Motivation-oriented Architecture Modelling for e-Healthcare Prosumption

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Abstract

The enterprise architecture (EA) is a coherent and consistent set of principles and rules that guide system design. In EA modelling methods, an enterprise is identified with institution, business or administrative unit, a firm or an industrialized region. Enterprise architecture is also considered as strategic information assets, which determine the business mission, the technology necessary to perform the mission, the transitional processes for implementing new technologies in response to the changing mission needs. In this paper, the human i.e., stakeholders' roles are emphasized as well as the motivation orientation in the enterprise architecture development is discussed. The following questions are formulated: who is the stakeholder of the EA, who is accountable and responsible for EA development, and what goals, constraints, and values are realized in the stakeholder activities' processes for the organization mission and vision by example of e-healthcare prosumption system.
Keywords: enterprise architecture, stakeholder, motivation, ArchiMate, e-healthcare, prosumption .

1. Introduction

The term "enterprise" can be interpreted as an overall concept to identify a company, business organization or governmental institution. According to Robins, an enterprise is considered as a coordinated social entity, with a relatively identifiable boundary and functions to achieve certain goals [14]. In enterprise engineering, system theory and system approach have dominated for the last fifty years, however, now the enterprise engineering is underpinned by two fundamental concepts:

- enterprise ontology, whereby the complexity of an enterprise is captured and understood by focusing on the implementation-independent essence of an enterprise [5, 11];
- enterprise architecture, which reduces the complexity of enterprise by addressing strategy objectives and areas of concern.

The ISO/IEC 42010: 2007 shows that an 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. The goal of EA is to create a unified information communication technology (ICT) environment across the firm or all of the firm's business units with links to the business side of the organization, to promote alignment, standardization, reuse of existing IT assets, and the sharing of common methods for project management and software development across the organization. The EA provides a holistic expression of the enterprise's strategies and their impact on business functions and processes, taking the firm's sourcing goals into consideration.

The paper aims to emphasize EA stakeholders' activities, their motivations, goals, constraints and values. The first part of the paper covers discussion on stakeholders' positions in the EA models. The second part is provided to present characteristics of the stakeholders. In the third part, conceptualization of e-healthcare prosumption model is included. Finally, the stakeholders and their motivations are formulated by example of e-healthcare prosumption architecture model.

2. Enterprise Architecture Frameworks Analysis in the Stakeholder Aspect

In this paper, the EA is considered as a bridge between strategy and design, and it is a creative application of scientific principles to develop business organization and to forecast its behaviour under specific operating conditions. There are many frameworks that support EA modelling and development, e.g. Zachman Framework (ZF), The Open Group Architecture Framework (TOGAF), Generic Enterprise Reference Architecture and Methodology (GERAM), Purdue Enterprise Reference Architecture (PERA), Computer Integrated Manufacturing Open System Architecture (CIMOSA), Lightweight Enterprise Architecture (LEA), Nolan Norton Framework (NNF), Extended Enterprise Architecture Framework (E2AF), Enterprise Architecture Planning (EAP), Federal Enterprise Architecture Framework (FEAF), Treasury Enterprise Architecture Framework (TEAF) [4, 16, 18, 22]. Mostly, the mentioned above frameworks are product-oriented, and some of them (i.e., ZF, FEAF, CIMOSA, MODAF, SEAM, CSAM) emphasize the role of stakeholders in the EA development processes.

The ZF provides a basic structure for organizing business architecture through dimensions such as data, function, network, people, time and motivation [26]. Zachman describes the ontology for the creation of EA through negotiations among several actors. The ZF presents various views and aspects of the EA 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), and Functioning Enterprise (user view). Each of these views is presented as a row in the matrix (Table 1).

Table 1. The Zachman Enterprise Architecture Framework.

	DATA What?	**FUNCTION How?**	**NETWORK Where?**	**PEOPLE Who?**	**TIME When?**	**MOTIVATION Why?**
SCOPE planner	Business Things	Business Processes	Locations	Business Units	Events/ Cycles	Business Strategies
ENTERPRISE owner	Semantic Model	Business Process Model	Business Logistics	Work Flow Model	Master Schedule	Business Plan
SYSTEM designer	Logical Data Model	Application Architecture	Distributed System	Human Interface	Processing Structure	Business Rules
TECHNOLOGY builder	Physical Data Model	System Design	Technology Architecture	Presentation Architecture	Control Structure	Rule Design
OUT-OF-CONTEXT Subcontractor	Data Definition	Program	Network Architecture	Security Architecture	Timing Definition	Rule Specification
ENTERPISE User	Data	Function	Network	Organization	Schedule	Strategy

Source of the Zachman Framework: [18]

The lower the row, the greater the degree of detail of the level represented. The model works with six aspects of the EA: Data (what), Function (how), Network (where), People (who), Time (when), Motivation (why). Each view (i.e., column) interrogates the architecture from a particular perspective. Taken together, all the views create a complete picture of the enterprise.

The Compaq Services Architecture Methodology (CSAM) is a methodology complimentary to Zachman's approach as it focuses on design decisions and not only on describing what exists on each level. The key issue is an understanding of the needs of all involved stakeholders. The CSAM method recommends using different discipline-specific theories (e.g., Porter's value chain approach) for consideration of web of goals, principles, and obstacles [7].

The Federal Enterprise Architecture Framework (FEAF) promotes interoperability and sharing of information among USA governmental agencies [1]. The FEAF components of the enterprise architecture are as follows: architecture drivers, strategic direction, current architecture, target architecture, transitional processes, architectural segments, architectural models, and standards. The FEAF is to support establishing the scope of the enterprise architecture similarly as it is in the Zachman Framework. The FEAF method also accepts the actor-oriented approach, including Planner, Owner, Designer, Builder, and Subcontractor Perspective and demanding analysis of Data, Application and Technology Architecture from that five viewpoints. So, the holistic model of EA is the result of negotiations and compromises among different stakeholders.

Table 2. The Federal Enterprise Architecture Framework.

	Data Architecture	**Application Architecture**	**Technology Architecture**
Planner Perspective	List of Business Objects	List of Business Processes	List of Business Locations
Owner Perspective	Semantic Model	Business Process Model	Business Logistics System
Designer Perspective	Logical Data Model	Application Architecture	System Geographic Deployment Architecture
Builder Perspective	Physical Data Model	Systems Design	Technology Architecture
Subcontractor Perspective	Data Dictionary	Programs	Network Architecture

Source of FEAF: [10]

The Command, Control, Computers, Communications (C4), Intelligence, Surveillance, and Reconnaissance (ISR) architecture framework covers three views [19]. The operational view describes and integrates the operational elements, tasks, activities, and information flows required to accomplish mission operations. The system view describes systems and their performance to the operational view. The technical view describes the minimal set of rules governing the arrangement and interdependencies of system components. The framework aims to ensure that the architecture is a description, from different perspectives, of the integrated, interoperable and cost effective capabilities in the field.

The Treasury Enterprise Architecture Framework (TEAF) provides guidance and template for development and evolution of information systems architecture. The TEAF's functional, information and organizational architecture views allow for modelling the organization's processes and business operations. The enterprise architecture description is a matrix, with columns being views (functional, information, organizational and infrastructure) and rows being perspectives (planner, owner, designer, and builder). The matrix supports the realization of the transition strategy to new environment and establishing sustainability of the enterprise and its architecture [4].

The principles of the Dynamic Architecture (DYA) model assume that enterprise architecture aims to achieve coherence and cohesion. Architecture investments have a chance to be approved, if they are an integral part of the investments necessary to attain important business objectives. By providing a clear insight into the relationships between various architectural objects (processes, information, applications) and various architectural levels (strategic, tactical and operational) within an organization, the transparent relationships are defined and the risk of uncontrolled growth of noncompliant solutions is reduced [24].

The Ministry of Defence Architectural Framework (MODAF) is the UK Government specification for architectural framework for the defence industry. The framework consists of seven viewpoints, i.e., acquisition, strategies, operational, system, service-oriented, technical

and All View viewpoint [13]. These viewpoints are interrelated and integrated to ensure long-term balance of EA components and further improvements within the assumed scopes.

The Computer Integrated Manufacturing Open System Architecture (CIMOSA) is assumed to produce a formal, executable model that may be used to simulate an enterprise [19]. The CIMOSA framework emphasizes the necessity to transfer the executable model from the enterprise engineering environment to the operational environment. The use of two separate environments supports the implementation of parallel and concurrent processes of the EA development. The CIMOSA modelling framework is based on four abstract views (function, information, resource, and organization views) and three modelling levels (requirements definition, design specification, and implementation description). The four modelling views are provided to manage the integrated enterprise model [21]. For the management of views, a hierarchy of business units grouped into divisions is assumed. According to the CIMOSA guidelines, enterprise integration is a continuous process, which requires that enterprise modelling activities should be realized simultaneously with the normal operation of the enterprise.

The Systemic Enterprise Architecture Methodology (SEAM) refers to the seamless integration between business and ICT. The SEAM paradigm include the SEAM philosophy, the SEAM method and prototypes of computer aided design (CAD) tools. The systemic philosophy is composed of the epistemology defining "what is knowledge", the ontology determining "what exists" and the ethics defining "what is right or correct". The last one captures the fundamental business and social values of the enterprise [24].

In The Open Group Architecture Framework (TOGAF) architecture has two meanings:

- a formal description of a system, or a detailed plan of the system at component level to guide its implementation;
- the structure of components, their inter-relationships, the principles and guidelines governing their design and evolution over time [8].

There are four architecture domains:

- the business architecture that defines the business strategy, governance, organization and key business processes;
- the data architecture that describes the structure of an organization's logical and physical data assets and data management resources;
- the application architecture that provides a scheme of the individual application, their interactions and their relations to the core business processes;
- the technology architecture that describes the logical software and hardware capabilities that are required to support the deployment of business, data and application services.

In TOGAF approach, the stakeholders are people who have key roles in, or concerns about the system, for example as users, developers, or managers. Different stakeholders with different roles in the system will have different concerns. Stakeholders can be individuals, teams or organizations. Concerns are the key interests that are crucially important to the stakeholders in the system, and determine the acceptability of the system. The problems of stakeholders are widely analysed in TOGAF modelling methodology. The Business Architecture Views address the concerns of users, planners, and business managers, and focus on the functional aspects of the system from the perspective of users of the system. The People view focuses on the human resource aspects of the system. The Business Process view deals with the user processes involved in the system. And the Business Function View deals with the functions required to support the processes.

The ArchiMate language is used to support the TOGAF modelling and as a language defines three main layers that need to be address by the business and IT system within the organization. The business layer offers products and services to external customers, which are realized in the organization by business processes performed by business actors. The application layer supports the business layer with application services which are realized by software applications. The technology layer offers infrastructure services (e.g. processing, storage, and communication services) needed to run applications, realized by computer and

communication hardware and system software. The primary focus of ArchiMate language is to support stakeholders to address concerns regarding their business and the ICT systems.

The motivational aspects in ArchiMate language correspond to the "Why" column of the Zachman framework. The Motivation extension of ArchiMate language adds the motivational concepts such as stakeholder, driver, assessment, goal, principle, constraint and requirement [9]. The motivational element is defined as an element that provides the context or reason lying behind the architecture of an enterprise. Stakeholders represent groups of people or organizations that influence, guide, or constrain the enterprise. A stakeholder's concern represents a key interest that is crucially important to certain stakeholders in a system and determines the acceptability of the system. A concern may pertain to any aspect of the system functioning, development, or operation, including considerations such as performance, reliability, security, distribution and evolvability. Drivers represent internal or external factors which influence the plans and aims of an enterprise. An understanding of strengths, weaknesses, opportunities, and threats in relation to that drivers is necessary for the plans development. An example of an external drive is a change in regulation or compliance rules, which require change in the way an organization works, e.g., Sarbanes-Oxley in the US. An assessment represents the outcome of the analysis of some problems. The assessment is a stimulant of a change to the enterprise architecture, which is addressed by defining new business goals. A goal represents some effects that a stakeholder wants to achieve. It is a high level statement of intent or direction for an organization typically used to measure its success. The measure is an indicator or factor that can be tracked, usually on an ongoing basis, to determine success or alignment with objectives and goals. Principle is a qualitative statement of intent that should be met by the architecture. Requirement is also a qualitative statement, but of a business need that must be met by a particular architecture or work package. A work package is identified with a set of actions distinguished to achieve one or more objectives for the business. A work package can be a part of a project, a complete project or a program. Constraint is understood as an external factor that prevents an organization from pursuing particular approaches to meet its goal. Vicente at al., applied the ArchiMate language to manage a business plan for ICT management in an organized manner and according to ITIL guidelines [23].

3. Stakeholder Theory

Stakeholder theory is important in science in the aspect of project management, business process and architecture models development. Stakeholders are groups and individuals who have a stake in the success or failure of a business. They are people, for whom the value is created, who are beneficiaries of the EA development decision, and whose rights are enabled. According to Freeman et al., [12] that theory should focus on the stakeholder relationships and on the jointness of stakeholder interests rather than solely on the trade-off that sometimes has to be met. The libertarian stakeholder theory has its roots in libertarian political theory, covering libertarian principles of personal freedom, voluntary association, and individual responsibility, the stakeholder theory is fundamentally about how we understand value creation and trade for profit maximization. The principles are as follows:

- stakeholder cooperation jointly satisfies each other's needs through voluntary agreements;
- stakeholder responsibility is based on the agreements for their actions;
- human beings have a multitude of motivations and values;
- people use organizations as a vehicle for constantly searching for new ways of creating value;
- competition and co-opetition are secondary effects, not primary drivers, in a context of cooperative schemes devoted to value creation in a free society.

Within the stakeholder community, value can be created, traded and sustained because they all can jointly satisfy their needs and desires by making voluntary agreements with each other that for the most part are kept. Almost each business organization involves customers,

suppliers, communities, employees, experts, ICT people, financiers, media, and public administration institutions. Recognition of the role of a multitude of stakeholders in the value-creation process diminishes the problem of the dominant group, they are engaged in creating many win-win situations [3]. A stake is usually understood as an interest, concern or a share in an understanding. They are mutually affected by the actions, decisions, policies and practices of the business firm. The perceived validity and appropriateness of a stakeholder's claim to a stake is defined as the stakeholder legitimacy. Therefore, owners, employees, and customers represent a high degree of legitimacy due to their explicit, formal relationships with a company. Stakeholders who are more distant from the organization might be thought to have less legitimacy. Power and urgency are two other characteristics of stakeholders. Power refers to the ability to produce an effect. Urgency is the degree to which the stakeholder claim on the business calls for the business's immediate attention or response [3]. Stakeholders are assumed to be the source of goals and constraints of the project. Sometimes however, the stakeholders are not aware of the problem nor of the need for a treatment. In other cases, they are aware of an improvement possibility or necessity, but they are not interested in carrying out the improvement. Or the stakeholders are aware of the improvement opportunity and desire it. Then the discussion on the feasibilities is started and economic, organizational, technical, legal feasibilities are considered for the stakeholder request fulfilment. System architecture is a process by which stakeholder needs and concerns are captured, an architecture to meet the need is designed and clearly described via an architectural description [20]. The architect is responsible for designing, documenting and leading the construction of a system that meets the needs of all its stakeholders. Therefore, it is needed to identify and engage the stakeholders, understand and capture the stakeholders' concerns, create and take ownership of the definition of an architecture into a physical product or system, involve stakeholders in the decision making processes, maintain their involvement, and review their contributions [17].

4. e-Healthcare Prosumption

From patients' perspective, culture is a powerful force that shapes their motivations, life styles and healthcare service choice, therefore the e-healthcare prosumption is strongly based on the local traditions. When developing international websites, e-healthcare institutions can achieve significant gains and cost reductions if they are able to centralize important care processes. A centralized global content management system enables e-healthcare knowledge provider to create, manage, publish and archive information in various formats and languages for use in many countries. Beyond that, a centralized system and workflows automate collaboration between important stakeholders in the web globalization process, such as project managers, translators, reviewers, experts, knowledge brokers and patients' guardians. A centralized web globalization team can be empowered (i.e., legitimated), responsible and accountable for the seamless integration of the web globalization workflows and coordination with regional and local communities. The centralized team could be needed to serve local teams in support of healthcare terminology management, healthcare evidence management, submitted information monitoring, intellectual property rights controlling, trainings, tools sharing, technology provision and maintenance, and quality assurance.

The basic premises of e-healthcare prosumption cover the development of technology supporting care at home, usage of in-house monitoring devices, enhancement of self-care for chronic disease management and post-acute monitoring. However, technology alone is not the key issue. Therefore, ICT must be incorporated into a care management program personalized to an individual's needs. The patient-physician relationship system with more virtual interactions is needed to better coordinate care. e-Healthcare prosumption is identified with healthcare self-serviceability of Internet users, i.e., patients and their assistants, in a manner that empowers them to independently meet their own needs. Therefore, there is a need of an architectural framework that establishes that ICT must be engaged for a service, and concerns data analysis, data sourcing, data cleansing, and data integration.

Generally, healthcare is an extremely important, but complex and costly activity, because of its telemedicine infrastructure, and the human and physical resources it requires. These costs are continually increasing as public expectations for healthcare rise, diseases such as cancer and mental illnesses are more prevalent, and demographics shift towards an aging population which require on average more frequent and longer periods of care [2]. The integration of digital information and exploitation of new technologies are having a significant impact on healthcare delivery and improving quality of life, while minimizing costs of the service. Many people prefer to discuss their problems with online advisors rather than immediately calling out their local doctor. Self-diagnosis has changed and recent advances in technology have enabled a vast range of more high-tech and affordable self-diagnosis tests to be available on the Internet as well as a huge number of more closely regulated products from street pharmacists. Internet pharmacies are gaining online, but some of their remedies may cause side effects, so self-medication can have serious consequences.

However, the potential benefits of e-healthcare prosumption are as follows:

- less face-to-face (F2F) contacts with physicians;
- a general culture shift to interact more through technology and new media;
- reduced waiting time because patients are not coming in as often;
- early avoidance of medical problems as self-diagnosis and self-testing are quicker;
- enabling the social networking to support assistance for surviving;
- reaching a wider geographically dispersed group that may not be able to, or want to meet physicians F2F.

e-Healthcare prosumption system should include questions and answers (Q&A) with medical professionals, as well as patient-to-patient communication. Moderation of social networking is important to ensure appropriate content and safeguarding vulnerable people. Therefore, e-healthcare prosumption system should cover two complimentary subsystems:

- patient interactions and online experiences sharing under control of authority, i.e., knowledge brokers;
- offering clinical support in terms of Q&A sessions with health professionals and access to information resources.

There are some risks connected with the e-healthcare prosumption system:

- elaboration of the system content requires heavy input of medical knowledge;
- online safety and protection of website knowledge against destruction;
- losing contact with people who might be vulnerable, but will not ask for help;
- limited access to the mobile devices i.e., smart phones, wearable sensors;
- inappropriateness of the e-healthcare system for people with learning difficulties, brain tumours, memory problems or who are vulnerable;
- time required for development and verification of content for the forums is sometimes too long.

In the healthcare sector, knowledge brokering has been increasingly analyzed, because of the social needs to enhance the performance of health policies and care. Knowledge brokering process covers recognition, acquisition, assimilation, transformation and exploitation or application of new knowledge [15]. Knowledge brokering has been recently enhanced through the use of Web platforms, i.e., websites, Facebook, blogs, Twitter, newsletters, wikis, YouTube, LinkedIn, podcasts, chatting, RSS feeds. In social networks, a knowledge broker could be responsible for mobilization of the stakeholders interested in the knowledge production and the use of knowledge.

In the aspect of validity, the patients and their guardians need the computerized access to the three types of knowledge:

- knowledge concerning incidents and problems, which are the results of insufficient learning or weaknesses of e-healthcare application. The problems MUST BE solved by medicine experts;
- questions, which answers are delivered by an expert or possibly by a user with the help of experts. The answers of the questions SHOULD BE received and the further works on e-healthcare system development and extension are necessary;

- suggestions provided by users as the result of their own experiences, wisdom and practices. Suggestions COULD BE further surveyed, analysed and discussed with a body of experts, presented in the form of case studies, and explained for the end user.

In the aspect of knowledge source, the e-healthcare knowledge can be differentiated between knowledge about the patients, knowledge from the patients, and knowledge for the patient. Knowledge about the patient comprises information about socio-demographic characteristics, their habits, health status, style of life and work, personal needs, abilities and illnesses as the results of analyses, interviews and observations. Knowledge from the patient mostly arrives in a direct way. The patient informs the physician about his health problems, illnesses and delivers basic health status parameters, e.g. blood pressure. That knowledge is gathered in diagnosis process through testing and self-testing, hospital and home monitoring or self-monitoring. When the patient shares his knowledge with another patient or physician, the last one is able to identify a possible knowledge gap and to further develop patient's knowledge to fulfil the "non-knowledge" space. The knowledge for the patients encourages them to self-monitor and recuperate.

5. e-Healthcare Prosumption Architecture Modelling

In this paper, a system architecture is to fulfil the goal of alignment ICT related activities with the stakeholders' goals. There are the following types of stakeholders:

- stakeholders, whose concerns address the consistency of the overall architecture of e-healthcare prosumption system or the strategic direction to follow in accordance with the political goals of e-healthcare prosumption, i.e., governmental agencies, healthcare associations, which accomplish these goals through the delivery of educational programs and knowledge for patients in a partnership with other health related organizations, academic institutions, government, technology community and standards bodies;
- stakeholders, who are the recipients of knowledge provided for patients in the knowledge supply process in the e-healthcare prosumption system. Basically, they are patients, their family members, health care assistants, friends, physicians and other healthcare personnel, or even anonymous Internet reviewers;
- stakeholders, who are involved during an ICT project to build or change a system, these are the project sponsors, the solution architects, knowledge brokers, healthcare process analysts, and project leaders;
- stakeholders that are charged with strategic planning, decision making, e.g., Chief Information Officer (CIO), Chief Security Officer (CSO), medical experts, knowledge engineers;
- stakeholders that are responsible for the controlling of how efficiently ICT is used in an enterprise. This is typically an internal or external auditor.

Stakeholders of the e-healthcare prosumption system contribute to the three kinds of architecture (i.e., Business, Application and Technology Infrastructure) in one consistent way. An end user may want to change the information requirement, if technology (i.e., wearable monitoring devices) does not constrain what can be achieved, or an architect may need to reconsider a design if new non-functional requirements arise. Architects in each of the architectural areas also influence each other's decisions. Software architects designing for software reliability need the design support of system architects as well as of knowledge brokers and end users.

The knowledge based e-healthcare prosumption system development relies not only on system developer research aims and epistemological stance, but also on organizational, historical, cultural evidence and personal factors, which are not problems to be solved, but factors that must be included in practical research design. For e-healthcare prosumption architecture modelling, the ArchiMate language is applied to emphasize the stakeholders in a suitable manner to support business agility (see Figure 1). The ArchiMate as a modelling standard published by the Open Group is now linked to the evolution of TOGAF and is

currently evolving to fit TOGAF more closely. This approach should also include the context and the healthcare creativity of users.

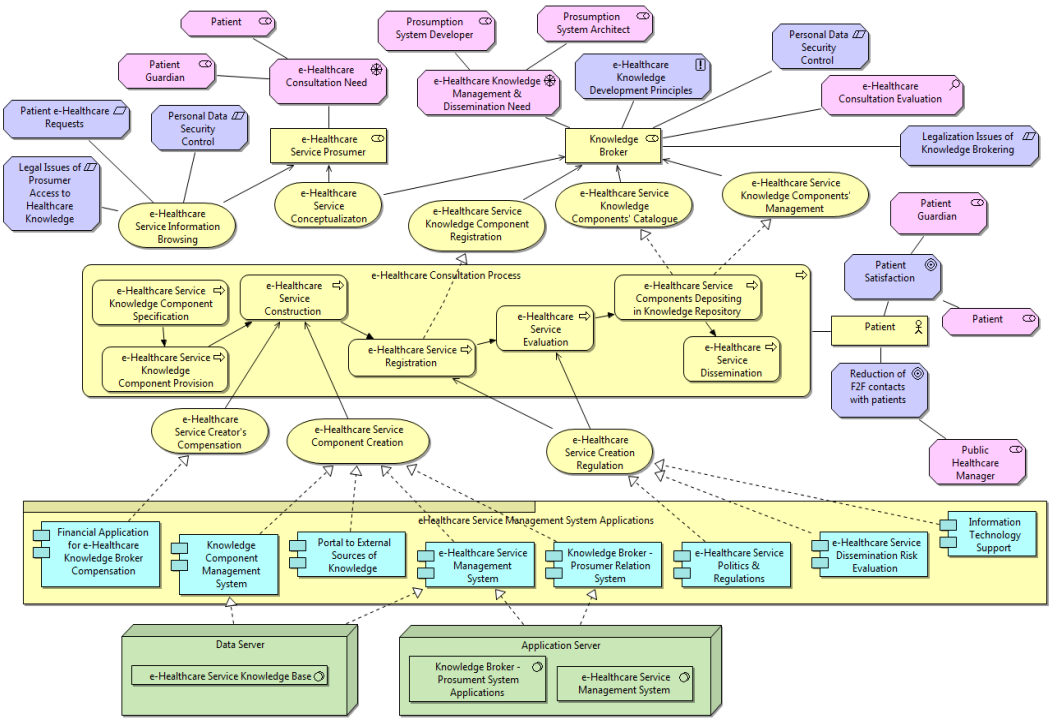

Fig. 1. e-Healthcare Prosumption Architecture Model.

A system architecture model in ArchiMate is organized into some basic layers:

- BUSINESS containing following elements: actor (i.e., Patient), role (i.e., e-Healthcare Service Prosumer, 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-e-Healthcare Requests), stakeholders (i.e., Patient, Prosumption System Developer, Prosumption System Architect, Patient Guardian, Public Healthcare Manager), constraints covering Legal Issues of Prosumer Access to Healthcare Knowledge, Legalization Issues of Knowledge Brokering, Personal Data Security Control.

The e-healthcare prosumption system stakeholders realize activities, which can be integrated and consolidated in the RACI model. The "RACI" acronym is developed as follows:

- RESPONSIBLE: refers to the person who must ensure that activities are completed successfully;
- ACCOUNTABLE: refers to the person or group, who has the authority to approve or accept the execution of an activity
- CONSULTED: refers to the people whose opinions are sought on an activity (two-way communication)
- INFORMED: refers to the people who are kept up to date on the progress of an activity (one-way communication) [6].

Table 3. RACI Chart for e-Healthcare Prosumption Stakeholders.

Key Management Practices	PG	HA	MS	II	SG	KB	ISD	ITA	PHM
e-Healthcare Strategic Planning	I	C	C	R	A	C	R	R	C
Understanding e-Healthcare Knowledge Brokering	C	C	C	R	C	A	R	R	C
e-Healthcare Prosumption Vision Development	R	A	C	C	C	R	I	I	C
The Cultural Environment Capabilities & Performance	A	A	R	R	C	R	R	A	C
The Target IT Capabilities Development	C	C	C	R	A	C	A	A	C
The ICT Investment Development & Project Planning	R	R	R	A	A	R	R	C	C

Proposed in Table 3 e-healthcare prosumption organizational structure covers the most important stakeholders, i.e., Patients and their Guardians (PG), Healthcare Associations (HA), Medical Staff (MS), Institutional Investors (II), State Government (SG), Knowledge Brokers (KB), Information Systems Developers (ISD), Information Communication Technology Architects (ICTA), Public Healthcare Managers (PHM). Their activities are further precisely specified and verified in particular projects. It should be noticed that particularly important role of e-healthcare prosumption development belongs to governmental agencies , healthcare associations, and ICT Architects to ensure that prosumption systems will be developed under control of professionals. End users, i.e., e-healthcare prosumers, patients and their guardians (PG) will be the most important beneficiaries of the system and the recipients of distributed knowledge. The quality of e-healthcare knowledge provided online should be ensured and verified by knowledge brokers (KB), information systems developers (ISD), ICT architects (ICTA), and medical staff (MS), however, the consultative roles of prosumers cannot be excluded.

ArchiMate as an architecture modelling tool seems to be appropriate for the visualization of EA stakeholders. Other architecture modelling tools, e.g., Enterprise Architecture Modelio focus on information modelling and specification of an enterprise ontology. They are suitable for applications and system design in UML and BPMN languages. The ArchiMate Canvas Model allows to catch intangible requirements and emphasize the stakeholders' place in the system architecture (Figure 4). Presented in Figure 4 e-Healthcare Prosumption Architecture Canvas Model includes specified: Key Partnerships, Key Activities, Key Resources, Value Propositions, Customer Relationships, Customer Segments, Channels for Communication, Cost Structure, and Revenue Streams. This specification allows to consider e-Healthcare Prosumption System as a project, or a program. Studying the Canvas Model enables analysing the most important functionalities and non-functional requirements of the proposed system architecture. The Canvas Model permits for consideration of the stakeholder relationships,

however the motivations of their behaviour are not clearly visible in ArchiMate diagrams. The determined list of value propositions can be identified with the list of concerns for the EA motivation modelling and analyses.

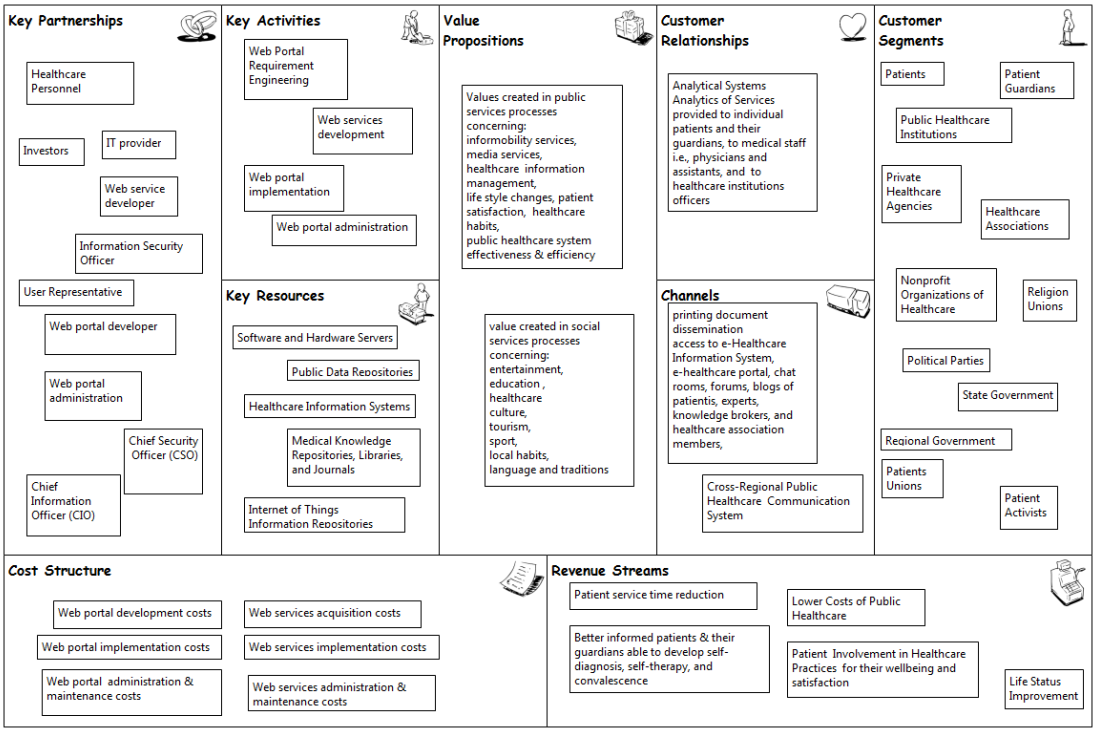

Fig. 2. e-Healthcare Prosumption Architecture Canvas Model.

6. Conclusions

The paper concerns the system architecture stakeholders as active as well as passive partners, who are involved in the process of EA products development. The reviewed in the paper enterprise architecture frameworks focus mostly on the enterprise methodology and stakeholder aspects are omitted. Therefore, the development of stakeholder oriented architecture framework and methodology is still a challenge. Some good works have been done by the Open Group, therefore the e-healthcare prosumption architecture model was done in ArchiMate language. The proposed architecture model is developed to emphasize the stakeholder position as well as an important proposal that could be further realized. The EA stakeholders are individuals, groups, or organizations who may affect, be affected by, or perceive themselves to be affected by a decision, activity, or outcome of a project. Within the community of stakeholders for e-healthcare prosumption system architecture development a particularly important role belongs to the knowledge brokers. Further research works should focus on designing tasks for them as well as on the development of learning objects for healthcare knowledge management.

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