

Zachman Framework Enterprise Modelling of the Estonian National Health Information System

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Abstract

The desire by various societies, organizations and countries of the world to ensure a much better healthy status and systems has led to the development of information systems. Many a time, these systems have been treated as individual entities rather than as an enterprise resulting in a lack of clear cut goals and definition of what these systems are meant to do. The Zachman Framework is a good modeling tool to identify the purpose, goals and components of any enterprise. The framework has successfully modeled the Estonian National Health Information System leading to the identification of the Estonian government, healthcare institutions, Estonian insurance fund, information technology specialist and industries, citizens and legal residents among the many stakeholders of the national health information system. Existing relationships among these stakeholders, the many different data and service functions provided by health information systems were also identified

Keywords: Estonia, health information system, Zachman, health system modeling, ehealth

1. Introduction

A system is a network of interdependent components that work together to accomplish the aim of the system. (Deming, 1986). A common denominator of a system is that all the interconnected components gives rise to a superior property or characteristics which often do not belong to any individual component making up the system. These superior characteristics could be a principle, rule, standard, assumption, doctrine, function or relationship. Moreover, these "characteristics" can be molded into an application, a service, product line or an enterprise which are used in various spheres of life including healthcare.

According to World Health Organization (WHO 2007), healthcare system consists of all organizations, people and actions whose primary intent is to promote, restore or maintain health. This includes efforts to influence determinants of health as well as more direct health-improving activities.

The desire by various societies, organizations and countries of the world to ensure a much better healthy status and systems has led to the development of information systems which are the software and hardware systems that people and organizations use to collect, filter, process, create, and distribute knowledge and data.

According to World Health Organization, health information system provides the underpinnings for decision-making and has four key functions: data generation, compilation, analysis and synthesis, and communication and use. The health information system collects data from the health sector and other relevant sectors, analyses the data and ensures their overall quality, relevance and timeliness, and converts data into information for health-related decision-making (WHO 2008).

A country that has been in the fore front of pursuing these ideas vigorously is one of the Baltic tigers. Estonia has developed a system called Estonian National Health Information System (ENHIS), a nationwide framework (database) that facilitates the exchange of health information for all stakeholders within the health system which were formally available only in local databases and information systems that often are not able to communicate with each other. (Aaviksoo 2005). The goal is to have a shift from institution-centered to patient-centered health information system available across the country. Aaviksoo also noted that the ENHIS functions include centrally ordering and filling of electronic prescription, appointment booking, providers' cost reimbursement and reporting, collection of national health and vital statistics and links to all health registries.

Many countries, societies and organizations in healthcare have been coming up with many information system, however, a lot of problems abound. Are clear system frameworks developed? Does this framework identify the main stakeholders and the data and service functions including the relationship that exist among them?

This study aim to review and develop a model of the Estonian NHIS based on the Zachman's framework, identify all the various stakeholders, data and service functions and explore the relationship between these identified targets.

2. The Zachman Framework

The Zachman (2003) framework is a logical structure intended to provide a comprehensive representation of an information technology enterprise. It allows for multiple perspectives and categorization of business artifacts. It has a structure (or framework) independent of the tools and methods used in any particular IT business.

The framework defines how perspectives are related according to certain rules or abstractions. These perspectives takes a tabular 6 by 6 cell with six rows (scope, business model, system model, technology model, components, and working system) and six columns (who, what, when, where, why, and how)

3. Estonian Health Information System Modeling with Zachman

The Estonian NHIS model based on the Zachman Framework is expressed by the 6 by 6 matrix. A diagrammatic representation of the model developed is shown in figure 1.

3.1 The Scope

The scope establishes the universe of discourse (Zachman, 2003). The Estonian government facilitated a shift from institution-centered to patient-centered health information system available across the country. To achieve this, the data (list of things) that were gathered included personal information of all Estonian citizens and legal residents, information technology and communication systems, and money was made available to run the enterprise.

The processes (how) included putting up some legislation and regulations as the backbone of the project. Such laws included the 2002 regulation of the Minister of Social Affairs, the Health Information Act 2008 and establishment of organization and management infrastructure-the Estonian eHealth Foundation in 2005 to facilitate its operation (www.e-tervis.ee, Aaviksoo 2005).

The Estonian NHIS network has a total coverage (network) of the whole country and the people (who) involved in the scope included the government which is represented by the ministry of social affairs, healthcare bodies such as the Estonian Medical Association, Estonian Hospital associations, family doctors, Estonian insurance fund, various service providers as well as the individual citizens of the country.

Severally stakeholders meeting were carried out with the aim that this system should be available at any time and immediately accessible. This was a significant event and timing in the life cycle of the system.

The overall motivation for the project was to facilitate the exchange of health information for all stakeholders within the health system, production of standardized medical documents, digital registration, prescription and image database. (Tiik, 2012)

3.2 Business Process

Zachman states that the business process is the descriptive representations reflecting the usage characteristics of the end product (Zachman, 2003).

For the Estonian NHIS, the semantic model of the business process (data) included shared clinical information across all institution and providers. It is the whole business entity and shows the relationship of the model.

The functional approach of the business model (how) is a shared communication via information communication technology (ICT) where content related standardization, technical standardization, development of central system services, ICT partnership, testings' and services acceptance are put in place as reflected by Zachman (2003).

The business logic (network) to ensure linkages of the Estonian NHIS is based on the public IT infrastructure of the government called the X-road. X-road is the backbone of e-Estonia. It's the invisible yet crucial environment that allows the nation's various e-services databases, both in the public and private sector, to link up and operate in harmony (Aaviksoo 2005). It has developed into a tool that can also write to multiple databases, transmit large data sets and perform searches across several databases. The model ensures that only authorized individual or organizations have access to the system allowing a good work flow model with a schedule time of immediate use and relationship/need based usage.

The overall objective (motivation) is to ensure compliance, smooth and operational flow of the national health information system.

3.3 System Model

This is the logical reflection of a system enterprise especially from the designers. For the Estonian NHIS, the engineers are logically looking at relevant data like clinical information access, security and privacy, exchange of information, storage and retrieval. Underlying relationships are also looked at such as the input-output user views. A basic underlying factor of the system model is how “informed consent” of the owner of the clinical information is received, its authentication processes and data encryption.

The architecture of the ENHIS makes use of several databases. These databases include Health Information Systems (HIS) of various institutions in Estonia, Electronic Health Records (EHR), Picture Archiving and Communication Systems (PACS) which are distributed across the country in different places. Data are stored and processed from these databases.

The system models different people by showing who is doing what and in what capacity. This human interface architecture includes patients/citizens of Estonia and legal residents (who have access to his/her record), health institution professionals (physicians, nurses etc.) and the roles or work based deliverables characteristics – “*attending physician*”. The processing structure must be such that there is interoperability among the various units of the ENHIS at any time.

The motivation is to have a co-ordinated structurally functioning system without impediment.

3.4 The Technology

Technology represents the capacity to apply technical opinion for creating an enterprise.

The ENHIS system model is based on the usage of messages (carrier of information) in the form of softwares, brokers, agents and servers. The system makes use of HL7, DBMS Oracle-road security, Advanced Security, Database Vault, web Methods Broker etc. These softwares carry data (function, set and elements) in the various databases. A unique identifier code for access to the system and audit purpose is used by the people.

The motivation is to technologically achieve sending of messages between institutions, validation, authorization, and document processing and database operations.

3.5 Detailed Representation

The detailed representation of the Estonian NHIS enterprise is the use of shared services through messaging of healthcare information and given of access rights to people who would have to use technological advanced digital identification methods on the health information systems.

The motivation is to ensure ease of work.

3.6 The Functioning Enterprise

The detailed representation of the Estonian NHIS enterprise is the use of shared services through messaging of healthcare information and given of access rights to people who would have to use technological advanced digital identification methods on the health information systems.

The motivation is to ensure ease of work.

4. Estonian NHIS Stakeholders, Data and Service Functions

The Zachman framework has shown that the different parts of the enterprise i.e. the Estonian National Health Information System (ENHIS) can be identified. The different stakeholders include;

- (a) The government of Estonia which provides all basic political, economic and policy framework
- (b) Various healthcare institutions-hospitals, family doctors, specialist, general practitioner (GP).
- (c) Insurance company-Estonian Insurance Fund
- (d) ICT service providers who design and maintain the systems
- (e) Legal Practitioners

(f) Estonian Citizens and legal resident

The Estonian NHIS has many service functions including improvement of business processes, enhancing application development; a basis for monitoring and audit, creation of robust databases and network management. Furthermore, there is the opportunity to develop secondary areas of ehealth based on the health information system data and an avenue to add value added services. These data has legal backing, its privacy and security has been ensured, validated, and non-repudiated and has a high level of integrity.

5. Conclusion

The Zachman Framework is a good modeling tool to identify the purpose, goals and components of any enterprise. It is a guiding light for policy makers, information technology industry, healthcare professionals and the citizen in the healthcare domain especially in this century of health 2.0

References

- Ain Aaviksoo. "National Health Information System". Health Policy Monitor, October 2005. <http://www.hpm.org/survey/ee/a6/3/>
- Deming, W. Edwards (1986). *Out of the Crisis*. MIT Press Pg. 32
- Health Metrics Network. Framework and standards for country health information systems. Geneva, World Health Organization, 2008 (<http://www.healthmetricsnetwork.org>, accessed 1 April 2010)
- John A.Zachman, "The Zachman Framework: A Primer for Enterprise Engineering and Manufacturing." Published by Zachman Framework Associates.2003.
- Madis Tiik "Access Rights and Organizational Management in Implementation of Estonian Electronic Health Record System", *Phd Thesis*, Tallinn University of Technology December 2012. <http://digi.lib.ttu.ee/i/?813>
- World Health Organization, "Everybody business: strengthening health systems to improve health outcomes", WHO's framework for action 2007
www.e-tervis.ee/

Figure 1: Estonia Health Information System Model Based on Zachman Framework

	Data (What)	Function (How)	Network (where)	People (who)	Time (when)	Motivation (why)
Scope	Citizen Information Finance ICT systems	Legislation Regulations	Entire Country	Government Service providers Citizen Insurance company	Immediately when needed	HIE
Business Model	Shared clinical information	Shared communication via ICT	X-road	Authorized Personnel	Immediate usage, Need based	Smooth operation flow
System Model	Clinical information access Security. Privacy Storage Retrieval	Consent Authentication Encryption	HIS PACS EHRs	Citizens Health Professional (attending relationship)	Work Deliverables at any time	functioning system without impediment
Technology Model	Messages	Processing and integration	HL7 DBMS ORACLE X-road	Unique identifier codes	Work deliverables (audit)	Validation
Detailed Representation	Shared services	Messaging Data sharing User Rights Monitoring Surveillance	EHR	People(ID- card, mobile ID, Digi ID)	Need based relationship	Ease of work
Functioning Enterprise	HIS(data)	ID cards	PACs, EHRs	Citizens , health professional	Work	A robust system of storage, communica- tion and usage

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