

# ENSURING HIGH VALUE NATIONAL E-HEALTH SOLUTIONS USING THE BUSINESS VALUE OF IT

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**Abstract** This paper provides insights from a pilot study which is part of a larger longitudinal research project focused on assessing the value of different national digital health solutions. In this study, the focus is on Australia's My Health Record and the German e-Health Card. The adopted methodology is a multi-case qualitative approach which enables deeper insights to be uncovered. Data collection is from multiple sources including semi-structured interviews, surveys and the analysis of key documents. An initial model for assessing the value of the digital health solution is presented and findings are analyzed against this model to provide recommendations and understand critical success factors for designing, developing and deploying national digital health solutions.

**Keywords:**

value based care, business value in IT, My Health record, German eHealth card.

## 1 Introduction

Healthcare systems in all OECD countries are undergoing several challenges due to an ageing population, longer life expectancy and the rapid rise of chronic diseases, leading to increasing cost pressure and rising consumer expectations as well as poor patient reported outcomes (Bloomrosen and Detmer 2010; Institute of Medicine, 2001). While the use of technology to increase efficiency and transparency in organisations has been widely accepted worldwide and transformed operations in many sectors, e.g., commerce, finance or education, in health care it has been slow to date; however, now the need for technological support is becoming even more prominent in health care.

Information and communication technology (ICT) is seen as an enabler of new healthcare delivery models (Wickramasinghe and Schaffer 2010). The evolution of ICT in the healthcare industry has led to what is called e-health. The World Health Organization (2003) notes that e-health enables the leveraging of the information and communication technology to connect providers and patients and governments; to educate and inform healthcare professionals, managers and consumers; to stimulate innovation in care delivery and health system management; and to improve our healthcare system.

At this time, most OECD countries are facing similar pressures including cost pressures, COVID-19, increasing and aging population and the rise of chronic conditions. To address these challenges, they are all looking to national digital health solutions but are tackling the design, development and even deployment of these solutions very differently (Eigner et al, 2019). Moreover, even initiatives that have been established for some time eg the German e-Health Card, still struggle to support and bring together individual approaches and solutions into a national, integrated eHealth system (ibid).

Thus, it becomes essential to evaluate the business value of these solutions and identify areas for improvement as well as opportunities for more investment and advancement. The problem that faces the endeavor to study the impact of e-health solutions is apparently their complexity. In order to avoid this, we use the model of BVIT (Haddad et al., 2014) which is briefly explained before reviewing the terms “value” and “business value” in the healthcare context and thus we answer the

research question how can we assess the business value of national e-Health solutions.

## **2 Value in Health Care**

Porter and Teisberg (2006) define value, as a concept, as the output achieved relative to the cost incurred, suggesting that measuring value is essential to understanding the performance of any organization and driving continuous improvement. Value in healthcare can also be defined as the patient health outcomes achieved per dollar spent. Determining value and measuring it, though, depend on the perspective one uses, i.e., from a patient's perspective, healthcare values include the healthcare outcomes, quality, the safety of the delivery process, and the services associated with the delivery process. From a society perspective, benefits might include the availability of healthy and productive people who contribute to society in many ways (Porter and Teisberg 2006).

Healthcare commentary often revolves around universal availability and cost control, i.e., access and cost. People are not likely to want the lowest cost; the central issue should really be the creation of a healthcare system that provides the highest value (Rouse and Cortese 2010).

## **3 The Business Value of IT in Health Care**

Business value of IT (BVIT) is commonly used to refer to the impact of IT on the organisational performance (Melville et al 2004). Defining the organisational performance in healthcare is different from it in other industries (Haddad et. al 2014). Cost reduction, profitability improvement, productivity enhancement, competitive advantage and inventory reduction are a number of performance measurements in other industries (Melville et al 2004). This is not the case in the healthcare industry, where organisational performance extends well beyond that to cover patient outcomes and healthcare quality (Haddad et. al 2014).

The impact of IT in health care has long been studied. Most of the current studies on this share same limitations in common: 1) looking at IT as a whole, without objectively classifying them according to agreed standards, and 2) limited scope, i.e., the impact of specific IT system on a specific outcome.

This research serves to address this gap by proposing a framework that conceptualizes the business value of IT in healthcare. This framework was designed and has been tested elsewhere (ibid). For the purpose of this paper, we will test the mapping between our framework and the national e-health initiative in Australia; namely the My Health Record. The following section summarizes the main features of this model.

#### 4 The Conceptual Model of Business Value of IT

In order to develop a framework to evaluate the business value of IT, we first needed to classify IT systems according to their business objectives. This is the heart of the theory of IT Portfolio by Broadbent et al.(1999) who classified IT investments into four categories: Infrastructural, Transactional, Informational, and Strategic. Each of these IT systems has distinctive business objectives and different industries adopt them to different levels according to their actual needs. At the same time, we recognised the need of socio-technical aspects when studying the healthcare industry. This is obtained from the works of Rouse and Cortese (2010) that looked at the healthcare delivery from a socio-technical perspective, and divided it into four layers: the healthcare ecosystem, the system structure, the delivery operations, and clinical practices. We designed our framework by combining these two theories/frameworks together, and by performing a rigorous literature review to divide these components to build more detailed structures as Figure 1 depicts.

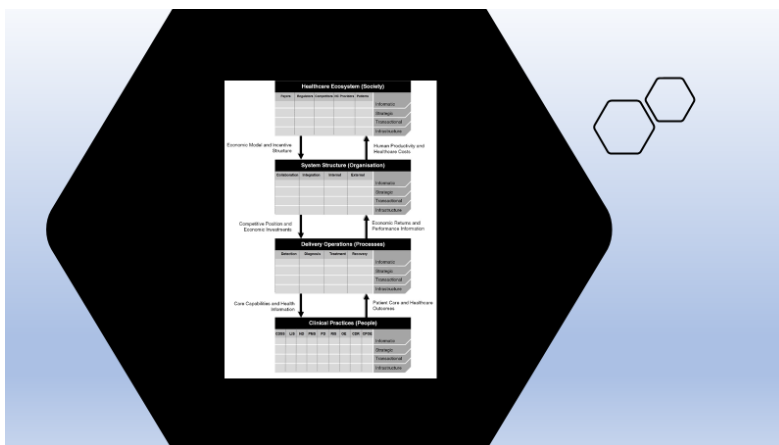


Figure 1: The Model of Business Value of IT in Health Care

## **5 Health Care in Australia and Germany**

Both Australia and Germany provide private and government health insurance; i.e., they support a two-tier healthcare system (Eigner et al, 2019). The two-tier health insurance model in Australia is complementary (Eigner et al., 2019). This is because the public and private insurance can be taken together i.e., it is not one or the other (ibid). This contrasts with substitutive two-tier models such as the one in Germany in which one may only have one type of insurance, with a few exceptions (ibid). It is interesting to note that the majority of the population is publicly insured in both instances (ibid). Germany spends slightly more on healthcare at approximately 11.1% of GDP as compared to Australia's 9.3% (OECD, 2015; Eigner et al, 2019). Further, both countries also enjoy some of the top rates in life expectancy and quality of care (WHO Global Observatory for eHealth, 2016; Eigner et al., 2019). Finally both systems have adopted a diagnosis related grouping modelling (Eigner et al., 2019). Thus for the purposes of this study the two national e-health solutions are assessed with respect to their business value.

## **6 My Health Record**

Like all OECD countries, the Australian healthcare system is confronting major healthcare funding and delivery challenges. A further challenge relates to the fact that, even though the healthcare system in Australia has been considered highly ranked internationally because of high life expectancy and low infant mortality (Heslop 2010; Armstrong et al. 2007), this ranking is now under strain as the system is hard-pressed by an ageing population, increased prevalence of chronic disease and its burden on healthcare service, and outdated infrastructure and organisation models of healthcare delivery (Armstrong et al. 2007). In addition, healthcare inequalities also persist in Australia and the gap of service accessibility between rich and poor is widening markedly (Duckett & Willcox 2011). To address the aforementioned challenges, the Australian government decided to introduce a national e-health solution. The terminology adopted in Australia for electronic record keeping and its e-health solution is known as My Health Record (previously the Personally Controlled Electronic Health Record) which sits between an individually controlled health record and a healthcare provider health record (DoHA 2011). Thus, My Health Record has a shared use and mixed governance model (DoHA 2011).

As we can see from the preceding overview, My Health Record is a patient-centric system where technology is going to be implemented in a complex clinical and organisational environment and users are going to include a different set of stakeholders including healthcare service providers, healthcare managers, government bodies, healthcare pressure groups and most importantly patients. Further, My Health Record is a patient centric system and is a model for essentially engaging patients in their healthcare and empowering them in this undertaking. It utilizes advances in technology most notably that of web 2.0 which makes it possible to engage users by providing them interactive user interfaces.

### **6.1 The Evolution of My Health Record**

In Australia, work on a nationally coordinated electronic health record was initiated in 1993 with the creation of National Health Information Agreement (NHIA). The primary function of NHIA was to develop a strategy and tools for better coordination between the Australian government and State and Territory governments for the collection and exchange of healthcare data and information (Bartlett, et al., 2008; NHHRC,2009). The establishment of the National Health Information Management Advisory Council (NHIMAC) resulted and occurred in 1998. A subcommittee of NHIMAC under the name of The National Electronic Health Records Task Force in 1999 in response to the House of Representatives “Health On-Line” Report was also established (Bartlett et al., 2008; Slipper & Forrest, 1997).

In 2008 (Deloitte a consulting firm was engaged to prepare a blueprint for the national strategy of eHealth development and deployment project. In 2009, the Federal government, with all State and Territory governments, announced the introduction of Health Identifiers and later in 2010 the introduction of the Health Identifiers Act to strengthen their position on the e-Health approach. Later with a budget of \$AUD446.7 million dollars, the government has successfully achieved the goal of having Healthcare Identifiers (HI) services for all Australians by July 2012. The HI service includes 16-digit reference numbers for consumers and is known as the Individual Healthcare Identifier (IHI), Healthcare Providers Identifier-Individual (HPI-I) as well as Healthcare Provider Identifier-Organisation (HPI-O). This service will be common for all e-Health services like e-pathology, e-discharge summaries, e-referrals and e-medication management as well as personally

Controlled Electronic Health Record. The e-health system has now commenced and patients can be registered and they can obtain their health identifier from Medicare.

## **7 The German eHealth Card**

Until 2004, Germany offered a basic health insurance card (KVK) providing minimum information about a patient's personal and insurance information as a credential for patients to claim health services. Due to limitations in storage and applications of this insurance card, the modernization act by the statutory health insurance in January 2004 proposed the extension of the insurance card to the electronic health card (EHC), which was finally implemented in early 2006. The goal behind the EHC was to provide health service providers access to patient information through IT to increase treatment quality, control health service processes and quality for medical treatments (GKV Spitzenverband, 2015a,b).

Since January 1st, 2015, the "Electronic Health Card (EHC)" has been mandatory credentialed in Germany to claim services covered by the health insurance (Eigner et al., 2019). The social act §291a (SGB) details the full list of required and optional information (ibid). Data security, a very sensitive and key issue follows a two-key-principle: this is essentially a public key – private key infrastructure (ibid). Although many features are yet to be implemented, the EHC is designed to include electronic patient records, medical reports, care records and medication records in the future (ibid). Table 1 presents the key aspects around interoperability, research development and uptake (European Commission, 2012; Eigner et al., 2019).

**Table 1: Key aspects around interoperability, research development and uptake**

<b>Interoperability</b>	<b>Research Development</b>	<b>Uptake and Deployment</b>
fostering EU-wide standards, interoperability testing and certification	build initiatives related to patient-centred, individual health management, as well as promote research on personal medicines	improving the education and skills of patients and health professionals
integration of processes for cross-border eHealth	develop a competitive eHealth market	guaranteeing free legal advice for business start-ups in the field of electronic health care
clarifying areas where there is legal uncertainty		measuring the added value
		International cooperation

## 8 User access and accessibility

To date, the eHealth acceptance rate in Germany has been hugely disappointing with a below-average increase on an EU level of 31 percent since 2007 (Eigner et al., 2019). This is particularly troubling given that over 97 percent of the insured population is now provided with an EHC (GKV Spitzenverband, 2015a; Eigner et al., 2019). Hence, a key priority moving forward is to address low acceptance.

## 9 Technology and infrastructure

Germany is a leading country in technology development considering financial and human resources devoted to research and development (R&D) as well as patents granted per capita (Florida et al., 2011). In health care, Germany currently ranks high considering the quality of care, access to healthcare services, efficiency and equity as well as expenditure per capita. Especially access to healthcare shows above-average results in international comparisons. Space for improvement is still found in the area of coordinated care, which constitutes a major issue to be solved by eHealth (Davis et al., 2014).



## 10 Key Challenges

The EHC was implemented in 2006 yet still issues around an integrated, accessible and data security compliant infrastructure for telemedical services is still not solved (Eigner et al, 2019). Through many regional projects, this challenge has tried to be addressed but as yet no suitable solution has been achieved (Dietzel, 200; Eigner et al., 2019). In addition other challenges are connected with a lack of IT standards in the healthcare sector and missing secure networks (Eigner et al., 2019). Further, lack of investments coupled with issues around liability and security also have led to massive delays (ibid).

## 11 Method

In order to assess the business value of these national e-health solutions, a combination of methods to collect data in a predominantly qualitative study is adopted. After securing the necessary ethics approvals, first a series of semi-structured interviews with the respective key stakeholders is conducted. In addition, a systematic review for archival records, documents and online recourses was maintained during the research project. This included published academic papers, reports, and grey literature such as, web blogs, and newspapers.

Table 2 summarizes the methods used in this study.

**Table 2: The Research Design for the Purpose of this Paper**

<b>Data collection technique</b>	<b>Data Source</b>
Semi-Structured interviews	Key stakeholders
Service Provider Qualitative Survey	GPs, specialist doctors, nurses, etc.
User group Qualitative Survey	citizens
Archival Records and Documents/On-line and Newspaper reports	Published academic papers, reports, web blogs and newspapers

**12 Findings**

Stage one of the analysis included an examination of the components of My Health Record and mapping them to the model of BVIT. These consisted of a combination of the basic technologies of unique identification, authentication and encryption to facilitate safe and secure method of healthcare information exchange. Mapping this comprehensive system to the IT Portfolio showed that My Health Record is mainly an informational IT system with supporting infrastructural and transactional components as well as strategic vision to transform the healthcare delivery structures in Australia. From a socio-technical perspective, My Health Record covers all components of the healthcare delivery structure in Australia. This covers the health ecosystem, health organisations, delivery operations and clinical processes. Table 3 depicts the mapping between My Health Record and the model of BVIT.

**Table 3: Mapping to the Model of BVIT**

	<b>Component</b>	<b>My Health Record</b>	<b>E-Health Card</b>
IT Portfolio	<i>Infrastructural</i>	Utilizes the Internet for information sharing. In so doing, the shared network is distributed amongst all uses. It also uses a wide range of supporting infrastructural	This is a chip card system which requires a dedicated infrastructure in clinics, doctors' offices and pharmacists to read
	<i>Transactional</i>	Enables patients to digitize their own health records.	Requires a public and private key system to initiate and perform transactions.
	<i>Informational</i>	The core functionality of My Health Record is to facilitate the exchange of digitized medical information between different stakeholders on an agreeable basis. This is facilitated by integrating patients' records entered via a dedicated web-based portal (called Consumer Portal) and the national eHealth record system. The national eHealth record system itself has a mutual information sharing structures with other different health providers.	Patient data , insurance data and medical data are stored

	<i>Strategic</i>	My Health Record could have a strategic nature, in terms of its role in transforming the shape of healthcare delivery in Australia. This is not the case all the time, as national e-health initiatives are now common around the world with increasing numbers of countries adopting these systems.	When the full features are implemented, then there will be e-prescribing and integration of health data to create complete health information record of the person is captured.
Healthcare Delivery	<i>Healthcare Ecosystem</i>	Patients	Patients are the central point
		Payers	The respective governments
		Regulators	The respective governments.
		Providers	Healthcare providers benefit from the system through having access to patients' records, and the ability to write on patients' records based on agreements with their patients (Consumers).
		Competitors	These are both unique systems tailored to suit the respective healthcare structures for care delivery
	<i>System structure</i>	My Health Record is designed to sit between an individually controlled health record and a healthcare provider via a shared governance model.	A chip card system designed to be convenient for all stakeholders
<i>Delivery Operations</i>	It is hoped that using the system will improve healthcare outcomes and lead to greater efficiency and effectiveness of care delivery and fewer errors	It is hoped that using the system will improve healthcare outcomes and lead to greater efficiency and effectiveness of care delivery and fewer errors	
<i>Clinical Practices</i>	My Health Record is designed to present information captured from different systems to healthcare consumers and their authorized healthcare professionals according to the shared responsibilities and mixed governance model (Leslie 2011; Haddad and Wickramasinghe 2014).	The e-health card does place an extra set up burden for clinicians as they must ensure they have correct card readers installed in their offices	

The way the two distinct solutions, My Health record and the e-Health Card, are structured makes them patient-centric systems. In theory, this gives the consumer (patient) a better position in shaping their care. This is vital in the light of the way healthcare is delivered to patients. One interviewee, who works closely on building better connections between patients and health providers, noted that patients normally don't have the opportunity to discuss the type of care they receive: *"we had a very long journey from where we are to where we need to be, understanding what the patient wants to get out of their visit. What product did they want? We decide on their behalf what they're going to get, largely. Even in the sittings where we discuss what they want, we don't document what they want"*. It can deliver the benefit of giving the patient *"more control of who has access to their information and they can add their own bits of comments to explain their condition in details"* as another interviewee noted. It is also anticipated that the My Health Record will assist to ensure better equality of quality of care; a point of concern raised in the Duckett report (Duckett, 2018)

The value of any IT system cannot be realised if it is not used. In order to leverage the highest potential of My health Record, 74% of the users believed incentives for the users should be introduced to start adopting the system, and 68% said that there must be an alignment between the system values and patients' values. The system must be easy to use and intuitive for 60% of the users to use the system.

### **13 Discussion and Conclusion**

Analyses of different data collected during this research shows that My Health Record and the e-Health Card, respectively, can be classified as an informational IT system in the terminology of the theory of IT Portfolio by Weill and Broadbent (1998). According to this theory, this system, as an informational IT system, should be capable to increase control over clinical information and healthcare delivery, facilitate better information sharing between different stakeholders across the spectrum of the Australian health care, create better integration between different layers of healthcare delivery, and improve healthcare quality. The collected data demonstrate that both systems still have a long way to go before their full potential can be realised. In order to do so, a number of technological, organisational, and human requirements should be met. Once these requirements are met, the systems will have respectively better likelihood to deliver more value for different players in the web of the healthcare ecosystems for which they are supporting. The promised

values include continuity of care, less fragmented, safer, and more efficient healthcare system.

From another dimension, the results demonstrate the flexible and comprehensive nature of the model of BVIT. As sophisticated IT systems can be mapped with a large number of technological and socio-technical components to the layers of this model; this indicates that the model of BVIT is capable to be used to evaluate the business value of eHealth initiatives and programs globally according to their unique circumstances. The findings in this research extend the range and reach of the theory of IT Portfolio well beyond its current scope, which allows it to cover the complex industry of healthcare. This is enabled by adopting a socio-technical perspective when looking at the healthcare delivery, which in turn was adopted from the works of Rouse and Cortese (2010). Thus, this research examines the validity of their framework of Healthcare Delivery. According to our results, this framework seems valid and comprehensive to cover the healthcare ecosystem, the structure of healthcare organisations, the delivery operations, and the clinical practices. By their very own nature, informational IT systems are of high risk, as realising their business value is not always an easy undertaking (Weill and Broadbent 1998). From this point of view, this research has spotted a number of points that must be addressed in order to achieve the promised business value of the respective solutions. This is of high importance practically, as different players in the healthcare system share, to different levels, the same objective: having better patient outcomes by having an efficient, cost-effective, and prudent healthcare system. In conclusion, My Health Record and the e-Health Card, as informational IT systems that leverage different IT systems, have the potential to generate business value by: 1) reducing fragmentation, 2) better engaging patients in their care, 3) enhancing patient safety, and 4) increasing the efficiency of different operations in the healthcare delivery. All these promised values are subject to technological, organisational, and human requirements highlighted in this research and the subject of our follow-up studies.

As noted, this paper proffers an initial model for assessing the value of national digital health solutions. Its focus has been to identify the key elements that must be considered. Evaluation of such solutions also necessitates a discussion around “from whose perspective” given that many of the key stakeholders in healthcare have orthogonal goals; eg, payers want to minimise cost while patients want maximum quality. A logical approach to addressing this dilemma is to develop

a weighted average in modelling the value and this will serve to form the focus of future research. In addition, it is noted that as this is an initial model no cost benefit analysis has been embarked upon, again as the intent of this study is to first identify the key elements, future work will then focus on drilling down and identifying suitable cost benefit scenarios to include. Given this is one of the first studies of this kind, it was essential to take time and care in identifying the key components for such a model.

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