorities with the business strategy and business risk management [13]. The IT governance focuses on: 1) explanation of who is making decisions on IT investments and who is responsible for their realization, 2) the processes of that decision making and 3) the communication about these decisions and measuring the results [14]. Therefore, IT governance requires the integration of the business and IT people competencies for providing unified and integrated development of IT architecture, establishing IT strategic initiatives, designing information systems and IT projects portfolio management. Achieving business-IT alignment is possible through business partner relationship management. The guidelines, principles and practices for BITA support within IT governance are included in the following frameworks and standards[13]:

- OPBOK Outsourcing and Sourcing IAOP (International Association of Outsourcing) (www.iaop.org) providing knowledge concerning communication, management and integration of business strategies, leading, development of business requirements, selection of providers, negotiations, and managing the transition.
- Six Sigma Quality Management and Process Improvement, provided by International Society of Six Sigma Professionals (ISSSP) (www.isssp.com), and concerning the identification of strategic business objectives, core processes, process owners, key metrics, key performance indicators, selection of process improvement criteria, prioritization of process improvement projects, and continuous management of processes.
- PMBOK, Program, Project and Portfolio Management PMI (Project Management Institute) (www.pmi.org) postulating that portfolio, program, and project management are aligned with organizational strategies, as well as project management organization is aligned with the business objectives and the strategic needs of the organization with the organization's strategy [15].
- Amsterdam Information Management Model, provided by University of Amsterdam (www.primavera.fee.uva.nl) as a certain interpretation of the Strategic Alignment Model developed by Henderson and Venkatraman, focused on interactions and relations of strategy, structure and operations represented by the business, communication and technology components.
- Agile Manifesto (www.agilemanifesto.org) focused on ways to increase the customer satisfaction, acceptance of changing requirements, and daily cooperation between users and developers, face-to-face conversation, self-organizing teams, and adaptation to changing environments.

- BABOK, Business Analysis Body of Knowledge (www.iiba.org), as a framework for business analysts, emphasizing the necessity to align business analysis planning and monitoring, requirement management and communication, enterprise analysis, requirement analysis and elicitation, solution assessment and validation.
- COSO, Committee of Sponsoring Organizations of the Treadway Commission (www.coso.org), focused on improving organizational performance and governance through effective internal control, enterprise risk management, fraud deterrence, and compliance with the applicable laws and regulations.
- PRINCE2 as project management methodology focused on business justification, dividing the project into manageable and controllable stages, utilization of a product-based planning approach, and on alignment of project stakeholders roles and responsibilities.
- VAL IT integrated in Cobit 5, includes alignment, planning and IT management which covers strategy management, enterprise architecture, innovation, portfolios, budgets, costs, human resources, relationships, services, suppliers, quality, risk and security.
- ISO 31000 (www.iso.org) as the standard for risk management is to enable all strategic, management and operational tasks in projects and processes to be aligned to a common set of risk management objectives.
- ISO 38500:2008 (ww.iso.org) providing principles on the efficient, effective and acceptable use of IT in organizations, on responsibility in terms of demand and supply of IT, and on business strategy alignment with IT possibilities, and on conformance of IT systems with legislations.

Business-IT alignment is important because of cost, risk and compliance. It must be ensured in the whole EA life cycle and re-assessed before, during and after changes. Wegener [2007] argues that alignment requires two models, one to present the solution, and the second - the compliance. According to Sarbanes-Oxley Act (SOA), by mapping a company's process to another company, it is possible to establish a desired target state, i.e., align the processes and monitor their compliance.

Nowadays, IT management is based on the service level management (SLM), which is a holistic managerial approach covering IT and business unit perspectives. Although SLM is focused on achieving a higher return on investment in IT expenditures, it is also a way for IT analysts and users to better understand each other and to better evaluate whether their expectations can be met [17]. In SLM, the service level agreements (SLAs) and service level objectives (SLOs) are the final results of mutual alignment of IT people and business users. In general, an SLA is an agreement concerning the guarantees of a service of IT. It reveals mutual understanding and expectations on a service between the service providers and service recipients. SLA document consists of sections describing the service quality and other service features' measures that the service provider is to guarantee. Service level agreement life cycle comprises five phases, i.e., service development, negotiation and sales, implementation, execution and assessment [18]. At each of those stages, the mutual alignment of IT and business people is necessary for the final version of the service as well as for its continuous improvement for the business need succeeding.

The IT service management issues are included as best practices in the ITIL framework, which is used by business organizations to establish and improve capabilities in service management. ITIL framework consists of two main components [19]:

- the ITIL core:
  - covering the best practice guideline applicable to all types of organizations that provide services to business organizations,
  - including five publications: Service Strategy, Service Design, Service Transition, Service Operation, and Continual Service Improvement,

- the ITIL complementary guide including a complementary set of publications with guidance specific to industry sectors, organization types, operating models and technology architectures.

The ITIL core guidelines are very important for the continuous improvement of BITA and for mutual understanding of IT and business people. The IT service is the basic subject of negotiations and is considered as a means of delivering value to users by facilitating outcomes they want to achieve in their business, but without any high risks and costs [19], [20], [21]. Service strategy provides guidelines on how to design, develop and implement service management. At that stage, BITA is analyzed on top level by managers, who negotiate service assets, catalogues, life cycle, financial management and service portfolio management. The critical for BITA is Service Design, which includes co-working on specification of design principles and methods for converting strategic objectives into service assets. Beyond that, Service Design covers the necessary improvements of the service life cycle management, and the considerations on the continuity of service and its conformance to standards and regulations. The Service Transition practices increase BITA in the process of services' operationalization and preventing unexpected consequences. The Service Operation is de facto a result of mutual alignment as a process of evaluation of achieved effectiveness and efficiency in the delivery and support of services. Finally, the Continual Service Improvement is an opportunity of further maintaining the BITA through better design and implementation of services.

The IT service management embraces the concept of value co-creation, where according to Ng et al. [22], the value is not a value-in-exchange (i.e., created in transaction), but value-in-use (i.e., jointly co-created by customer and service provider for joint benefits). In the service delivery process, the customer is conceived as a service co-creator, who plays an active role in the value development process. A service delivery process is a learning process, in which new knowledge and new methods are enabled to support the cognitive practices. It is the learning by experience, which requires mutual understanding and alignment in increasing the capabilities of individuals. However, in the IT service management, the alignment is necessary among all the stakeholders, not only between the users and service providers. The alignment for service value-in-use is required among service analyst, operator, provider, tester, maintainer, controller, broker, negotiator, evaluator and top manager.

3 BITA IN EA FRAMEWORKS

Authors, i.e., Mekawy et al. [7] and Wiggers et al. [23] emphasize the strategic alignment between business strategy and IT strategy and respectively between IT strategy and information systems (IS) infrastructure and processes, as well as between organizational infrastructure and processes and information systems infrastructure and processes. Therefore, the EA modeling tools seem to be useful for the visualization of these alignments. Enterprise architecture as the discipline of designing enterprises comprises the principles, frameworks, methodologies, requirements, modeling tools, reference models, and standards. The EA goal is to design across enterprise boundaries, to develop business process for strategic benefits, to align information technology and business strategies, and to integrate the enterprise. The enterprise architecture is developed to create a unified IT environment across the firm or all of the firm's business units with links to the business side of the organization. The EA development objective is to promote alignment, standardization, reuse of existing IT assets, and the sharing of common methods for project management and software development across the organization [24]. In the EA development process, the map of IT assets and business processes is created, and the EA governance principles are set to drive a discussion about business strategy and how it can be supported by IT. The principles emphasize the EA understandability, robustness, elements' well defining, completeness, consistency and elements' stability.

In general, the EA includes the following layers:
- business layer describing all business elements, processes and structures,
- information layer for identification of the data, the data flows and interrelations necessary to support the business functions,
- systems and applications layer aimed at delivering computerized IT systems,
- technology infrastructure layer required to support the information and application layers.

Taking into account the above layers it would be valuable to specify and visualize the alignment among the layers. Therefore, at first, different enterprise architecture frameworks are analyzed in the aspect of the EA elements alignment.

3.1 TOGAF

The Open Group Architecture Framework (TOGAF) is considered to be the open standard way of working for the development of modern IT systems in enterprises. TOGAF is a formal description of a system, a detailed plan to guide its implementation. There are four architecture domains, which TOGAF is designed to support, i.e., the architecture of business, data, application and technology. For the design in each domain and for modeling the relationships among them the ArchiMate language can be applied and the Architecture Development Method (ADM) was formulated. The Preliminary Phase in that method describes the preparation and initiation activities required to create an architecture capability including the customization of TOGAF and the definition of architecture principles. Next, Architecture Vision, and Business, Information Systems and Technology Architecture models are developed. In the next phases, Opportunities and Solutions for initial implementation are analyzed, Migration Planning is realized to present the move from the Baseline to the Target Architecture, Implementation Governance is developed to provide the architectural oversight of the EA implementation, Architecture Change Management is proposed to establish the procedures for managing change to the new architecture, and finally the Requirements Management examines the process of managing architecture requirements in the ADM [25]. Eventually, the final phase is responsible for the business-IT alignment, although application of suitable modeling tools provides a big value.

3.2 Zachman Framework

The Zachman Framework (ZF) provides a basic structure for organizing a business architecture through dimensions such as data, function, network, people, time and motivation [26]. According to John Zachman, the Framework is a model or ontology for understanding and managing change in an enterprise. The approach is highly original and suitable to emphasize the BITA problems. Zachman assumes that architecture is an Actor-Network approach realization, so he describes the process of presentation of the EA components as negotiations among the actors, i.e., planner, owner, designer, builder, subcontractor and user [27]. The Zachman Enterprise Architecture Framework presents various views and aspects of the enterprise architecture in a highly structured and clear-cut form. It differentiates between the levels: Scope (contextual, planner view), Enterprise Model (Conceptual, owner view), System Model (Logical, Designer view), Technology Model (physical, builder model), Detailed Representation (out-of-context, subcontractor), Functioning Enterprise (user view). Each of these views is presented as a row in the matrix. The lower the row, the greater the degree of detail of the level represented. They all must be aligned, although each of them concerns a different view on the elements of architecture. The model works with six aspects of the enterprise architecture: Data (what), Function (how), Network (where), People (who), Time (when), Motivation (why). Each view (column) interrogates the architecture from a particular perspective. Taken together, the matrix cells create a complete picture of the enterprise. Also the six categories of enterprise architecture components inserted in columns

should be aligned one to another to construct the whole vision of architecture at each level (i.e., ZF view).

3.3 Federal Enterprise Architecture Framework

The Federal Enterprise Architecture Framework (FEAF) Practical guide elaborated by the US Federal CIO Council, the General Accounting Office and the Office of Management and Budget provides guidance for initiating, developing, using and maintaining the enterprise architecture [28]. At the initiation of the enterprise architecture program, each business unit should establish the scope of its enterprise architecture and formulate a strategy that includes the definition of a vision, objectives and principles. The FEAF framework similarly like Zachman Framework promotes the alignment of EA perspectives, i.e., perspectives of Planner, Owner, Designer, Builder and Subcontractor, as well as the alignment of different architecture aspects, i.e., Data, Application and Technology. Thanks to that, there is integration of the EA components: architecture drivers, strategic direction, current architecture, target architecture, transitional process, architectural segments, architectural models, and standards.

3.4 C4ISR

The C4ISR architecture framework is intended to ensure that architecture descriptions are interrelated between and among each organization's operational, systems, and technical architecture views, and are compatible and integrated across business organization boundaries [29]. The framework provides directions on description, design, implementation, development and acquisition systems-of-systems. According to that framework, system architecture is to identify system interfaces and define the connections between systems, so multiple systems link and interoperate. System architecture views concerns a full range of systems from sensors to processing and information systems. Particularly, operational view as the essential framework product concerns connectivity and information flow between operational nodes. The supporting product "Command Relationships Chart" is applied to present the command, control and coordination relationships among organizations. Beyond that Activity Model includes activities and relationships among them. The Systems Matrix is developed to illustrate relationships among systems in a given architecture as well as it can be designed to relationships of interest, e.g., interfaces [29].

3.5 Treasury Enterprise Architecture Framework

The Treasury Enterprise Architecture Framework (TEAF) supports business processes in terms of work products and meets the requirements of recent legislation. By grounding the architecture in the business, the TEAF defines the core business procedures and enterprise processes. Through its explicit models, a TEAF-based architecture enables the identification and reasoning of enterprise- and system-level concerns and investment decisions. The TEAF separates enterprise architecture information into Enterprise Architecture Direction (drivers, policies, program roadmap), Enterprise Architecture Description, and Enterprise Architecture Accomplishment (transition strategy, technical forecasts and insertion). The Enterprise Architecture Description is a matrix, with columns being views (functional, information, organizational, and infrastructure) and rows being perspectives (planner, owner, designer, builder) [25]. The application of matrix of views and perspectives is similar to the approaches provided in FEAF and ZF, therefore, the BITA is realized by the conformance of views as well as the perspectives, to each other.

3.6 MODAF

The Ministry of Defense Architectural Framework (MODAF) is the UK Government specification for architectural frameworks for the defense industry. The MODAF is made of 7 viewpoints [30]. The All View viewpoint is created to define the terms and concepts that are applied to all the other viewpoints. That viewpoint is to ensure the semantic interoperability. The technical viewpoint defines the standards for the five core viewpoints. The acquisition viewpoint identifies and defines projects and programmes for the whole business organization. The strategic viewpoint identifies and defines the required capabilities. The operational viewpoint analyses these capabilities and describes the operational elements required to satisfy them. The service-oriented viewpoint contains a view that allows the solution to be described in terms of its services. The system viewpoint and the service-oriented viewpoint allow potential solutions to be described that realize the operational elements and satisfy the required capabilities. In the MODAF framework, the alignment instruments hidden in these viewpoints support cohesion of the whole EA.

4 ENTERPRISE ARCHITECTURE RELATIONSHIP MODELING

Mahmood and Hill [31] explain that enterprise architecture is to align IT with the business vision. Taking into account the above frameworks, enterprise architecture is to ensure the integration of business systems, processes and data sharing, as well as the comprehensive understanding of the current state, the desired state, the interrelationships of processes, people, and technology. The organization has a bigger consistency of processes and information across business units [32]. The EA identifies opportunities for its components' reuse that prevents the development of inconsistent processes and information. By understanding an organization's architecture, you can develop a metadata dictionary to minimize data inconsistency. The EA models should ensure the traceability of business processes, data, applications, user roles and profiles as well as infrastructure.

The EA modeling refers to a systematic activity taken to describe and present abstract objects in a structured and formal way [33]. Modeling standards such as the Unified Modeling Language (UML), the Business Process Modeling Notation (BPMN), the Meta Object Facility (MOF) and the XML Metadata Interchange (XML) are supporting a whole generation of model driven tools and methods. The data language defines how IT and business work together to achieve cost and risk reduction in application construction and change management. The ArchiMate is an open and independent modeling language for enterprise architecture that is further realized by different consulting firms and vendors tools. The language and the tool allow for a detailed breakdown of the enterprise architecture elements into layers of business, application and technology, as well as for the specification of cross-layer dependencies, relationships, and alignment within the EA model. The ArchiMate language improves collaboration of system analysts, business process consultants and infrastructure engineers and is the modeling language particularly accepted in the TOGAF framework. The ArchiMate offers a structuring mechanism for architecture domains, layers, and aspects as well as concepts for specifying inter-relationships. It defines a structure of generic elements and their relationships in three different layers, i.e., business, application and technology. The relationships show how the elements in one layer are served by the services of the same and other layers. In the ArchiMate language, elements in lower layers may realize comparable elements in higher layers [34].

Beyond layers, the ArchiMate language covers three aspects:

- the Active Structure Aspect, representing the business actors, application components, and devices that display actual behavior,
- the Behavior Aspect, representing the processes, functions, events and services,

- the Passive Structure Aspect, representing the physical and information objects on which behavior is performed.

In the ArchiMate language, layers and aspects are used to visualize the enterprise architecture, however there are also motivation elements, which correspond to the "Why" column of the Zachman Framework. The motivation elements provide a context for EA modeling, therefore the EA stakeholders have an opportunity to analyze a certain justification of the EA development. The ArchiMate 3.0 language version was extended and covers the Implementation and Migration (IM) elements, i.e., work package, deliverables, implementation events, relatively stable state of architecture known as plateau, and gaps between plateaus. The IM elements support the project portfolio management, while the problems of those elements' alignment is also discussed by the enterprise architects.

The ArchiMate language specified the generic relationships, connecting a predefined set of source and target concepts within a layer. The generic relationships are structural, dependency, dynamic and other. Structural relationships represent the static composition and nesting within architecture. Dynamic relationships present temporal dependencies among the architecture elements, e.g., the data flow or the triggering representing a control flow between elements. However, beyond the exemplified above inter-layer relationships, a central issue in EA is business-IT alignment, which is visualized by cross-layer dependencies. In the ArchiMate 3.0 there are two types of cross-layer relationships:

- serving relationships, representing the behavioral and structural aspects of the support of the business by applications and by technology infrastructure,
- realization relationships, indicating that data object is a digital representation of the corresponding business object, or the technology object is a physical representation of the business object.

In the presented in Figure 1 Architecture Model, the e-Healthcare system is organized into some basic layers:

- BUSINESS containing following elements: actor (i.e., Patient), role (i.e., Knowledge Broker), process (i.e., e-Healthcare Consultation Process covering 17 subprocesses), service (i.e., e-healthcare Service Information Browsing, e-Healthcare Service Conceptualization, e-Healthcare Service Knowledge Component Registration, e-Healthcare Service Knowledge Components' Catalogue, e-Healthcare Service Knowledge Components' Management). In the paper, the e-healthcare knowledge management is component-oriented. Therefore, each service consists of some knowledge components, which are designed, constructed and selected to provide optimal advice to patients and their guardians. The knowledge components can be further designed as learning objects for education of end users and for their community considered as organization of learning good medical practices.
- APPLICATION covering elements such as Financial Application, Knowledge Component Management System, Portal to External Sources of Knowledge (e.g. libraries, journals, document repositories), Service Management System, Knowledge Broker-Patient Relation System, e-Healthcare Service Politics and Regulations, Risk Evaluation, IT Support.
- TECHNOLOGY including elements such as Data Server, Application Server.
- MOTIVATION containing the following elements: drivers (i.e., e-Healthcare Consultation Needs), principles (i.e., e-Healthcare Knowledge Development Principles), assessment (i.e., e-Healthcare Consultation Evaluation), goals (i.e., Patient Satisfaction, Reduction of F2F contacts with patients), requirements (i.e., Patient e-Healthcare Requests), stakeholders (i.e., Patient, System Developer, System Architect, Patient Guardian, Public Healthcare Manager), constraints covering Legal Issues of Patient Access to Healthcare Knowledge, Legalization Issues of Knowledge Brokering, Personal Data Security Control.

In the e-Healthcare System modeling the following relationships were used to visualize the BITA problems:

- The relationship "association" is used to model relationships between business objects or data objects. For example, within the same layer, the element "stakeholder" e.g., patient is connected with the element "driver", e.g., e-Healthcare consultation need. Within two layers, Motivation layer element "requirement" i.e., e-Patient Healthcare Request is connected with the Business layer element "business service" i.e., e-Healthcare Information Browsing,
- The relationship "used by" models the use of services by processes, functions, or interactions and the access to interfaces by roles, components, or collaborations. For example the element "Service" i.e., e-Healthcare Information Browsing is used by the element "Business Role" i.e., e-Healthcare Recipient.
- The relationship "realization" connects a logical entity with a more concrete entity that realizes it. For example, a business process or function may realize a service. In Figure 1, the process e-Healthcare Service Registration realizes the service e-Healthcare Knowledge Component Registration.
- The relationship "triggering" is applied to describe the temporal or causal relations between business processes, functions, interactions, and events. For example, the sub-processes in e-Healthcare Consultation Process are included in a causal chain.

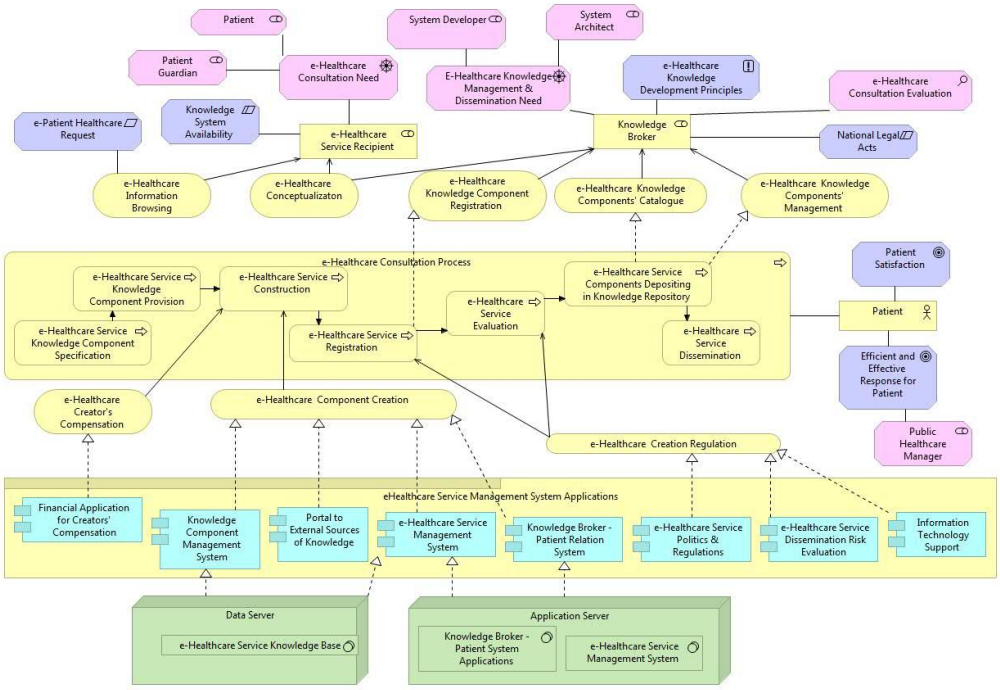

Fig. 1. e-Healthcare Architecture Model.

5 CONCLUSION AND FUTURE WORK

The business - IT alignment is considered as top managers problem, however, the methods of solving the issues are derived from different areas of practice and research. The various approaches are developed to cope with the problem at all organizational levels. Maybe it would be reasonable to accept the BITA problem as a matter of the whole organization and then it would be solved in different way on each of the organizational levels. Taking into

account the EA layers, the alignment issues are considered inside layers as well as among them. In these analyses, it would be necessary to focus on the relationships between the enterprise ontology elements. The alignment issues should be revealed during the enterprise architecture development process and widely discussed among the EA stakeholders. The visualization of the intra- and inter-layer relationship is helpful, although there is a request of constant improvement of the language used for the visualization.
The ArchiMate 3.0 language includes the elements which are needed for general modeling of enterprise architecture. That version is still not satisfactory for many users, who must complement the visualization and add the supplementary descriptive documents, particularly explaining the business-IT connections. However, the ArchiMate language is open and still under development and it also offers an opportunity to provide additional information by application of profiling mechanism.

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Biography

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