BOTTOM-UP OR TOP-DOWN? A COMPARATIVE ANALYSIS OF ELECTRONIC HEALTH RECORD DIFFUSION IN IRELAND AND ISRAEL

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Abstract

Purpose: The limited success of Electronic Health Records (EHRs) implementation in the healthcare services in general, and a national EHR in particular, requires better understand and documentation of the current drivers and inhibitors of EHR adoption, together with a definition of a national EHR.

Design/methodology/approach: Factors affecting EHR adoptions were elicited from extant literature and the stakeholder/actor framework is used as the theoretical framework. The multiple case study approach has been used as the research method, and data has been collected in Ireland and Israel by interviews and analysed using text coding methods.

Findings: Factors elicited in the literature were generally corroborated, yet the salient factor on the localized perspective appears to be the degree of centralisation of the healthcare services; while different factors affected the national perspective. In summary, it seems that Israel is more ready for national EHR implementation than Ireland due to the high level of computerization and high levels of integration of primary and secondary care patient data.

Research implications and value: Contribution to research is in the definition of a national EHR, the illustration of various levels of analysis and their relative impacts on EHR adoption, the analysis framework, and by showing that EHR adoption is a top-down, change management process.
Practical implications: EHR adoption should be driven by a powerful actor in the healthcare sector addressing the need for a high level of integration within and between care levels, while focusing on clinicians’ requirements. Technological and legislative infrastructures are mandatory for establishing a national EHR.

Keywords: Electronic Health Records, National EHRs, Stakeholder Analysis, Drivers, Inhibitors

Paper Type: Research Paper

1. Introduction

Whilst the area of adoption and diffusion of IT innovation is one of the main areas of attention in the IS field (Davis, 1989, Swanson and Ramiller, 2004), there has been evidence that organisations have sometimes adopted a hasty and incomplete approach to their adoption decisions, preferring to ‘jump on the bandwagon’ as stakeholders try to conform to the latest fad or fashion (Abrahamson, 1991). The techniques that intermittently emerge from within the fashion setting community are transient in nature; however, some gain legitimacy and become ingrained in management culture (Ponzi and Koenig, 2002). The approach that is typically used to engineer self-replicating demand for a new fad of fashion is the identification of performance benefits offered by the new method, and a corresponding performance gap suffered by those that have not adopted it (Abrahamson, 1996). This results in the ‘bandwagon effect’, which has been observed by researchers in many areas of IS (for example most notably in Enterprise Resource Planning (ERP) packages); therefore, the question has to be asked if the same ‘bandwagon effect’ is surrounding the global legitimacy that has been created around the concept of the EHR system and the pursuit of the single national patient record.

For some time “integration has been a Holy Grail of MIS” (Kumar and Van Hillegersberg, 2000, p. 23). In this paper we argue, from a theoretical perspective, that the motivating factor for healthcare entities’ implementation of an EHR system is twofold, namely: integration and process-orientation, which together provide a common ‘technological infrastructure and information architecture’ to underpin e-Health. This paper illustrates that the integration necessary to enable a national EHR being fully operational is contingent upon process-related and infrastructural factors, which has yet to be realised in any country. It extends extant literature by developing an integrated characteristics framework, documenting the key drivers and inhibitors of EHR adoption together with a definition of a national EHR. The evolution
towards a national EHR was investigated using the national health services of Ireland and Israel, and the key drivers and inhibitors in the evolution towards a national EHR in these two countries are documented. The paper concludes by discussing the implications for theory and practice of the findings of this research, addressing the question as to whether the elicited drivers and inhibitors can attest to the future of EHR adoption, at least in these countries; therefore, is there a real business necessity or is it just another fad?

2. Background

The utilisation of EHRs is not a new phenomenon. Since the 1970s medical data has been stored in electronic format. There are numerous advantages purported as being associated with EHRs. Advantages discussed in the literature include efficient data storage, reduced costs, reduced data redundancy, improved levels of physician efficiency, the ability to have remote access to patient data, reduced medical errors and improved communication between practitioners and patients as well as among practitioners (Zandieh et al. 2008; Tan 2005). It is accepted that further benefits can be realised through the adoption of a national integrated EHR; for example, Detmer et al. (2008) discussed the potential of integrated EHRs. They stated that the major capabilities underlying integrated EHRs relate to 1) Quality, Completeness, Depth and Accessibility of Health Information, 2) Facile Communication, 3) Access to Health knowledge, and 4) Portability.

The impetus towards integrated electronic health records has been driven by national and international health policy with health organisations in many countries recognising that consumer engagement in health promotion and disease management is critical to quality improvement and health care cost containment strategies (Detmer et al., 2008). Thus, EU countries signed the e-Health Action Plan at the Lisbon Inter-Governmental Conference committing to creating electronic infrastructure for health and ensuring portability of health data and national insurance information across all EU health administration (Reynolds, Harper, Jenner and Dunne, 2008). Furthermore, in recent times, patients have started to play a much more active role in requiring access to their Personalised Health Record (PHR), which has been developed and made available as a web-based service, enabled by patient portals (Stone, 2007). Web-based patient-centered health record systems are currently available as private solutions which are patient-owned and patient-managed, for example: iHealthRecord, PatientSite, Microsoft HealthVault, Google Health and My Personal Health Record; with the patient taking an active part in managing their own PHR. Yet a lack of systems integration inhibits such solutions having any real impact on national healthcare provision, besides concerns about potential breach of privacy (Steinbrook, 2008).
While there is ample literature in support of EHR adoption (Pagliari et al., 2007), other views have been documented. For example, evidence about the contribution of EHR to improved quality of care is non-conclusive or partial (Delpierre et al., 2004), and the negative effects of physicians investing a significant portion of the patient visit time to computer typing has been noted (Margalit et al., 2006). Further, the danger of perpetuating erroneous information as a result of computerized information sharing has also been noted, as well as the risk of the physician-patient encounter becoming a mechanistic process due to rigid computer-based standards enforced on clinicians (Hartzband and Groopman, 2008).

Ideally, an EHR system should facilitate cross-institutional, longitudinal and secure storage of a patients' health record. However in an operational context, evidence illustrates that adoption of EHR systems has been disappointing. In the United States, in the area of primary healthcare, there is a national goal to have universal adoption of EHR systems by 2014 (Zandieh et al., 2008). Yet, evidence suggests that in an operational context this goal will be difficult. A 2007/8 survey of physicians in the US found that 13% reported having a basic system facilitating patient demographics and problem lists, electronic lists of medications taken, clinical notes, orders for prescriptions, and viewing laboratory and imaging results. However, only 4% of physicians reported having an extensive, fully functional EHR system that includes medical history follow-up, order for laboratory and radiology tests, prescriptions sent electronically, electronic imaging and clinical decision support (DesRoches et al., 2008).

In tertiary care, research (Linder et al., 2007) has illustrated that less than 10% of hospitals in the US as of 2006 have a fully integrated system. This makes the policy of pursuing a national integrated EHR system very difficult in the US. This trend is reflected internationally with poor adoption rates in many countries, with EHR systems not making the impact that many hoped for (Anderson et al., 2006). In terms of EHR systems, the nirvana is a complete electronic health record available to all medical practitioners and patients. This dream, however, has yet to be realized at the organizational and local level, let alone the national level.

2.1. The National EHR Story

The existence of an EHR governing the operations of a country's health service could lead to a variety of efficiency and effectiveness benefits to all stakeholders, but most importantly, to the patient; for example, a patient could enjoy reduced transaction costs through streamlined processes, incorporating prompt information flow, within the health service. Therefore, a national EHR can be characterised as the integration of patient information and information-

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1 This is now further supported by President Obama’s stimulus package, where it is estimated that $19 billion has been made available to bring America’s health care records into the electronic age; embracing the use of IT to create and manage EHRs (from Washington Post on 17/2/2009).
based processes within and across functional areas of the health service into a single system (Walker, 2005).

However, attempts to establish a national health record has been documented for the last decade. For example, the public sector in South Korea introduced district health information systems (DHIS) in health centres in the early 1990s, aimed to help health centres to provide comprehensive health care services and to achieve effective and efficient management of their work. DHIS was intended as an infrastructure for a national health record in South Korea, yet the adoption rate was less than expected, as problems relating to requirement inadequacy and the lack of a national implementation strategy. These emergent problems hindered the system’s adoption and implementation (Han and Lee, 2003). The ultimate goal of achieving a national EHR system has thus not been realized. A similar, rather small scale, national system has been attempted by the US Health Resources and Services Administration and All Kids Count to foster development of an integrated child health information system (Hinman, Eichwald, Linzer and Saarlas, 2005). It seems, however, that this initiative eventually served as an offline repository of child health related data (see http://www.aecf.org/KnowledgeCenter.aspx). Evidently, all early attempts to introduce a shared infrastructure have so far been unsuccessful.

Consequently, several problems have been documented as inhibiting implementation of a national EHR, the most common of all is the lack of national infrastructure (Tsiknakis et al., 2002; Yasnoff et al., 2004; Haux, 2006; Reynolds et al., 2008;). Other obstacles including semantic and interoperability incompatibility as well as financial issues have also been noted (Ingenerf et al., 2001; Sensmeier, 2003; Hillestad et al., 2005; Kleinke, 2005; Walker et al., 2005). Quite surprisingly, the academic literature is rather less expressive surrounding the public debate about whether a national EHR is at all desirable from the standpoint of patients and legislators, compared with the plethora of opinions in the popular press, as well as on the web, dealing with these issues. For example, in a blog on USNews.com (Healy, 2009) entitled “Electronic Medical Records: Will Your Privacy Be Safe?”, Dr. Healy claims that

“recognizing the importance of the public's confidence in the sanctity and confidentiality of medical records, the IOM came down hard on the current privacy protections that are supposed to ensure this. The group concluded that government rules to protect patients' medical records are simply inadequate”.

This blog evoked 23 postings of which only two were supportive of a national EHR and one suggested learning from the experiences of other countries. Although not a statistical sample, hence no inclusive conclusions should be drawn, the overall impression is that, especially in the US, there is concern about: [1] privacy breaches as a result of a national EHR among the
general public (Cundy and Hassey, 2006; Terry and Francis, 2007), and [2] the American Recovery and Reinvestment Act (2009) for investing $19 billion in advancing the national EHR; which has been criticized from medical, social and financial aspects (Goldman, 2009). In contrast, a somewhat different experience has been gained in Israel, where the largest HMO has successfully implemented a nation-wide electronic patient record covering clinical data related to about half of the population. This solution, however, did not attempt to implement a physical national infrastructure but rather adopted an interoperable solution designed to facilitate ad-hoc access to disparate medical databases nationally (Saiag, 2005).

2.2. What is EHR Adoption?

The adoption of an EHR system within a healthcare entity (at local or national levels) is essentially a business change as opposed to an IT initiative, and can be classified as a Transformation Investment (c.f. Ross and Beath, 2002; Haux, 2006). A transformation investment is perceived as a strategic decision as opposed to a cost justified business decision as “transformational investments are necessary when an organisation’s core infrastructure limits its ability to develop applications critical to long-term success” (Ross and Beath, 2002, p. 53). However, it is critical to understand that healthcare transformed infrastructure must be aligned with the changing business processes and requirements of the healthcare entities (Hillestad et al., 2005; Walker, 2005). As a result, for an EHR investment to be considered a true transformation investment and to achieve the expected benefits, the importance of changes to the business processes needs to be fully understood from the outset along with the realisation that payoffs from such an investment are not easily or quickly achieved (c.f. Ross and Beath, 2002). Furthermore, “transformation investments demand significant senior management commitment to invest funds, guide implementation and process change, and steer the organisation toward opportunities to leverage the investments” (Ross and Beath, 2002, p. 57). While such transformation might be disruptive for regular organizations, its realization in environments such as the healthcare sector is tenfold as complex. Here, adopters are individuals, while organizations and the nation are the regulating and funding authority, where each entity is further composed of customers, providers, supporters etc. (Mantzana et al., 2007). It is no wonder, therefore, that based on the many reported global cases of EHR implementations (c.f. Tan, 2005), investments in EHR systems are often unrealistic and lack credibility, resulting in an inability to realize the desired outcomes. Thus, it is necessary to establish what actions should be taken by healthcare stakeholders to ensure that EHR investments turn out to be transformational in terms of their impact, and research needs to be conducted to first understand the drivers and inhibitors of EHR system adoption and implementation by the various stakeholders.
3. A National EHR: Characteristics, Drivers and Inhibitors

From a review of the literature, there is a lack of evidence as to the existence of a comprehensive definition of an EHR, and indeed, there is uncertainty regarding the optimal approach that should be followed to implement such an integrated solution in order to achieve a single national patient record. Based upon our concept of a national EHR, we characterise a national EHR as:

“an integrated information system spanning all entities of a country’s healthcare provision network (namely: primary, secondary, and tertiary entities) that facilitates a nation-wide streamlining of patient-centred health data regardless of the inherently different processes and infrastructure that the data was created by”.

Therefore, if EHRs are to become a reality, it is paramount that there is a high level of integration (data and technical infrastructure) within and across the three healthcare entities involved. From this perspective, integration is concerned with automating and integrating patient health data within and across the health service, and providing access to patient information in a real-time environment. This conceptualisation is visualised in Figure 1.

The visualisation presented in Figure 1 illustrates the two levels of integration that are a prerequisite to the implementation of a national EHR. By streamlining health service entities’ data flows, an EHR system provides stakeholders with universal and real-time access to a large quantity of up-to-date patient-centric data. Furthermore, this seamless integration of data provides a number of critical benefits, including increased patient satisfaction, streamlined communication and improved cross-functional efficiency and effectiveness (Reardon and Davidson, 2007). An integrated EHR system can provide seamless business process integration among providers within a similar environment (e.g. a clinic), greater interoperability between systems; for example among the various care levels, and improved workflow between health service functions, standardised business practices, superior management and again better patient service and care (LeRouge et al., 2007). Finally, by imposing a single, integrated patient health record mechanism across the health service, there is an infrastructural issue associated with providing a common set of patient data, a single application, and a unified interface. A country’s progress in relation to their evolution towards a single national EHR record can be described by utilising the framework in Figure 1 to illustrate the state of play of the country’s EHR-related entities.
Since it is evident that a national EHR implementation is contingent upon the degree of EHR diffusion in the three healthcare levels, there is merit in first investigating its determinants. An analysis of the literature has revealed a wide range of factors which are deemed to be drivers and inhibitors of EHR adoption. Following our review of the literature, we adopted a concept-centric approach to organising and presenting our observations. As a result of this approach the factors were categorised into two groupings as illustrated in Table 1, namely: (i) factors at an individual level, i.e. those factors which impact upon clinicians adoption of EHR and (ii) organisational & environmental factors, i.e. those organisational and partnership factors which impact upon the adoption of EHR (Mantzana et al., 2007).
### Individual Level of Analysis

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<th>Concept</th>
<th>Description</th>
<th>Factor from Literature</th>
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| User Acceptance – Usefulness, System Usability & Ease of Use | User acceptance is broken down into either clinical or financial usefulness. This suggests the dichotomous nature of user acceptance as being one of a clinical or financial consideration with regard to the adoption of EHR. User acceptance is affected by the level of computer-use efficacy, and by the perception of lost productivity. The ease of use of the EHR system and the ability of healthcare professionals to navigate their way through the infrastructure. The flexibility of the EHR system infrastructure is also of importance. | Decreased time spent retrieving patients charts  
Ability to exchange information and improve communication  
Impact on work practices and productivity (performance issues)  
System-wide cost savings and increased revenues  
Return on Investment (ROI)  
Fewer medical errors and improved quality of care  
Application customisation and vendor stability | Tsiknakis and Kouroubali, (2009); Detmer et al. (2008); Wulsin & Dougherty (2008); Zandieh et al. (2008); Vishwanath and Scamurra (2007); Poon et al. (2006); Valdes et al. (2004) |

| Trust                     | Trust in the EHR system can either be high or low. In situations where trust is perceived to be low then there is the issue of risk associated with the system-in-use.                                                                                                                                                                                                                                                                                                                                                   | Liability risks (Personal Health Records)  
Security/privacy issues  
Secure Access and Authentication for users  
Balancing physician and patient autonomy | Detmer et al. (2008); Vishwanath and Scamurra (2007); Poon et al. (2006) |

### Organisational/Environmental Level of Analysis

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| Services Structure, Culture & Norms | The structure and delivery of healthcare services can be characterised as being either centralised or decentralised. The culture defining the various healthcare entities along with the procedures followed in carrying out clinical practices.                                                                                                                                                                                                                                                                                          | Move Towards Patient Empowerment  
Increased public health monitoring and disease management  
Commitment of Organisations involvement and enthusiasm of all major service players | Tsiknakis and Kouroubali, (2009); Wulsin & Dougherty (2008); Vishwanath and Scamurra (2007); Poon et al. (2006); Valdes et al. (2004) |
| Politics & Legislation       | The political and legislative system of the healthcare sector along with that of the country itself considering the adoption.                                                                                                                                                                                                                                                                                                                                                                               | Need for regulatory reform  
Role of insurance organisations                                                                                                                                                                                                 | Vishwanath and Scamurra (2007); Poon et al. (2006) |
The existence of a common vocabulary and a standard definition for the patient and clinical data stored in the EHR system.

Common Framework for networked Personal Health Information

Need for technology standards (data standards)

Integration and connectivity

Detmer et al. (2008);
Vishwanath & Scamurra (2007); Poon et al. (2006); Valdes et al. (2004)

Table 1: Determinants of EHR Adoption

At the individual level, factors which impact upon the adoption of EHR are categorised as: 1. User Acceptance – Usefulness, System Usability & Ease of Use and 2. Trust. At the organizational/environmental level, three categories of factors exist: 1. Services, Structure, Culture & Norms, 2. Politics & Legislation and 3. Common Vocabulary & Semantics. For the purposes of this research paper we use Table 1 as a lens to examine the adoption of EHRs in the Irish and Israeli health services and our analysis and findings are presented using these five concepts also.

4. Research Methodology

The case study approach is one of the most commonly used research methods in the information systems field (Benbasat et al., 1987; Eisenhardt, 1989; Darke et al., 1998). It aims to obtain an in-depth understanding of the phenomenon and its context (Cavaye, 1996). Case studies enable researchers to investigate pre-defined phenomena without explicit control or manipulation of any variables (Yin, 1994; Cavaye, 1996; Darke et al., 1998); therefore, they serve to capture the reality and richness of organisational behaviour in context (Galliers, 1992; Gable, 1994). Researchers such as Benbasat et al. (1987) and Eisenhardt (1989) argue that multiple case designs are desirable when the intent of the research is to build theory; as with this study. In particular, Eisenhardt (1989) argued that constant comparison across cases, obtaining data from numerous sources and reconciling this with the literature, presents the opportunity of creating new, novel theory. Furthermore, a multiple case design can help to ensure generalisation of research findings (Benbasat et al., 1987), replicability (Darke et al., 1998) and prediction (Benbasat et al., 1987; Darke et al., 1998), thereby strengthening research. In fact Miles and Huberman (1994, p.25) have commented that “multiple cases offer the researcher an even deeper understanding of processes and outcomes of cases, the chance to test (not just develop) hypothesis, and a good picture of locally grounded causality”.

From the perspective of this research study, the following description of the appropriateness of a case study to a particular type of research seems accurate: “case research is particularly
appropriate for certain types of problems: those in which research and theory are at their early, formative stages, and sticky, practice-based problems where the experiences of the actors are important and the context of action is critical” (Benbasat et al., 1987; p.369). However, the selection of cases, the sampling problem, is an important aspect of any type of research approach, especially when building theory from case studies.

For the purposes of this study both archival documentation and interviews were the primary sources of empirical data, and a three phase data gathering strategy was adopted. Phase one involved the researchers conducting a thorough archival search to determine the existence of public domain material in relation to EHRs in both Ireland and Israel. Documentation analysis was exploited as much as was possible, and for each case the documentation provided specific details to corroborate, and in some instances clarify, evidence collected through interviews.

Phase two incorporated an onsite visit to interview key stakeholders involved in primary, secondary and tertiary care in Ireland and Israel respectively. Stakeholders were identified using the stakeholder/actor framework after studying the structures of the Israeli and Irish health care services. Thus, we aimed at interviewing representatives of the various stakeholders: clinicians, policy makers, academics, and EHR experts from both the customer and provider sides. Phase three consisted of follow up focused interviews aimed at clarifying ambiguities and discrepancies from the first round of interviewing.

Over ten hours of interview data was gathered over a two month period (January-February 2009) from a broad spectrum of stakeholders involved in implementing and utilising EHR systems in Ireland and Israel. All interviews were unstructured, varying from one to one and a half hours in duration. Interviewees were asked to freely tell their story around their involvement in an EHR implementation, and offer their insights into the current state of affairs around EHR adoption and the reasons for this situation. Field notes were taken during all interviews and while some interviews were audio-taped, in some instances recording was declined by the interviewees, therefore, the available field notes were the sole source of evidence from these interviews. Both field notes and recordings were transcribed and sent to the interviewees for review and verification of the content. Furthermore, the interview data was triangulated with available archival documentation to ensure that the ‘plot’ (Abbott, 1992) of each case was reported correctly.

Content analysis was undertaken as part of both the within-case and cross-case analysis. Content analysis can be used to demonstrate the meaning of written sources of evidence (e.g. interview transcripts and documentation) by systematically allocating their content to predetermined detailed categories and then interpreting the outcomes (Myers, 2009). Furthermore, the researchers search “for structures and patterned regularities in the text and
make inferences on the basis of these regularities” (Myers, 2009, p.172). In this study, content analysis was performed using the open coding technique, a technique proposed by Strauss and Corbin (1990) and exemplified by the research of Orlikowski (1993) and Urquhart (2001). This approach is consistent with a post-positivist epistemology (cf. Charmaz, 2000). It necessitates the researchers to be immersed in the data (Glaser and Strauss, 1967) and to draw on existing theoretical knowledge without imposing a theory (Corbin and Strauss, 1990; Urquhart, 2001). Data was examined ‘line by line’ to ascertain the main ideas in relation to the drivers and inhibitors of EHR adoption. This process continued in an iterative manner with the factors being grouped based upon the concepts presented in Table 1. The concepts in Table 1 were further used to compare both cases systematically, illustrating the similarities and differences between the cases. For the purposes of this paper some of the finalised outputs of this within-case and cross-case analysis process are presented in Tables 2 and 3. An illustration of the coding process is also included in Appendix 2.

5. Results

5.1. The State of EHR Diffusion in Ireland

The Health Service Executive (HSE) was established in 2005 and is responsible for managing the provision of health services for everyone living in the Republic of Ireland. The HSE was set up as part of the provisions of the Health Act in 2004, which states that the objective of the HSE is to provide services that improve, promote and protect the health and welfare of the public. The establishment of the HSE represented the beginning of the largest programme of change ever undertaken in the Irish public service. Prior to its establishment, services were delivered through a structure of ten regional Health Boards. Within each health board, entities involved in primary, secondary and tertiary care operated independently with very little interaction between these entities. The HSE replaced the ten regional health boards with four administrative health service areas, and became the national management body with sole responsibility for health services in Ireland.

Clinical information systems have been widely implemented in Ireland at primary level since the late 1980’s. At that time, the Irish College of General Practitioners (ICGP) set up an IT group whose main role was to accredit software for use within the GP’s practice. This meant that certain standards were met and certain training issues were addressed. Presently, four GP practice software products have achieved certification. The products are: CompleteGP, Health One, Helix Practice Manager and Socrates.

Certification incorporates issues such as service level agreements between GPs and vendors, help desk support, training, escrow agreements as well as the specific functional requirements
needed for GP systems, such as consulting, prescribing and vaccinating. "Previously this was a paper exercise," says Dr. O'Mahony (ICGP, 2009), "but the testing benchmarked the software against specific functions and assessed if the software product achieved the required standard" (ICGP, 2009).

While penetration rates of these systems amongst GPs is high (estimated at over 80% by the ICGP), these are standalone applications, installed within GP practices. These systems are not integrated between clinicians involved in primary care or indeed with any systems within secondary or tertiary healthcare entities. While these applications are also used by clinicians operating within secondary care entities in Ireland, those clinicians operating in secondary care typically are associated with a number of hospitals. This means that they operate in a number of geographical locations. In their primary clinic, however, they typically implement one of the four GP applications documented above on a standalone basis. However, in terms of patient health records they “typically bring patient charts with them in their briefcase when moving between the various locations” (HSE IT manager). Therefore, in secondary care, apart from patient’s demographic details, the vast majority of clinical information relating to patients is stored in a paper format.

At the tertiary level, most hospitals have implemented a wide range of IT systems dealing with patient demographics and the various areas of medicine which they support. However at present, many hospitals are only currently integrating these various systems in-house. For example, Cork University Hospital (www.hse.ie/eng/find_a_service/Hospitals/cuh/), one of the leading hospitals in Ireland, is currently undertaking a process to integrate data across all the systems which are utilised within the hospital. The HSE IT manager described this process as “being a very time consuming and expensive process”. Therefore, hospitals in Ireland are currently dealing with the process of integrating their in-house systems. The process of integrating data between hospitals and between the levels of the healthcare service is described by the IT manager at CUH as “being a long way off”. At present, there is no national EHR record for Irish citizens and this ‘holy grail’ seems some distance away in the future.

5.2. The State of EHR Diffusion in Israel

Clinical information systems have been widely implemented in Israel since 1990. For almost twenty years, the EHR system Clicks® has been used by the majority of primary-care physicians in Israel, as well as in many secondary care clinics and in hospitals (Pliskin, 1994, Pliskin et al., 1996). Since the two largest Health Maintenance Organizations (HMOs) in Israel, which provide medical care to about 80% of the population, have adopted this application as their mandatory organizational EHR system, and a third HMO has partially
adopted it (covering an additional 10% of the population), almost all primary care records in Israel and the vast majority of secondary care records are fully computerized and highly integrated via this EHR system. The other two HMOs largely use their proprietary EHR system, mandatorily used by all primary and secondary care clinicians, perceived by clinicians "as an interactive medical learning environment…” (HMO Medical Director). Installed on a desktop personal computer, these systems are linked to a patient-records database generally hosted on local or central servers (depending on the organizational information-technology architecture of the implementing HMO). The EHR systems facilitate electronic real-time documentation of all physician-patient encounters during a visit, and selective context-based data retrieval during treatment monitoring. Based on the classification suggested by DesRoches et al. (2008), the systems can be classified as comprehensive EHR systems. The systems are interfaced in real-time with administrative computerized systems, used to validate patient insurance coverage and transmit various administrative data to the HMOs, used, for example, for cost calculation and other decision support purposes.

Most secondary care clinics affiliate with one of the four HMOs and as a result use the EHR system advocated by the HMO, positioning EHR penetration in this healthcare level at about 80%. The developer of the Clicks® system, an M.D. said: “The system was developed focusing on clinicians’ requirements and following the clinical procedure in a common visit…” (Roshtov Founder and CEO).

Unlike primary and secondary care levels, the picture in Israeli tertiary care is quite different. All ER departments at Israeli hospitals are equipped with an administrative system that is directly interfaced to the central Israeli Citizens Registry controlled by the Ministry of Interior Affairs, where demographic details of every Israeli citizen are registered, sorted by a unique identification (ID) number issued to every Israeli new-born or immigrant upon granting of citizenship. This ID number allows unique identification of every patient who is an Israeli citizen.

Israeli hospitals vary in the level of clinical information systems penetration. The larger hospitals have implemented bespoke systems, ranging from basic registry systems aimed at issuing discharge letters to the referring GPs, to fully functional EHR management systems used at admittance, patient bedside, and discharge. The CIO of the second largest public hospital in Israel remembered: "in the mid-1990s we allowed departments to choose one of four recommended systems. This strategy represented a local view. In 2001, however, the hospital's strategy changed and we started to implement a self-developed standard EHR system for all the departments. The system was co-developed with hospital clinicians as a flexible platform addressing the differences among clinical processes". However, in contrast to this experience, several hospitals are still using paper-based patient records.
Since 2001, the largest HMO, who provides healthcare services to about 50% of Israeli citizens and owns several large hospitals, has installed a SOA-based interoperability EHR solution facilitating any authorized care provider to view a wide range of a patient health data retrieved from distributed databases (see www.dbmotion.com). The system can display the patient demographics and health history including GP and specialist visits, symptoms and prescribed drugs, laboratory results, imaging and hospitalization history by typing in the patients’ National ID, which is the unique patient identifier in all primary and secondary care systems. This record vanishes upon typing an ID of another patient and is not kept in a central repository. By employing this interoperability solution, the HMO has in fact created a unified EHR for its members, covering primary, secondary and tertiary care. About two years ago, the two largest public hospitals implemented this interoperability solution bringing the number of patients whose full records are available online to 60%-70%: "this system registers 3,500 entries per month, attesting to its extensive use and importance. Hospital clinicians can't now imagine working without it…" (Hospital CIO).

In spite of the advanced state of diffusion of primary and secondary care EHRs, a national EHR has not yet been officially implemented in Israel, although a public committee has been nominated to recommend a solution. This committee is considering several solutions and should come up with a recommendation, yet both the Head of the Department of Health Administration and the Medical Director of a HMO have agreed that "it has not yet been decided due to political reasons, and because politicians on the committee prefer to wait till the legislation has been acted…". Apparently, Israel is quite advanced in EHR penetration compared to other Western countries (Vardy et al., 2008). In the next section EHR drivers and barriers in Ireland and Israel are summarized using the lens described in Table 1.

5.3. Summary of Findings

In this section, Table 2 and Table 3 present a snapshot of a cross-case comparison of the Irish and Israeli ‘story’ with regard to EHR systems. Both tables structure the case data around the five macro-level concepts derived from the literature and presented in Table 1. Furthermore, Tables 2 and 3 and each of the concepts presented are logically divided into two perspectives (localised and national). For each cell entry in these tables a legend of (D) is used to represent the notion of driver to EHR adoption and (I) is used to represent an inhibitor. As with all qualitative analysis techniques used in the data reduction process, the findings of the cross-case analysis are meaningful, as much for what is not observed as for what is actually seen.

In both the Irish and Israeli cases the level of computerisation of primary healthcare entities is extensive and the types of systems cover ‘basic’ patient record management to ‘comprehensive’ patient record management containing clinical observations, etc. However,
the route to computerisation of these primary healthcare entities in both countries, as well as the level of integration within and between healthcare levels, has been very different along with the motivations to adopt a system for managing patient records electronically. This route and motivation of primary healthcare stakeholders has been driven by the structures of the health service and the nature of legislative and regulatory standards within each country (over two very different timelines where Israel has several years experience over Ireland). The centralised structure of the healthcare services in Israel facilitated high level of EHR integration within and between at least the first two care levels. Therefore, in achieving the goal of a national health record, having a high level of computerisation and integration across care levels is an important prerequisite. Israel appears to have achieved this objective. In Ireland, the opposite has been the case with the decentralised structure of the Irish Health service and the historical autonomy of the various entities making integration extremely difficult. To date, integration hasn’t taken place across and among the care levels in an Irish context.

As presented in Table 2, considering the *user acceptance - usefulness, system usability & ease of use* concept, this factor has mostly been a driver of EHR adoption in primary care, since in both countries systems have been developed with clinicians in mind. This is also the case in Israeli secondary care but less so in tertiary care. In Ireland, however, secondary and tertiary care clinicians are still reluctant to change work processes. On the individual level of analysis, in both countries clinicians were encouraged to adopt EHR systems by offering financial benefits on the one hand (e.g. low system cost, tax rebate, and prompt payments by HMOs), and by emphasizing the clinical advantages, on the other hand. It is also assumed that culture and norms affect the willingness of individual clinicians to adopt EHR, yet this is suggested for further research.

As expected, both Ireland and Israel do not have obvious drivers or inhibitors affecting the users’ acceptance of the EHR system from a *national perspective*, as issues around user acceptance would almost always have an impact at the local level where the EHR systems are rolled out and used by clinicians in a particular local context. System *trust* can be a driver or an inhibitor, yet it seems that this is not a primary issue affecting EHR adoption from the localised, individual perspective. However, it is illustrated in Table 2 that system trust is rendered a significant inhibitor in Israel only at the National level.

As presented in Table 3, focusing on the *services, structure, culture & norms* concept within the organisational level of analysis, it appears that Ireland is distinctly different to Israel from two points of view: 1) the structure of the healthcare sector, and 2) the lack of a unique patient identifier in Ireland. As to the former, the centralised Israeli healthcare services facilitated a top-down approach to EHR adoption at least in the two lower levels of healthcare, whereas
the decentralised Irish structure yielded a bottom-up diffusion of EHR systems, resulting in the disparate present state of EHR systems within and across healthcare levels. Regarding the latter issue, Ireland has not yet agreed on a unique patient identifier to drive the implementation of a national health record. This is a major inhibitor to the Irish approach, due to the fact that without such a unique identifier (like a car registration number) for each patient, the accuracy and integrity of patient data, stored to create a national EHR, is called into question and serious doubt of ever happening. On the other hand Israel has enjoyed the existence of a national identity card since its foundation and this has proved invaluable to fulfil the role of unique patient identifier in all of the EHR systems currently implemented.

As presented in Table 3, focusing on the *common vocabulary & semantics* concept, it appears that Ireland is distinctly different to Israel from the point of view that Israel is exploiting its EHR systems promoting value-added activities within the health service; however, Ireland is inhibited by the fact that a common understanding of what constitutes an EHR has not yet been agreed, either at a localised or national level.

<table>
<thead>
<tr>
<th>Individual Level of Analysis</th>
<th>Ireland</th>
<th>Israel</th>
</tr>
</thead>
<tbody>
<tr>
<td>Localised Perspective</td>
<td>(D) Patient management systems implemented in both GP clinics and hospitals are deemed easy to use by clinicians; these systems were designed with clinicians in mind and require minimum training</td>
<td>(D) Systems are developed in conjunction with users and incorporate knowledge gathered from users; these systems are deemed as a learning environment by clinicians, are easy to use and require minimum training</td>
</tr>
<tr>
<td></td>
<td>(D) Patient management systems have improved quality of care through flagging of events and clinicians believe that it reduces the number of medical errors</td>
<td>(D) Systems alert clinicians to various adverse situations (e.g. patient allergies and drug contra-indication)</td>
</tr>
<tr>
<td></td>
<td>(D) Viewed by clinicians as cheaper than paper based records</td>
<td>(D) Viewed as an inexpensive patient visit documentation system</td>
</tr>
<tr>
<td></td>
<td>(D) Financial incentives (through tax rebates) available to GPs to adopt</td>
<td>(D) On-line access to members' database endures full coverage details at the clinic</td>
</tr>
<tr>
<td></td>
<td>(I) Data protection and lack of a systems infrastructure means that electronic sharing of clinical data across all healthcare entities does not take place</td>
<td>(D) Accurate and fast payment to GPs</td>
</tr>
<tr>
<td></td>
<td>(I) Clinical processes are highly diverse and there is an unwillingness by clinicians in secondary and tertiary entities to change work practices</td>
<td>(I) Tertiary clinical processes are highly diverse and hospital department heads are autonomous</td>
</tr>
<tr>
<td></td>
<td>(I) There is a lack of hardware, training and</td>
<td>(I) There is low end-user computing literacy and less incentives to use EHR systems in tertiary healthcare</td>
</tr>
<tr>
<td>National Perspective</td>
<td>System Trust</td>
<td>Localised Perspective</td>
</tr>
<tr>
<td>----------------------</td>
<td>--------------</td>
<td>-----------------------</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(I) The perceived lack of security around EHR systems among clinicians at secondary and tertiary levels creates a sense of fear that records can easily be updated by a broad spectrum of users</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(I) Sharing of usernames and passwords among clinicians in a tertiary healthcare setting is a common occurrence</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(D) Secured central systems facilitate clinicians’ direct access to and retrieval of patient data, rather than data residing on clinicians’ personal computers; increasing trust in the system</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(D) Secured identification of clinicians and patients; clinicians and patients have authorisation-dependent access to the patient's clinical data in real-time</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(I) A ‘Big Brother’ effect among clinicians in all levels of healthcare</td>
</tr>
<tr>
<td>----------------------</td>
<td>--------------</td>
<td>-----------------------</td>
</tr>
</tbody>
</table>

Table 2: Drivers/Inhibitors of EHR Adoption: A Cross-Case Comparison - Individuals

<table>
<thead>
<tr>
<th>Organisational/Environmental Level of Analysis</th>
<th>Services, Structure, Culture &amp; Norms</th>
<th>Ireland</th>
<th>Israel</th>
</tr>
</thead>
<tbody>
<tr>
<td>Localised Perspective</td>
<td>(D) The stated health service strategy is to place the patient at the centre of the health service</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(I) There health service has a highly decentralised structure with no national body responsible for the role out of an EHR system</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(I) Health service entities have enjoyed high levels of autonomy and there are no incentives provided to move to an EHR system</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(I) Agreement has yet to be reached on what that unique patient identifier is for a national HER system</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(I) The national social security number (PPS) cannot be used in healthcare as a unique patient identifier for legal and operational reasons</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(D) The highly centralised structure of healthcare facilitates widespread buy-in and enables the roll out of an integrated EHR system</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(D) EHR data available for cost control measurement and to control payments</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(I) Tertiary care entities are highly autonomous and fail to agree on a common EHR system</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(D) Four HMOs who cover all primary and secondary care endorse the roll-out of a clinical focused EHR to improve and standardise clinical processes, improve the quality of care, disseminate guidelines and procedures, along with policy making improvement</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(D) EHR data available for cost control measurement and to control payments</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
| National Perspective | (I) A national body (HIQA) has been established to look at the issue of a unique patient identifier  
| | (D) Diffusion of PC and broadband services nationally facilitating adoption of EHR systems  
| | (D) Existence of a National identifier solves the patient unique identifier issue  
| | (D) Ministry of Health endorses nation-wide collection of quality of community health data, serving as a benchmark for healthcare providers  
| | (I) Political instability jeopardises legislation for national EHR system implementation  
| | (I) Questionable Return On Investment (ROI) under tight budgets  
| Politics & Legislation Ireland | Israel  
| Localised Perspective | (I) Legal grounding of EHR is untested in court and clinicians fear they may be held liable  
| | (D) EHR system assures service provision to members only and is backed by the state  
| National Perspective | (I) Lack of political will-power and resources to create a single national EHR system  
| | (D) Compliance with national standards  
| | (I) State has not yet passed the National Health Record Bill  
| | (I) National committee unable to agree about the preferred national EHR solution  
| | (I) National committee members concerned about a central clinical information repository for establishment of national EHR  
| Common Vocabulary & Semantics Ireland | Israel  
| Localised Perspective | (I) No national or local understanding of what an constitutes an EHR, but multiple interpretations of what is and what is not an EHR exist  
| | (D) Facilitates the creation of data warehouses for clinical decision making  
| National Perspective | (I) Lack of universal standards for clinical semantics  
| | (D) Facilitates the collection of a limited number of agreed upon national 'quality of healthcare' indicators  
| | (I) Lack of universal standards for clinical semantics  

**Table 3: Drivers/Inhibitors of EHR Adoption: A Cross-Case Comparison – Organisations**

### 6. Discussion

When evaluating drivers and barriers to EHR adoption in the Israeli and Irish healthcare services, the salient differentiating factor is the structure of the relative sectors. Whereas in
Israel the majority of health services are provided as part of the national health insurance covering every Israeli citizen, and the private insurance is rather complementary, the situation in Ireland is just the opposite. Public health coverage is mostly secondary to the coverage provided by private insurance, hence the relatively decentralized structure of the healthcare industry and the limited power of the government. Further, health services in Israel are provided by four HMOs which literally control most primary and secondary healthcare services, as well as many auxiliary care and services providers such as laboratories and institutions. Consequently, most care clinicians are employed, either directly or via an ad-hoc contract, by the HMOs.

Examining the drivers and inhibitors of EHR adoption in both countries as summarized in Tables 2 and 3 emphasize the contribution of the centralized structure to the high penetration and integration rate of EHR in Israeli primary and secondary care. In fact, HMOs drove this adoption top-down, following realization that ROI would be positive due to administrative and financial benefits rendered by these systems. These findings corroborate the extant literature which echoes the need for a central force to drive EHR adoption (LeRouge et al., 2007; Hayrinen et al., 2008; Jha et al., 2009; Kush et al., 2008; Blumenthal, 2009).

These HMOs, however, also realized that administration or financial-oriented EHR systems are likely to be rejected by clinicians, therefore adopted a clinical-focused approach to the development of these systems. A similar, clinic focus approach is also dominant in Ireland. Thus, in both countries the adopted systems were developed for clinicians driving user acceptance on the local and individual levels. Clearly, this factor is insufficient to promote broad adoption of EHR as evident by the lower diffusion level in tertiary care in both countries, in spite of maintaining a similar approach to systems development. The question of EHR diffusion in tertiary care is evidently different and calls for an in-depth investigation.

While the centralized structure of the Israeli primary and secondary care services seems to have played a positive role in achieving the 100% diffusion rate and the high level of integration of EHR in primary and secondary care, it did not have the same effect on adopting a national EHR mainly due to political reasons such as the lack of legislation under which decision makers would be covered against potential liabilities. This conclusion is supported by the fact that a technical solution for a national EHR has already been successfully demonstrated in Israel (Saiag, 2005), yet not officially chosen as the National solution. In Ireland, however, reasons for the lack of a national EHR are quite different, rather stemming from the fact that the required preliminary infrastructure is yet to be achieved. These reasons are similar to findings in other studies (Halamka et al., 2005; Kaushal et al., 2005; Hayrinen et al., 2008)
In summary, it seems that Israel is more ready for national EHR implementation than Ireland due to the high level of computerization and high levels of integration of primary and secondary care patient data which is a prerequisite to the implementation of a national EHR.

7. Conclusions

7.1. Implications for Research

Since the early 1990s, EHR systems have been purported in the literature as having numerous advantages for healthcare. Yet, at least at a national level, a national EHR still remains as illusive as ever with no country having successfully implemented such a system. In order to fully understand why this has been the case, a characteristics framework for EHR adoption was developed by integrating extant research on the drivers and inhibitors of EHR adoption. In addition to the characteristics framework, this study makes a number of contributions to the literature on EHR adoption and implementation.

Firstly, the lack of a definition of what constitutes an EHR is a shortcoming of the extant literature. This paper contributes to the EHR literature by deriving a formal definition of what constitutes an EHR through integrating prior studies to derive a comprehensive EHR definition.

Secondly, this study illustrates that EHR systems are adopted at 4 distinct, yet theoretically integrated levels within a country's health service framework (i) primary (ii) secondary (iii) tertiary and (iv) national. This study has illustrated that several conditions are a prerequisite if a national EHR system is to be developed. Privacy and security are two issues which are of critical importance in the area of EHR, yet political, legislative and infrastructural issues need to be addressed in order to facilitate a national EHR system. Yet this study illustrates that in order for a national EHR to be achieved, it is necessary for a flow of information to take place across and between entities. This study illustrates that achieving the correct balance between privacy and integration issues is as yet an illusive concept which needs to be addressed through legislation.

Thirdly, this study used the constructs of the Stakeholder/Actor Framework proposed by Mantzana et al. (2007), distinctively analysing individual and organizational/environmental entities as these have different interests in, and impact on, EHR diffusion. The data gathered in this study in two countries differing in their relative level of EHR penetration support this framework. Furthermore, it corroborates factors elicited in the literature at both levels of analysis. Thus, the data shows that user acceptance and system trust are indeed important determinants of EHR adoption by individual care providers, whereas structural, cultural and norm related factors impact the EHR adoption by organisations (Gans et al., 2005, Southon et
A salient factor emerging in this study is the detrimental impact of the healthcare decentralised structure on EHR adoption. The data, as well as the literature, attest to the importance of central forces to drive the adoption of an integrated EHR solution (Middleton, 2005). This, however, is contingent upon healthcare organizations realising EHR ROI, which is still not clearly established (Menachemi and Brooks, 2006).

Finally, this study illustrates that an evolution towards national EHR systems has many parallels with multinational organizations implementing large ERP projects, although health data is perhaps more sensitive than business data hence additional complications are associated with national EHR implementation. Nonetheless, this study focuses on other factors, and the patient privacy perspective is left for future research. Thus, the findings imply that implementing an EHR system should be treated as a change management programme, rather than simply an IT project. It also demonstrates that, similar to ERP implementation, this should be a top-down rather than a bottom-up process. ERP researchers would therefore argue that EHR researchers could learn much from the ERP literature on top-down change management projects and could apply many of the theories utilized to inform researchers dealing with EHR systems.

Several limitations should be noted. First, data collection has been limited to a number of key stakeholders selected based on the theoretical framework; yet they clearly expressed their personal perspectives. Therefore, results should be cautiously interpreted and further research is called for. Second, the research is limited to two relatively small countries therefore generalizability is clearly not advocated. Finally, the topic of national EHR is much more complex than described in this study because of issues pertaining to security and privacy. In fact, there is a strong resistance in the USA to a national EHR, and people do not trust legislation to protect their private personal health data. We did not hear a strong voice about these concerns in the two countries that were the focus of this study, yet clearly more research into these issues as inhibitors of national EHR implementation is called for.

### 7.2. Implications for Practice

Evidence from the data gathered in this study suggests that broad and deep adoption of EHR is more easily achieved when central, powerful organizations deem the system beneficial and drive its adoption, corroborating previous similar assertions in the literature (Taylor et al., 2005). Such powers can be governmental, large HMOs or insurance companies. Disparate and unorganized private care providers are unlikely to have the resources to drive a major change in this direction. However, it should be noted that interests of healthcare organizations and clinicians often differ therefore such healthcare organizations or governments wishing to drive EHR adoption nation-wide should collaborate with clinicians in order to develop
clinical- rather than administrative-focused systems. Only clinical focused systems deemed useful by clinicians are likely to be widely adopted by clinicians, provided that financial incentives are offered alongside the clinical benefits.
8. References


Cundy, P.R., and Hassey, A. (2006) "To opt in or opt out of electronic patient records?: Isle of Wight and Scottish projects are not opt out schemes," BMJ (333:7559), July 15, pp. 146-150.


### Appendix 1: Interviewee Description

<table>
<thead>
<tr>
<th>Interviewee Organisation</th>
<th>Interviewee Role</th>
<th>Role Duration</th>
<th>Interview Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Roshtov Software Inc.</td>
<td>Founder, Owner, CEO</td>
<td>Since foundation in 1989</td>
<td>Two interviews in January and February 2009, conducted at the interviewee's office each for about an hour. Full access was gained to the most prevalent Clicks® EHR application</td>
</tr>
<tr>
<td>Rambam Hospital, the second largest public hospital in Israel, Haifa</td>
<td>CIO</td>
<td>&gt;10 years</td>
<td>In February 2009 at the interviewee's office. The interview lasted 1.5 hours</td>
</tr>
<tr>
<td>Ben-Gurion University of the Negev</td>
<td>Head of the Department of Health Administration and an expert in Decision Making in Healthcare</td>
<td>2 years (second term)</td>
<td>In January 2009 at the interviewee office. Interview lasted 1 hour</td>
</tr>
<tr>
<td></td>
<td>Head of the Department of Industrial Engineering and Management, Head of the National Community Quality of Care Indicators project</td>
<td>4 years as a Department Head, since 2001 as Head of the project</td>
<td>In January 2009 at the interviewee office. Interview lasted 1 hour</td>
</tr>
<tr>
<td>Leumit Health Fund (HMO)</td>
<td>Medical Director</td>
<td>1 year</td>
<td>In February 2009, at the CIO office for 1.5 hours</td>
</tr>
<tr>
<td></td>
<td>CIO</td>
<td>&gt;10 years</td>
<td></td>
</tr>
<tr>
<td>Maccabi-Health (HMO)</td>
<td>Head of the Healthcare Research and Evaluation Department</td>
<td>5 years</td>
<td>In January 2009, an update phone interview which lasted half an hour, following collaborating on a conference paper in 2007</td>
</tr>
<tr>
<td></td>
<td>Head of the Information and Quality Services Department, IT Division</td>
<td></td>
<td>1) January 2009</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>2) February 2009</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>At the interviewee's office. Each interview lasted an hour</td>
</tr>
<tr>
<td>GP Clinic, Kilkenny city, Ireland</td>
<td>GP</td>
<td>5 years qualified as a GP</td>
<td>In February 2009 at the interviewees office. Interview lasted 1 hours</td>
</tr>
<tr>
<td>Health Service Executive (HSE)</td>
<td>IT manager</td>
<td>10 years</td>
<td>In February 2009 at the interviewers office. Interview lasted 1.5 hours</td>
</tr>
<tr>
<td>Cork University Hospital (CUH)</td>
<td>Head of IT, CUH</td>
<td>4 years</td>
<td>In February 2009 at the interviewees office. Interview lasted 1.5 hours</td>
</tr>
<tr>
<td>Mercy University Hospital, Cork</td>
<td>Consultant</td>
<td>3 years practicing as a consultant in Ireland</td>
<td>In February 2009 at consultants home. Interview lasted 1 hour</td>
</tr>
</tbody>
</table>
Appendix 2: Example of Data Coding for Drivers and Inhibitors of EHR Adoption in Ireland and Israel

### Individual level of analysis

<table>
<thead>
<tr>
<th>Driver</th>
<th>How Impacted by</th>
</tr>
</thead>
<tbody>
<tr>
<td>User Acceptance – Usefulness, System Usability &amp; Ease of Use</td>
<td>How Impacted by</td>
</tr>
<tr>
<td></td>
<td>External System's developer (Clicks®)</td>
</tr>
<tr>
<td></td>
<td>HMO CIO / Medical Director</td>
</tr>
<tr>
<td></td>
<td>Hospital CIO</td>
</tr>
<tr>
<td>&quot;I was able to design a good system because I came from the field, being a physician by education…&quot;</td>
<td>&quot;The system was, and still is, designed by clinicians and for clinicians. IT merely provides the technical expertise…&quot; (CIO)</td>
</tr>
<tr>
<td></td>
<td>&quot;The system is not just a documentation system, but a full interactive learning environment for clinicians…&quot; (Medical Director)</td>
</tr>
<tr>
<td></td>
<td>&quot;We were always attentive to the users. Actually, the system was, and still is, developed with constant interaction with the users...The system encompasses deep clinical knowledge gathered from the users, so everyone realizes right on the outset that the system is useful and beneficial, enhancing productivity and clinical care...Departments where clinical research is a main interest use the system for collecting data required for their research...&quot;</td>
</tr>
</tbody>
</table>

### Organisational/Environmental level of analysis

<table>
<thead>
<tr>
<th>Driver</th>
<th>How Impacted by</th>
</tr>
</thead>
<tbody>
<tr>
<td>Services, Structure, Culture &amp; Norms</td>
<td>HMOs</td>
</tr>
<tr>
<td></td>
<td>Hospitals</td>
</tr>
<tr>
<td></td>
<td>State</td>
</tr>
<tr>
<td>60% of clinicians using the system are directly employed by HMOs who incentivized system use</td>
<td>Most hospitals owned by the State or by one HMO</td>
</tr>
<tr>
<td>System use became a norm with the majority of HMO employed clinicians, influencing independent clinicians to follow suit</td>
<td>System use became a norm after 'Champion' departments demonstrated improved clinical processes</td>
</tr>
</tbody>
</table>

### Quotations

**IT Manager HSE**

- “The HSE is now evolving towards a culture of being patient centric. The patient doesn’t care where they are in the system. They just want a service”
- “That’s a good way of looking at this…putting the patient in the middle”

**Common Vocabulary & Semantics**

- “The major issue is defining the record. You might just have demographics and/or medical data.”
- “What constitutes the critical mass of elements that constitute a EHR? Is it all patients within hospitals, within various areas and at a national level”