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# TOWARDS A CONCEPTUAL FRAMEWORK OF ACTORS AND FACTORS AFFECTING THE EAI ADOPTION IN HEALTHCARE ORGANISATIONS

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## Abstract

*The non-integrated nature of Healthcare Information Systems (HIS) is strongly associated with a reduction in the quality of care and the medical errors that occur. In particular, around 80,000 people die per year or paralyse in Australia due to problems related to medical errors and are mainly caused by the non-integrated nature of HIS. There is therefore a real need to integrate the Information Technology (IT) infrastructures, to improve the quality of care provided. During the last years much emphasis has been given on Enterprise Application Integration (EAI) technology to bridge heterogeneous systems. Although EAI is being widely used by public and private organisations, it is underutilised in the area of healthcare. Thus, it is of high importance to investigate this area and result in research that contributes towards successful adoption of EAI. Currently, much of the literature on EAI in healthcare has focused on the identification of the factors that influence its adoption. In this paper, the authors attempt to extend this research area, by identifying the actors involved in the EAI adoption process. In doing so, the paper describes the causal relationships among the healthcare actors and factors that influence its adoption. Thus, the paper results in a novel approach that: (a) identifies the healthcare actors that are involved in the EAI adoption process and (b) combines these actors with the factors influencing the adoption of EAI. The proposed approach is significant, as it (a) extends the existing models on EAI adoption by incorporating an actor-oriented analysis and (b) might enhance the decision-making process for EAI adoption by supporting a more detailed level of analysis.*

*Keywords: Enterprise Application Integration (EAI), Healthcare Information Systems (HIS), Adoption, Factors, Actors.*

# 1. INTRODUCTION

Information Systems (IS) are playing an increasingly crucial role in the revolution that is taking place in the healthcare field. The technological advancement in the area of information systems is a key issue in the improvement of quality and productivity of healthcare systems (Ragupathi, 1997; Wanless *et al.*, 2002). Rodrigues *et al.*, (1999) defined the IS implemented in the healthcare field as Healthcare Information Systems (HIS). In the early stages of implementing Information Technology (IT) in the healthcare (e.g. 1960's), IS were dealing with simple transaction processing tasks (Siau *et al.*, 2002). In the 1970's, HIS that support management began to evolve and in the 1980's, decision support systems started being developed and used. Network applications (e.g. internet, intranet and extranet) and information warehousing integrated with data mining tools had been implemented in the healthcare sector in the 1990's. In the 2000's, the need for implementing virtual patient records became apparent. As the expectations from the HIS users have increased, the need for patient records implementation has expanded. Thus, healthcare organizations are shifting towards the development of integrated care.

The efforts for the modernisation of the healthcare sector have resulted in the development of disparate, incompatible and heterogeneous systems (Howcroft and Mitev, 2000; Tai *et al.*, 2000). The non-integrated nature of the healthcare systems is strongly associated among others with the medical errors that occur. For instance: (a) hard copy films are constantly lost/unavailable and (b) information needed for diagnosing is often missing. Thus, as the information needed is not available on time, errors usually occur in prescribing, administering and dispensing drugs to patients (Cowan, 2004). Such medical errors have caused the loss of around 64 persons per day die in UK due to the non-integrated nature of HIS (Khoumbati *et al*., 2003).

Within the same lines, Sutherland and Willem (2002) noted that minimum levels of automation would reduce the percentage of human life loss that is caused by medical errors in USA, by 50% to 80%. Moreover, they stated that, through the use of automated systems, the deaths related to medication errors could be reduced from 106,000 to less than 25,000. When the heterogeneous HIS function together, $85 billion a year will be saved. It appears that the technological advancement in the area of IS is a key issue in the improvement of HIS quality. Nowadays, IT is not perceived anymore as a supporting tool, but as a strategic necessity for the development of integrated IT infrastructure that will significantly improve healthcare services. The development of an integrated healthcare IT infrastructure that will result in enhanced services and will safe and improve human lives is the main priority for the healthcare sector worldwide.

During the last years, much emphasis has been given on Enterprise Application Integration (EAI) technology to develop integrated IT infrastructure. Many private and public organisations have deployed EAI solutions (Irani *et al.*, 2003; Puschman and Alt, 2001), with the healthcare sector having recently realised the effectiveness and functionality of EAI (Khoumbati *et al.*, 2003). Nonetheless, the IS adoption remains a lengthy, time-consuming and complex process and issues associated with its management would appear to be of paramount importance (Irani and Love, 2001). However, not only technical and organisational, but human factors should be considered to reduce the complexity of EAI adoption and enhance its management (Fitzerald *et al.*, 2002). The unawareness of human factors increases the actors'-stakeholders'[1] resistance to adopt EAI (Mantzana and Themistocleous, 2004). Thus, researchers and decision-makers involved in the development, evaluation and adoption processes should consider the actors to successfully accomplish them (Turunen and Jan, 2000).

This paper describes in Section 2 the factors influencing EAI adoption in healthcare organisations. Moreover, the need for healthcare actors' identification is highlighted to support the analysis of the

[1] In this paper, the terms actor and stakeholder are used equally to refer to all individuals and organisations that are affected and/or affect the EAI adoption.

factors affecting EAI adoption process. Section 3 identifies healthcare actors and proposes the conceptual design. In Section 4 the research methodology used in this paper is described. The case study used to evaluate the conceptual design is presented in Section 5. The empirical findings are discussed and analysed thereafter and conclusions are drawn.

## 2. FACTORS INFLUENCING EAI ADOPTION

Different efforts have been made to identify and analyse the parameters affecting EAI adoption. Themistocleous (2002; 2004) has studied the application of EAI in private and public organisations, proposed and validated a model, which explains factors that influence EAI adoption. That model includes among others factors like: (a) cost, (b) barriers, (c) benefits, and (d) internal pressures. Khoumbati *et al.*,(2003) applied the model proposed by Themistocleous (2002) in the healthcare sector and slightly extended it based on a comprehensive literature review on health informatics. In doing so, they suggested that other factors like medical (e.g. telemedicine and clinical support) should be considered during the EAI adoption by healthcare organisations. A summary and description of all the factors reported in the two aforementioned models is presented in Table 1.

| EAI Adoption Factors | Description | Dimension |
|---|---|---|
| 1. Cost | Cost is a significant parameter that influences the adoption of EAI in healthcare organisations. It has been stated that EAI reduces the integration cost (Khoumbati *et al.*, 2004). | Organisational / Technical |
| 2. Barriers | The adoption of EAI causes problems in healthcare organizations, such as operational, tactical and strategic. These barriers should be identified and considered during the adoption process. | Organisational / Technical |
| 3. Benefits | The EAI benefits have been well identified and classified into (a) organisational, (b) managerial, (c) operational, (d) strategic and (e) technical (Themistocleous and Irani, 2001). | Organisational / Technical |
| 4. Support | The consultants' and vendors' support is an additional factor that influences EAI adoption (Themistocleous, 2002). Especially, in the healthcare sector, considerable amount of money is invested on the implementation of an integrated IT infrastructure (Anonymous, 2004a). Thus, this factor should be considered as an influential parameter affecting EAI adoption in healthcare. | Organisational / Technical |
| 5. Internal Pressures | Pressures, such as technical and managerial affect the adoption process in healthcare organizations (Khoumbati *et al.*, 2004). | Organisational |
| 6. External Pressures | The multiple healthcare actors such as patients, suppliers and insurance companies expect improved collaboration with organisations. According to Khoumbati *et al.*, (2004) it should be considered as an EAI adoption influential factor. | Organisational |
| 7. IT Infrastructure | Healthcare organisations need to bridge together the heterogeneous HIS. The non-integrated nature of HIS adversely affects the services provided. The existing IT infrastructure is a factor that effects EAI adoption in healthcare. Thus, this should be considered as an influential factor. | Technical |
| 8. IT sophistication | Themistocleous (2002) stated that IT Sophistication is related to the level of technical expertise an organisation has. Furthermore, it influences the EAI adoption in the healthcare sector. | Technical |
| 9. Evaluation of Integration Technologies | Multiple EAI technologies exist in the integration marketplace. Themistocleous (2002) proposed a framework for evaluating these technologies. This can be used as a decision-making tool to support EAI adoption in healthcare organisations (Khoumbati *et al.*, 2004). | Technical |
| 10. Packages Assessment Framework | A variety of EAI packages exist in the integration marketplace. Themistocleous (2002) proposed a framework for evaluating these packages. This can be used as a decision-making tool to support the adoption of EAI in the healthcare sector (Khoumbati *et al.*, 2004). | Technical |
| 11. Readiness of Organisation | Themistocleous, (2002) mentioned that readiness of organisation is strongly associated to other parameters such as training and skills development Moreover, it has been reported that it is a factor that highly affects the EAI adoption in private, public and in healthcare organisations. | Organisational / Technical |
| 12. Telemedicine | Healthcare organisations use telemedicine technologies to deliver services to isolated areas and to allow information and knowledge exchange between specialists. However, the advantages of telemedicine have not yet been perceived as anticipated, due to the non-integrated nature of HIS (Khoumbati *et al.*, 2004). Therefore, the author has considered this as factor for EAI adoption. | Technical |
| 13. Clinical Support | Clinical decision makers require tools and HIS that support the exchange and sharing of information / knowledge. This can be achieved through the HIS integration (Khoumbati *et al.*, 2004). | Organisational / Technical |
| 14. Patient Satisfaction | Multiple researchers have mentioned that Patient Satisfaction is a significant factor influencing adoption process (Anonymous, 2004a; 2004c; Lapointe *et al.*, 2002). According to Khoumbati *et al.*, (2004) Patient Satisfaction should be considered, similarly as an EAI adoption influential factor. | Social |

*Table 1: Factors affecting the EAI adoption process*

The authors observe (as summarised in Table 1) that 13 out of 14 of the proposed factors focus on organisational and technical issues (dimensions) but not on social. This is possibly a limitation of these models as McGrath and More, (2001) suggested that there are also "People-Related Issues" (e.g. actors involved) that should be studied and analysed by organisations when introducing integration technologies in healthcare. Therefore, particular attention should be drawn to this aspect, as there is a tendency to ignore or, at least, underestimate these "softer" issues (McGrath and More, 2001).

Robey (1979) and Ginzberg and Zmud (1998) among others have studied the significance of actors' beliefs and attitudes and how these beliefs and attitudes are affected and/or affect the factors influencing the adoption process. The diffusion theory (Rogers, 1995) proposes that the actors and the perceived characteristics of innovation have an impact on individual's adoption of IT. These individual actors can be critical in defining the success of information technology adoption in organizations. For example, Chau and Hu (2002) argue that physicians play a fundamental role in the adoption and use of IT. Furthermore, Fitzerald *et al.*, (2002), Schuring and Spil, (2002), Wiley-Patton and Malloy (2004) and Spil *et al.*, (2004) highlighted that the adoption process is highly affected by the actors involved or "adopters" of the innovation. The healthcare actors are not passive acceptors of an idea, but are actively involved and are a really fundamental attribute of the adoption process. The adopters exercise a powerful influence on the form of innovations' adoption. In support of this Lauer *et al.*, (2000) suggested that factors like benefits and pressures should be analysed from the user (actor) point of view. In addition, Chen (2003a) suggested that actors should be considered and analysed with other parameters affecting the decision making process related to the adoption of integration technologies.

The authors suggest that the recommendations of McGrath and More, (2001), Ginzberg and Zmud (1998), Lauer *et al.*, (2000), Chen (2003a) (explained above) can be applied in the area of EAI adoption in healthcare. In doing so, an actor-oriented analysis of the factors summarised in Table 1 might significantly contribute to the level of understanding in this area. Therefore, multiple healthcare actors should be studied in relation to the factors influencing the EAI adoption process. As a result, the focus of this paper is not the identification of the factors that influence EAI adoption in the healthcare sector, but the analysis of them in combination with the actors involved.

# 3. CONCEPTUAL DEVELOPMENT: IDENTIFICATION AND PROPOSITION OF HEALTHCARE ACTORS

Freeman's research (1984) has had a great impact on the management and research thinking as he was among the first who introduced the actors' concept. Since then, multiple researchers have defined the term actor in the normative literature. Many of these definitions provide examples or broad guidance for identifying actors. However, to the best of the authors' knowledge there is limited literature that identifies and classifies a full range of healthcare actors that affected and/or affect EAI adoption. There is therefore a need to: (a) identify categories of healthcare actors as well as the actual actors and (b) classify these actors using these categories. To address this need, the authors have: (a) reviewed the normative literature, (b) identified practical efforts and methods, dimensions, principles and guidelines to support the identification and classification of healthcare actors. From the practical efforts review, the categories of healthcare actors have been defined. These efforts are summarised below:

- An actor-oriented approach has been employed for the classification of the benefits that derived from the adoption of an innovative technology in the healthcare area (Anonymous, 1993). In 1993 the National Health Service, in UK, published a report, in which used an actor-oriented approach to classify the benefits of the Electronic Health Care Records (EHCR). That report identified three different "worlds" that will be affected by the use of EHCR, which are the (a) patients' world (patients, next of kin, carers), (b) the clinicians' world (clinicians, non-clinicians, responsible clinician, a health care facility and clinical student) and (c) the third parties world (controller, technologist, administrator, legal professional, other third parties).
- Siau *et al.*, (2002) studied the benefits of decision support applications and internet applications for the different actors in the healthcare sector. According to their study, the healthcare actors have

been classified in two categories: (a) providers and (b) consumers. Similarly, to study the Internet use in the healthcare sector, Siau (2003) mentioned that healthcare organisations can use the Internet to link their own operations with the operations of the suppliers (insurance and pharmaceutical companies), physicians and needs of patients.

- In Australia, the impact of the Information and Communication Technologies (ICT) on the pharmaceutical companies has been studied in relation to the actors. The researchers initially identified the actors interacting with the technology. Therefore, the actors had been classified in four categories: (a) payers, (b) providers, (c) practitioners and (d) patients. Moreover, the impact of the ICT on each of them had been studied and presented (Houghton, 2002).

From the practical approaches, it appears that the healthcare actors can be classified in the following categories: *(a) Acceptors, (b) Providers, (c) Supporters and (d) Controllers.* Moreover, as there is a need for the development of an essential *patient centric* information system (Anonymous, 2004a), the authors place the acceptors (patient's world) in the centre of this categorisation (Figure 1).

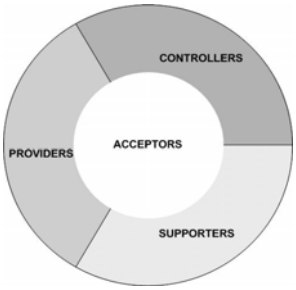


*Figure 1: Identification of Healthcare Actors*

In an attempt to identify extensively the healthcare actors, different theoretical methods, dimensions, principles and guidelines were used. These are presented in Table 2.

| | Methods, Dimensions, Principles and Guidelines for Actors Identification | Reference |
|---|---|---|
| **(a)** | Methods for stakeholders identification:<br>• Imperative: The sources of imperatives, slogans and acts in the context of a policy issue<br>• Positional: Those who occupy formal positions (internal and external to the organisation)<br>• Reputational: Stakeholders nominated by knowledgeable and important people<br>• Social Participation: Stakeholders that participate in activities related to a policy issue<br>• Opinion-leadership: Those who shape the opinions of the others<br>• Demographic: Identifies stakeholders by such characteristics as age, sex, race, occupation etc<br>• Organisational: identifies the focal organisation and the individuals and organisation related | Mason and Mitroff, (1981) |
| **(b)** | Dimensions for stakeholders identification:<br>• The nature of the information systems<br>• Internal vs external stakeholders<br>• The type of relationship to the system (stakeholder roles)<br>• Depth of impact<br>• Level of aggregation (individuals, groups, societies) | Lyytinen and Hirschheim, (1987) |
| **(c)** | Principles for stakeholders identification:<br>• Stakeholders depend on the specific context and time frame<br>• Stakeholders cannot be viewed in isolation<br>• The position of each stakeholder may change over time<br>• Feasible options may differ from the stakeholders' wishes | Pouloudi, (1997) |
| **(d)** | Guidelines for stakeholders identification:<br>• Identify all specific roles within the baseline group<br>• Identify "supplier" stakeholders for each baseline role<br>• Identify "client " stakeholders for each baseline role<br>• Identify "satellite" for each baseline order<br>• Repeat steps 1 to 4 for each of the stakeholder groups identified | Sharp, (1999) |

*Table 2: Methods, Dimensions, Principles and Guidelines for Actors Identification*

According to Chen, (2003b) the actors have been defined as individuals or organizations that affect or get affected by the adoption decisions. Also, the authors suggest that for each of the four proposed categories there exist actors that can be classified in two different dimensions: (a) human and (b) organizational. Such a categorization has been used by many other researchers such as Miles and Huberman, (1994). Both human and organizational issues should be studied through the adoption or application of a new technology. It is of great importance to identify how the adoption of this technology will affect the human relationships and the organizational processes. Thus, the authors support that for each of the four proposed categories there exist actors that can be classified in two different dimensions: (a) human and (b) organisational.

The healthcare actors identified by the authors through the use of these methods, dimensions, principles, guidelines and through the use of the human and organisational dimensions are the following: (a) Patients, (b) Next of kin, (c) Clinicians, (d) Non-clinicians, (e) Clinical students, (f) Managers, (g) Legal professionals, (h) Researchers, (i) Suppliers, (j) Technologists, (k) Hospitals, (l) Medical departments – Clinics, (m) Administrators, (n) Insurance companies, (o) Government (e.g. Department of Health, Economics) and (p) Health authorities.

These sixteen actors are classified in Figure 2, based on the general categories presented in Figure 1.

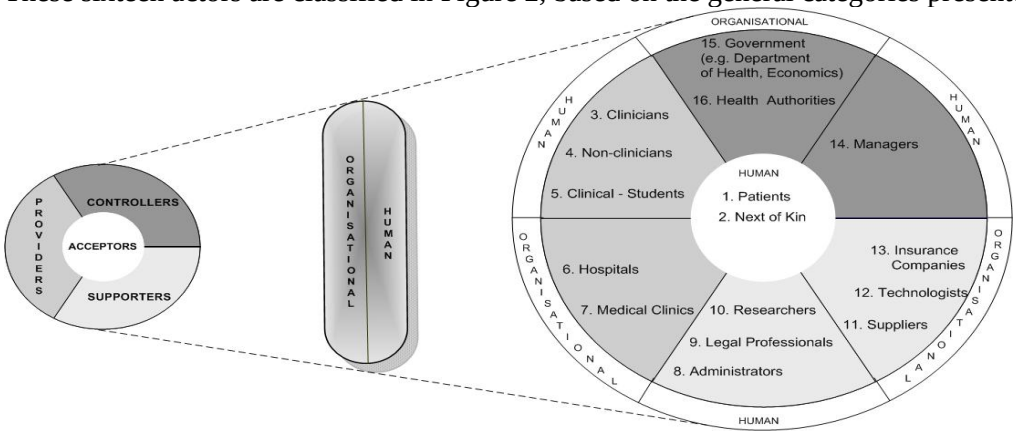


*Figure 2: Novel Conceptual Model of Healthcare Actors*

The proposed taxonomy in Figure 2 is novel as it might: (a) support the developers of HIS to realise the complexity of the healthcare sector and (b) provide effective and efficient IS solutions. Figure 2 illustrates the four main categories of healthcare actors. These categories are analysed through the viewpoint of two different dimensions: (a) human and (b) organisational. Consequently, the actors identified for each dimension and category, are presented. The implications of this categorization are that: (a) it improves the level and the depth of analysis (more detailed), (b) it can further facilitate the decision making process and (c) it separates the human actors from the organisational and it therefore allows different strategies to be applied when focusing on the one or the other dimension. The latter is in accordance with other classifications published in literature, which separate human and organisational parameters (Irani, 1998).

In the following sections, the authors will: (a) evaluate the healthcare actors' classification (Figure 2) and (b) try to identify the relationship between the factors influencing EAI adoption in the healthcare sector (Table 1) and healthcare actors.

# 4. CASE STUDY

For the purpose of this paper, an interpretive case study strategy was adopted as a research approach. A case organisation-hospital (CASE_HOSP) has been studied to test the conceptual design. CASE_HOSP is a specialized acute (specialist) trust, a major international centre for postgraduate teaching and research that runs in UK. It has with more than 1,200 employees, who work on 11 sites.

This specialized National Health Service (NHS) Foundation Trust consists of nine clinical departments. CASE_HOSP organisational chart consists of four divisions. Every employee, each service and department, belongs to one of four divisions, each of which has a separate management.

The CASE_HOSP faced many problems including among others: (a) lack of integration of primary, secondary and tertiary services, (b) lack of communication between the trust and its patients from admission to discharge, (c) unsatisfactory level of quality of the patient services and care, (d) development of a patient centric approach to support involving patients in the medical decision making process and keeping them informed on issues like delays, admissions, and their treatment and (e) reduction of the errors and adverse events as well as commitment to learn from mistakes and share that learning with others. As a result, the hospital with the support of the Commission for Health Improvement (CHI) decided to significantly improve its services. This is in accordance with the practices of the UK healthcare sector modernisation effort that is taking place. During the last years, the UK government, through the UK NHS Care plan, has focused on the development of an essential patient centric IS, to provide efficiently and effectively care within an integrated infrastructure between health and social care (Anonymous, 2004a). The key objectives for the UK Government Health Sector, within the NHS, in this area are to provide quality of care to patients twenty four hours, seven days a week (24/7) and to modernise healthcare services especially through the new IS Strategy, Information for Health (1998 - 2005) (Anonymous, 2004b).

CASE_HOSP decided to seek more efficient solutions for their IT infrastructure, due to (a) the problems that the hospital faced and (b) the targets set by the NHS. Therefore, CASE_HOSP developed partnerships with software suppliers to redevelop and integrate the existing systems. The hospital turned to consultancies and suppliers to provide software packages that match precisely with its business processes. This practise is in accordance with published literature which suggests that the organisations seek support from consultants and other experts to evaluate and adopt EAI solutions (Themistocleous, 2004). The consultants initiated the development of a pilot project to support integrated IT infrastructure. This was proposed to integrate a number of processes of the HOSP_EAI. In doing so, the hospital managed to assess the benefits of EAI technology and take decisions for further development. These actions (pilot system and benefits evaluation) are also in accordance with existing practices followed by organisations in other sectors when deploying EAI applications.

Based on the evaluation results, CASE_HOSP revisited its plans and decided to integrate the Patient Administration System that holds all patient demographics (e.g. address, date of birth, GP, admission details) with existing administrative and clinical systems. In addition to this, CASE_HOSP is planning to integrate its telemedicine and e-health systems with the EAI application.

The authors interviewed the different categories of actors identified in Figure 1: (a) to evaluate the actors identified in Figure 2 and (b) to identify the actors related to each factor during and after the adoption of the pilot EAI system in this hospital. In this paper, face-to-face semi-structured interviews were conducted to different actors to investigate the decision making process for EAI adoption. The actors that had been interviewed are the following: (a) Patient, (b) Next of Kin, (c) Clinician, (d) Non-Clinician, (e) Clinical Student, (f) Hospital, (g) Medical Department, (h) Researcher, (i) Supplier, (j) Technologist, (k) Insurance Company and (l) Manager.

Four actors namely: (a) Administrators, (b) Legal Professionals, (c) Government and (d) Health Authorities had not been interviewed, due to various reasons. The authors did try to contact these actors and to interview them, but due to lack of availability of these actors it was not possible to conduct these interviews. Information about the involvement of these actors was collected through the rest of the actors. Although this information does not represent the beliefs and ideas of the actors *that were not* interviewed, it was considered for this work. The reason for this is that the interviewees provided interesting information and were aware of the role of the non-interviewed healthcare actors, as they usually cooperate. However, the authors are aware that such a decision includes a kind of bias. For that reason, the values for these four actors presented in the Table 3 have a pale grey to show the difference.

The authors interviewed the different categories of the aforementioned actors, to identify the casual relationships among actors and factors during the adoption of the pilot EAI system in this hospital. The authors had a forty-five minute or more discussion with each actor. During the interviews, were requested to provide feedback the healthcare actors' identified by the authors. One really interesting outcome was that *66% of interviewees from different actors' categories mentioned that "bank" should be considered as another actor*. In addition, the multiple factors influencing the EAI adoption in healthcare organisations were presented and analysed to the interviewees. They were asked to define-describe their relationships with these factors.

All these factors have been categorised and presented in the Table 3, by combining: (a) EAI influential factors (Table 1) and (b) the taxonomy of the healthcare actors (Figure 2). Such a combination can provide a more detailed level of analysis. Horizontally, Table 3 illustrates the factors influencing the EAI adoption process. Vertically the healthcare actors are illustrated grouped into acceptors, providers, supporters and controllers. Each of these categories is broken down into human and organisational sub-actors. Due to space limitations the authors refer to each of the actor using (a) its initial letter and (b) the corresponding number given to them in Figure 2. For instance the actor number 1 refers to the patient (P) whereas the actor number 16 to the health authorities (HA). The symbol (✓) indicates that the specific actor is related to a specific factor where the symbol (×) shows no relationship.

| | | **EAI Adoption Actors in Healthcare** | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | **Acceptor** | | **Provider** | | | | | **Supporter** | | | | | | **Controller** | | |
| | | **H** | | **H** | | | **O** | | **H** | | | **O** | | | **H** | **O** | |
| **EAI Adoption Factors** | | **1 P** | **2 NK** | **3 C** | **4 NC** | **5 CS** | **6 H** | **7 MD** | **8 A** | **9 LP** | **10 R** | **11 S** | **12 T** | **13 IC** | **14 M** | **15 G** | **16 HA** |
| **1** | Cost | × | × | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | × | ✓ | ✓ | ✓ | × | ✓ | ✓ | ✓ |
| **2** | Barriers | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| **3** | Benefits | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| **4** | Support | × | × | × | × | × | ✓ | ✓ | × | × | × | ✓ | ✓ | × | ✓ | ✓ | ✓ |
| **5** | Internal Pressures | × | × | ✓ | ✓ | × | ✓ | ✓ | × | × | × | ✓ | ✓ | × | ✓ | ✓ | × |
| **6** | External Pressures | × | × | ✓ | ✓ | × | ✓ | ✓ | × | × | × | ✓ | ✓ | × | ✓ | ✓ | × |
| **7** | IT Infrastructure | × | × | × | × | × | × | × | × | × | ✓ | ✓ | ✓ | ✓ | ✓ | × | × |
| **8** | IT sophistication | × | × | × | × | × | × | × | × | × | ✓ | ✓ | ✓ | ✓ | ✓ | × | × |
| **9** | Evaluation Framework of Integration Technologies | × | × | × | × | × | × | × | × | × | ✓ | ✓ | ✓ | ✓ | ✓ | × | × |
| **10** | Framework for the EAI Packages Assessment | × | × | × | × | × | × | × | × | × | ✓ | ✓ | ✓ | ✓ | ✓ | × | × |
| **11** | Readiness of Organisation | × | × | ✓ | ✓ | × | ✓ | ✓ | × | × | ✓ | × | ✓ | ✓ | ✓ | ✓ | ✓ |
| **12** | Telemedicine | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | × | × | ✓ | × | × | × | ✓ | ✓ | ✓ |
| **13** | Clinical Support | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | × | ✓ | × | × | ✓ | ✓ | ✓ | ✓ |
| **14** | Patient Satisfaction | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | × | ✓ | × | × | ✓ | ✓ | ✓ | ✓ |

*Table 3: Validated Framework of Actors and Factors that Affect the EAI Adoption in Healthcare*

# 5. DISCUSSION

This section discusses and analyses the main findings of the case study presented in Table 3.

**Cost factor:** It appears that the Cost factor is related to the actors: (a) Clinicians, (b) Non-Clinicians, (c) Clinical Students, (d) Hospitals, (e) Medical Departments, (f) Administrators, (g) Researchers, (h) Suppliers, (i) Technologists, (j) Managers, (k) Government and (l) Health Authorities. However, there

are differences to the type of cost that is associated with these actors. For example, Clinicians and other actors are related to the Cost in terms of training whereas the actor Hospital is responsible to cover the training expenses as well as to pay for the overall integration cost. *It would be more interesting though to investigate these relationships in depth to facilitate a better level of analysis.* Hence, this finding can be suggested for further research in this area.

**Barriers and Benefits factors:** There are evidences from Table 3 depicting that all the actors identified and interviewed are interested in the Benefits and the Barriers that affect the EAI adoption process. It appears that all the actors (with different backgrounds, interests and knowledge regarding the EAI technology) would be really interested in being informed about the Benefits and Barriers depicting from the adoption of EAI in healthcare organisations. *This finding highlights the actors' need to be considered and informed during the EAI adoption process as individuals.* Such an issue is also emphasised in the normative literature (Anonymous, 1993; Siau, 2003). Also, a more detailed analysis of the different parameters of benefits and barriers should be carried out in relation to the actors (for the same reasons reported in the analysis of the factor Cost [above]).

**Support factor:** The analysis of the empirical data indicates that the Controllers' category (human and organisational dimensions) and the organisational Providers category are related to the factor Support. Moreover, the factor Support is related to the Suppliers, Technologists and the Managers. It appears that due to the complexity of EAI technology, the actors need support to adopt it (Ginzberg and Zmud, 1998; Robey, 1979). The findings derived from the analysis of the Cost factor also apply in this factor as well as to the rest of the factors.

**Internal and External Pressures factors:** Table 3 illustrates that the Clinicians and Non-clinicians, the organisational Providers, the Suppliers and the Managers are the actors that are interested in the Internal and External Pressures Factors. *This indicates that mainly these actors cause or receive pressures during the EAI adoption process. This finding should be studied in depth and in relation to these actors, as these factors can possibly increase the resistance to change (Mantzana and Themistocleous, 2004). Thus they can affect adversely the EAI adoption process.*

**IT Infrastructure, IT Sophistication, Evaluation Framework of Integration Technologies and Framework for the EAI Packages Assessment factors:** The empirical data suggest that all these four factors can be examined and analysed as a group since, they are related to the same set of actors: Organisational Supporters and the Researchers (Human Supporters). This finding suggests that *the technological factors should be studied in relation to the aforementioned actors (Supporters) to support EAI adoption.* In support of this, Grimson *et al.,* (2000) reported that the exiting healthcare IT Infrastructure and Sophistication as main barriers in improving healthcare services.

**Readiness of Organisation factor:** From the findings it appears that: (a) Clinicians, (b) Non-clinicians, (c) Hospitals, (d) Medical Departments – Clinics, (e) Researchers, (f) Technologists, (g) Managers, (h) Government and (i) Health Authorities are related to this factor. Along similar lines to the literature (Themistocleous, 2002) the organisational readiness is strongly related to other parameters such as training and skills development (e.g. technical). All these parameters are coming from different factors (in this case organisational readiness, barriers and cost) influencing and being influenced by various actors. This indicates that the analysis should not only focus on the relationships among actors and factors but also on the interrelationships among different factors and actors (e.g. how a specific actor or a parameter of a factor affects or is affected by other factors, actors or parameters of the same factor). *To this end, the authors suggest that all these interrelationships should be studied in fully detailed and mapped using modelling techniques (e.g. Fuzzy Cognitive Mapping) to enhance the decision making process*. In doing so, further research is required on this issue.

**Telemedicine factor:** Table 3 illustrates that the Patients and Next of Kin (Acceptors), the Human and Organisational Providers (Non-clinicians, Clinical Students, Hospitals, Medical Departments – Clinics) are related to the Telemedicine Factor. From this finding it appears that the application of EAI should support the Telemedicine factor that is of great importance to the aforementioned healthcare actors and to the CASE_HOSP trust.

**Clinical Support and Patient Satisfaction factors:** There are evidences from Table 3 depicting that the Clinical Support and Patient Satisfaction factors affect and/or are affected by all the actors expect the Legal Professionals, the Suppliers, Technologists. As, the vision in the healthcare sector world widely is the development of a patient-centric IT infrastructure (Wanless *et al*., 2002), *it appears that most of the actors are interested in the EAI adoption's effect upon the clinical processes and the patient satisfaction.*

# 6. CONCLUSIONS

In this paper, the need to improve the healthcare services through the integration of its information systems has been highlighted and explained. EAI is an emerging technology and although it is widely applied in many sectors, its adoption in healthcare is underutilised. For that reason, there is a need to investigate this area and analyse the factors influencing its adoption in healthcare. In doing so, this will significantly contribute to the decision making process and thus, speed up its adoption in this area.

The authors reviewed the normative literature and realised that human parameters and other soft issues were not considered in previous published models explaining EAI adoption. However, this is a limitation as the role of actors is important during the implementation of IS in the healthcare. Thus, the authors proposed an actor-oriented approach to analyse the factors affecting the adoption of EAI in healthcare. This paper initially identified healthcare actors and then their relationships with the influential factors. In doing so, a novel approach is proposed and validated through the practical arena. The proposed approach is novel in terms that is combining an existing classification of EAI factors with an actor-oriented approach and it is applied in an area, which lacks of research. Moreover, the paper makes novel contribution to this area as, it is the first time that an actor-oriented approach is used to analyse and understand EAI adoption influential factors (in general).

Using such an approach the paper: (a) allows a better realisation of the EAI adoption process, (b) supports managers and researchers in understanding which actors should be considered during the study of EAI adoption factors (c) supports the multiple healthcare actors in the realisation of the factors related to the EAI adoption process and (d) might increases the adoption of EAI in healthcare. Consequently, it is suggested that this approach might reduce the resistance to change and speed up the adoption of EAI. Therefore, less people will be harmed from the non-integrated nature of HIS.

The outcomes of this research presented herein are based on a real life case study. This is one of the limitations of this work as the data and the observations derived from this case cannot be generalised. Nonetheless, it is not the intention of this paper to offer prescriptive guidelines about which actors are affected and/or affect each influential factor in healthcare but rather, describe a case study perspective that allows others to relate their experiences to those reported. Therefore, this paper offers a broader understanding of the phenomenon of EAI realisation in the area of healthcare.

However, the analysis of the case study suggests that there is a need for a more detailed categorisation of the actors. For instance, in the proposed taxonomy the actor manager (in the category controller) represents all managers at all levels. However, this is not accurate in terms of analysis, as diverse categories of managers exist with different interests (e.g. IT Manager, Clinician Manager, Finance Manager). In addition, the patients should be differentiated from the citizens, for whom the government is trying to improve the quality of life. It has become one of EU plans not to focus on how to provide treatment to patients, but to place effort on minimizing the percentages of people that need treatment, by improving their quality of life (citizens). Moreover, it has been recommended by the interviewers that private organisations, which provide healthcare solutions to the NHS, walk-in-centres and Diagnostic Treatment Centres (DTC), should be included in the actors' classification. For this reason, the author suggests to expand this research in the future to define the whole range of actors at all levels and then test again their perceptions regarding EAI influential factors.

Furthermore, it has to be mentioned that the actors' interrelationships are of great importance and interesting research outcomes might come out of this study. Initially, the clinical pathways can be

sketched and the way that they become altered through the use of the new technology can be examined. Studying and analysing the clinical pathways can provide interesting research outcomes, such as: (a) if the patients waiting times can be affected (reduced or increased), (b) if the information is time effectively transmitted and stored. The aforementioned issues are of great importance, as a key objective of an information system should be to handle that: (a) information is captured as soon as it occurs (b) information is captured once and (c) information is stored in a central database (Simon, 2004). To assure that the developed IS meets the specified requirements, the flow of the information and consequently the clinical pathways should be analysed.

Last but not least, further research can be made on the detailed analysis of all the factors related to EAI adoption individually. This is an area that not much research has been made. Thus, the factors affecting the EAI adoption in the healthcare sector should be studied and analysed in accordance to the different healthcare actors, as this will support the multiple actors to fully realise the adoption factors. There is a need for integration in the healthcare sector and such further work will improve the analysis in this area and contribute in better healthcare services and decision-making.

## References


Anonymous 1993. *'The Good European Health Record: Ethical and Legal Requirements'*, National Health Service (NHS), [Day of Access, 23rd June 2004]

Anonymous 2004a. *'The NHS Plan - A Plan for Investment, a Plan for Reform'*, http://www.nhs.uk/nationalplan/execsum.htm, [Day of Access, 19th April 2004]

Anonymous 2004b. *'Information for Health - An Information Strategy for the Modern NHS 1998-2005: A National Strategy for Local Implementation'*, http://www.nhsia.nhs.uk/def/pages/info4health/contents.asp,, [Day of Access, 20th April 2004]

Anonymous 2004c. *'15th Annual HIMSS Leadership Survey Sponsored by Superior Consultant Company'*, HIMSS.

Chau, P. Y. K. and Hu, P. H. 2002. 'Investigating healthcare professionals' decision to accept telemedicine technology: an empirical test of competing theories', *Journal of Information and Management,*, **39**(4): 297-311.

Chen, M. 2003a. *'An Analysis of the Driving Forces for the Adoption of Web Services'*, In (Eds), Proceedings of The Second Workshop on e-Business, Seattle, U.S.A, 173-184., Dec 13-14 2003

Chen, M. 2003b. 'Factors Affecting the Adoption and Diffusion of XML and Web services Standards for E-business Systems', *International Journal of Human-Computer Studies*, **58**(2003): 259-279.

Cowan, J. 2004. 'Medication Safety in 2004: the NHS agenda', *Clinical Governance: An International Journal*, **9**(2): 132-135.

Fitzerald, L., Ferlie, E., Wood, M. and Hawkins, C. 2002. 'Interlocking interactions, the diffusion of innovations in health care', *Human Relations*, **55**(12): 1429-1449.

Freeman, R. E. 1984. *'Strategic Management: A stakeholder Approach'*, Ballinger Publishing Co., Cambridge.

Ginzberg, M. J. and Zmud, R. W. 1998. 'Evolving Criteria for Information Systems Assessment' *In Information Systems Assessment: Issues and Challenges* (Ed, Bjorn-Anderson, N. and Davies, N., pp. 41-52.

Houghton, J. 2002. *'Information Technology and the Revolution in Healthcare'*, Victoria University of Technology, [Day of Access, 25th August 2004]

Howcroft, D. and Mitev, N. 2000. 'An empirical study of Internet usage among medical practice management in the UK', *Internet Research: Electronic Networking Applications and Policy*, **10**(2): 170-181.

Irani, Z. 1998. *'Investment Justification of Information Systems: A Focus on the Evaluation of MRPII', PhD Thesis, Department of Manufacturing and Engineering*, Brunel University, London, UK.

Irani, Z. and Love, P. 2001. 'The Propagation of Technology Management Taxonomies for Evaluating Investments in Information Systems', *Journal of Management Information Systems*, **17**(3): 161-177.

Irani, Z., Themistocleous, M. and Love, P. E. D. 2003. 'The Impact of Enterprise Application Integration on Information System Lifecycles', *Information and Management*, **41**(2): 177-187.

Khoumbati, K., Themistocleous, M. and Irani, Z. 2003. *'A Conceptual Model for the Adoption of Enterprise Application Integration In Healthcare Organisations'*, In Chung, M. (Eds), Proceedings of Ninth Americas Conference on Information Systems, (AMCIS 2003), Tampa, Florida, USA, pp. 881-889. August 4-6

Khoumbati, K., Themistocleous, M. and Irani, Z. 2004. *'The Adoption of Enterprise Application Integration in Healthcare Organisations: Methodological Perspective'*, In Gallette, D. and Ross, J. (Eds), Proceedings of Tenth Americas Conference on Information Systems, New York, 268-277. August 6-8

Lauer, T. W., Josshi, K. and Browdy, T. 2000. 'Use of the Equity Implementation Model to Review Clinical System Implementation Efforts: A Case Report', *Journal of the American Medical Informatics Association,* **7**(1): 91-102.

Lyytinen, K. and Hirschheim, R. A. 1987. '*Information Systems Failures - a Survey and Classification of the Empirical Literature'*, Oxford University, Oxford.

Mantzana, V. and Themistocleous, M. 2004. 'Identifying and Classifying Benefits of Integrated Healthcare Systems Using an Actor Oriented Approach', *Journal of Computing and Information Technology,* **2**(4).

Mason, R. and Mitroff, I. 1981. *'Changing Strategic Planning Assumptions'*, Wiley, New York.

McGrath, G. M. and More, E. 2001. *'Data Integration Along the Healthcare Supply Chain: The Pharmaceutical Extranet Gateway Project'*, In Sprague, R. J. (Eds), Proceedings of Proceedings of Thirty-Fourth Annual Hawaii International Conference on System Sciences, (Hicss 34), Big Island, Hawaii, USA, IEEE Computer Society, Los Alamitos, California, USA., [CD Proceedings]. January 3-6

Miles, M. B. and Huberman, A. M. 1994. *'Qualitative Data Analysis: an Expanded Sourcebook'*, London.

Pouloudi, A. and Whitley, E. A. 1997. 'Stakeholder Identification in Interorganisational Systems: Gaining Insights for Drug Use Management Systems', *European Journal of Information Systems,* **6**(1): 1-14.

Puschman, T. and Alt, R. 2001. *'Enterprise Application Integration - The Case of the Robert Bosch Group'*, In (Eds), Proceedings of Proceedings of the Thirty Fourth Hawaii Conference on System Sciences, Big Island, Hawai, USA, [CD Proceedings].

Ragupathi, W. 1997. 'Health Care Informaton Systems', *Communications of the ACM,* **40**(8): 81-82.

Robey, D. 1979. 'User Attitudes and Management Information System Usage', *Academy of Management Journal,* **22**(1): 527-538.

Rodrigues, R. J., Gattini, G. and Aalmeida, G. 1999. *'Setting up Healthcare Services Information Systems: A Guide for Requirement Analysis, Application Specification, and Procurement.'* Washington, USA.

Schuring, R. W. and Spil, T. A. M. 2002. 'Explaining plateaued diffusion by combining the user-IT-success factors (USIT) and adopter categories: the case of electronic prescription systems for general practitioners', *International Journal of Healthcare Technology and Management,* **3**(3-4): 303-318.

Sharp, H., Finkelstein, A. and Galal, G. 1999. *'Stakeholder Identification in the Requirements Engineering Process'*, In (Eds), Proceedings of Proceedings of the 10th International Workshop on Database & Expert Systems Applications, Florence, Italy, IEEE Computer Society, 387-391. September 2-3

Siau, K. 2003. 'Health Care Informatics', *IEEE Transactions on Information Technology in Biomedicine,* **7**(1): 1-7.

Siau, K., Southbard, P. and Hong, S. 2002. 'E-healthcare strategies and implementation', *International Journal of Healthcare Technology and Management,* **4**(1/2): 118-131.

Simon, S. 2004. 'Hospital Profitability Crisis: an Integrated Process and Technology Solution', *International Journal Healthcare Technology and Management,* **6**(2): 158-172.

Spil, T. A. M., Schuring, R. W. and Michel-Verkerke, B. M. 2004. 'Electronic prescription system: do the professionals use it?' *International Journal of Healthcare Technology and Management,* **6**(1): 32-55.

Sutherland, J. and Willem, J. 2002. 'Enterprise Application Integration and Complex Adaptive Systems', *Communications of the ACM,* **45**(10): 59-64.

Tai, S., Donegan, C. and Nazareth, I. 2000. 'Computers in General Practice and the consultation: the health professionals view', *Health Informatics Journal,* **6**(27-31.

Themistocleous, M. 2002. '*Evaluating the Adoption of Enterprise Application Integration in Multinational Organisations', PhD Thesis, Department of Information Systems and Computing*, Brunel University, London.

Themistocleous, M. 2004. 'Justifying the Decision for EAI Implementations: A Validated Proposition of Factors', *Journal of Enterprise Information Management,* **17**(2): 85-104.

Themistocleous, M. and Irani, Z. 2001. 'Benchmarking the Benefits and Barriers of Application Integration',

Turunen, P. and Jan, T. 2000. *'Stakeholder groups in the evaluation of medical information systems'*, In Brown, A. and Remenyi, D. (Eds), Proceedings of Seventh European Conference on the Evaluation of Information Technology, Dublin, Ireland, 329-334. 28-29 September

Wanless, D., Charlesworth, A., Walker, I., Beck, M., Black, J., Blue, I., Brindle, S., Bucht, C., Dunn, S., Fairweater, M., Ghazi-Tabatabai, Y., Innes, D., Lewis, L., Patel, V. and York, N. 2002. *'Securing our Future Health: Taking a Long-Term View'*, HM Treasury, http://www.hm-treasury.gov.uk/wanless, [Day of Access, May 2004]

Wiley-Paton, S. and Malloy, D. A. 2004. *'Understanding Healthcare Professionals' Adoption and Use of IT'*, In (Eds), Proceedings of The Tenth Americas Conference on Information Systems, New York, 179-183. August 6-8